



PROCEEDINGS

Workshop

Data Gathering on Renewable Energies for New
Member States and Candidate Countries
Cavtat-Dubrovnik, Croatia, 15-16 November 2006



Editors: Nicolae Scarlat

Jean Francois Dallemand

Julije Domac





EUROPEAN COMMISSION
DIRECTORATE-GENERAL
Joint Research Centre



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Cover photo: Jennifer Rundle



2007

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The mission of the IES is to provide scientific and technical support to the European Union's policies for protecting the environment and the EU strategy for sustainable development.

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Preface

The present Proceedings include the presentations made at the Workshop *Data Gathering on Renewable Energies for New Member States and Candidate Countries*, which was held on 15-16 November 2006 in Cavtat-Dubrovnik, Croatia. This was the third workshop dedicated to data collection on the Renewable Energies promotion in New Member States and Candidate Countries, after the ones held in Malta and Cyprus in 2004 and 2005, respectively.

The workshop was organised by the Joint Research Centre of the European Commission - Institute for Environment and Sustainability, Renewable Energies Unit Action: *Scientific Technical Reference System on Renewable Energy and Energy End-use Efficiency*, in cooperation with the Energy Institute Hrvoje Požar, Croatia.

The workshop objectives are in line with that of the specific objectives of the Action:

- Assessment and comparison of national and regional policy measures, tools and incentives in view of planned introduction of renewable energy;
- Monitoring of EU strategy and legislation fulfilment, implementation and research progress of renewables and energy efficiency;
- Assessment of renewable energy resources and implementation in the new Member States and analysing the specific technical and non-technical barriers;
- Scientific and technical support to political activities at EU-level;
- Building a Scientific reference centre for data on Renewable Energy and Energy End- Use Efficiency, supporting all sustainability related policies.

The primary aim of workshop was the collection of the data on the latest achievements in the field of Renewable Energy in the New Member States and Candidate Countries:

- Status of RES Policies and support schemes, existing Programmes promoting RES;
- Status of the implementation of the RES technologies;
- Development and Planning for RES, potentials, financing, etc.

The workshop was organised for governmental and institutional specialists and scientists in the field of sustainable energy development. It aimed to get together experts from different countries aiming at sharing information and experience on RES development at EU level and market developments, providing a forum for discussions on technical and non-technical issues.

However, the Workshop was not only aiming at gathering data and background information from the participating Countries, but providing information from the last activities carried out by the Scientific Reference System and its Core-Group partners.

The key note speeches of the experts from European Renewable Energy Council (EREC) and International Energy Agency (IEA) gave a signal on the importance and general interest on RES at international level and provided all participants with a general view on the latest data on the trends and developments of RES at international level.

The presence, for the first time of the specialists from West Balkan Countries at a workshop organised by JRC for RES was also an extra added value. Their presence provided very new and important data on energy in their country, but also contributing to their knowledge and understanding on the RES development at EU level.

The completeness of presentations, the wealth of newest, updated and complementary information on RES brought together by the workshop participants, contributed to the achievements of the meeting's objectives and represents a success.

The content of these proceedings are available on the website of the Scientific Technical Reference System: <http://re.jrc.ec.europa.eu/refsys/>

Acknowledgement

I would like to thank all participants for their commitment and work for the preparation of their presentation, contributing decisively to the success of this event. They provided latest available information on RES in their countries and shared information and experience on RES development at EU level.

My special thanks go thus to the invited key-note speaker *Mrs. Christine Lins*, General Secretary of the European Renewable Energies Council, EREC, Brussels. She contributed a lot to the success of the workshop and provided valuable info in her presentation "*Latest trends and developments in European renewable energy markets*".

I have to address special thanks also to *Mrs. Samantha Ölz*, Policy Analyst in the Renewable Energy Unit from International Energy Agency (IEA), for her precious information provided in her key note speech on "*IEA data collection on RES*".

Last but not least I would like to thank my colleague Jean-Francois Dallemand from the DG JRC Renewable Energies Unit, for his contribution and commitment for the success of the meeting.

I would also like express my sincerest thanks to Mr. Julije Domac from the Energy Institute Hrvoje Požar, Croatia and for his contribution at the preparation of the meeting.

Ispra, 2007

Nicolae Scarlat

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Latest trends and developments in European renewable energy markets

Christine Lins
Secretary General
European Renewable Energy Council

Data gathering on Renewable Energies for New Member States and Candidate Countries
Dubrovnik, 15th November 2006



EREC – European Renewable Energy Council

Umbrella organisation representing all RES sectors:

- ✓ **AEBIOM** European Biomass Association
- ✓ **EGEC** European Geothermal Energy Council
- ✓ **EPIA** European Photovoltaic Industry Association
- ✓ **ESHA** European Small Hydropower Association
- ✓ **ESTIF** European Solar Thermal Industry Federation
- ✓ **EUBIA** European Biomass Industry Association
- ✓ **EWEA** European Wind Energy Association
- ✓ **EUREC Agency** European Renewable Energy Research Centres Agency

Representation of European RES industry, trade & research



EREC - activities

- To act as a forum for exchange of information and discussion on issues related to RES
- To provide information and consultancy on renewable energies for the political decision makers on local, regional, national and international level
- Information dissemination on RES issues (organisation of conferences, workshops, publications, etc.)
- To promote European RES equipment, products and services on world markets



The driving forces for a renewable energy policy

- **Security of supply** - independence from energy imports
- **Protection of environment** - including the necessity to reduce greenhouse gas emissions
- **Regional and local development**
- **Industrial development**
- **Employment**



RES policy framework

RES White Paper (1997)

↳ To double the share of renewable energy from 6% to 12% of gross energy consumption in Europe (EU-15) by 2010

Green Paper on Security of Energy Supply (2000)

RES Electricity Directive (2001)

↳ To establish a framework to increase the share of renewables electricity from 14% to 22% of gross electricity consumption by 2010

Directive on liquid biofuels (2003)

↳ To achieve a share of 5.75 % of biofuels for transport in the total amount of fuels in Europe by 2010

Biomass Action Plan (2005)

Green Paper "A European Strategy for Sustainable, Competitive and Secure Energy" (2006)



Renewable energy today

- About 15% of all EU electricity supply is generated by renewable energy sources
- About 10% of heat demand is supplied by renewable energy sources
- About 1% of transport fuel demand by renewable energy sources



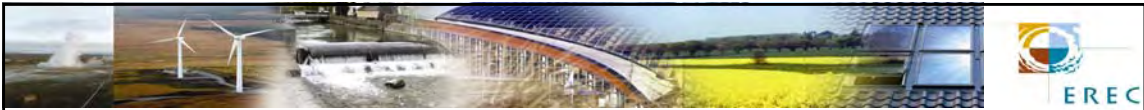
Renewable energy targets 2010

- 22 % of all EU electricity supply is generated by renewable energy sources
- 16 % of heat demand is supplied by renewable energy sources
- 5,75 % of transport fuel demand by renewable energy sources

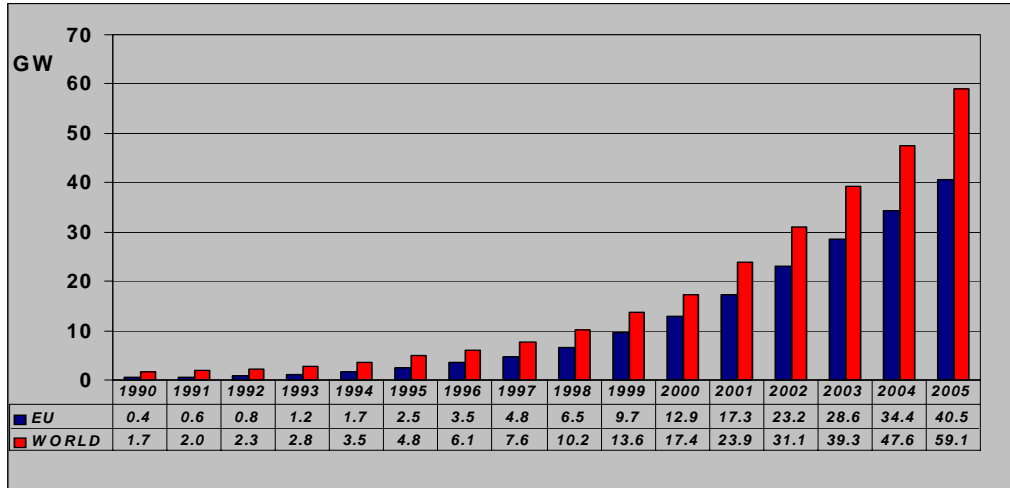


Renewable Energy benefits

- ✓ Europe is global leader in RES development
- ✓ 300.000 jobs in Europe already now
- ✓ Annual turnover of 15 billion € already now
- ✓ Innovative Business Sector
- ✓ Economic growth and regional development



Cumulative Wind Energy Installed Capacity

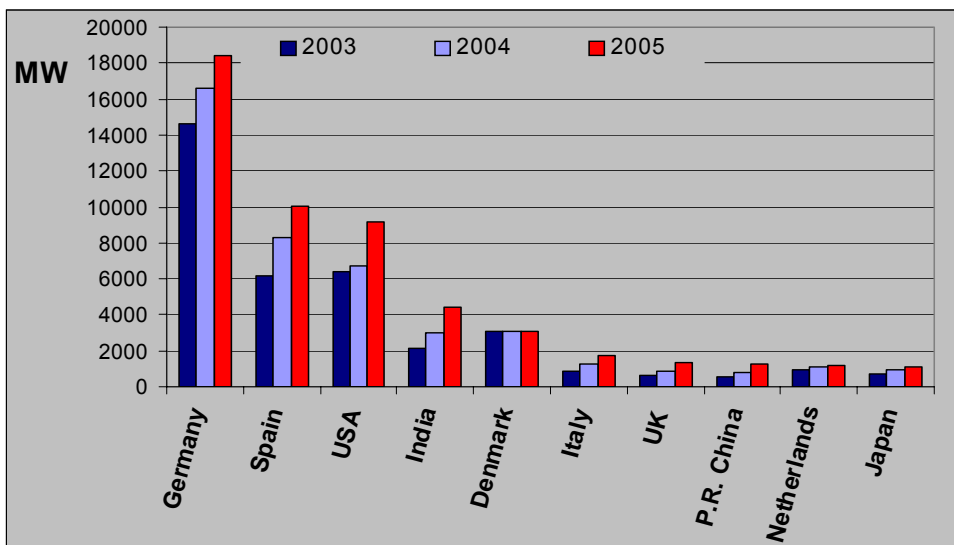


Europe: Average Annual Growth Rates 1995-2000 38.8%, 2000-2005 25.7%
 World: Average Annual Growth Rates 1995-2000 29.4%, 2000-2005 27.8%

Source: EWEA, GWEC



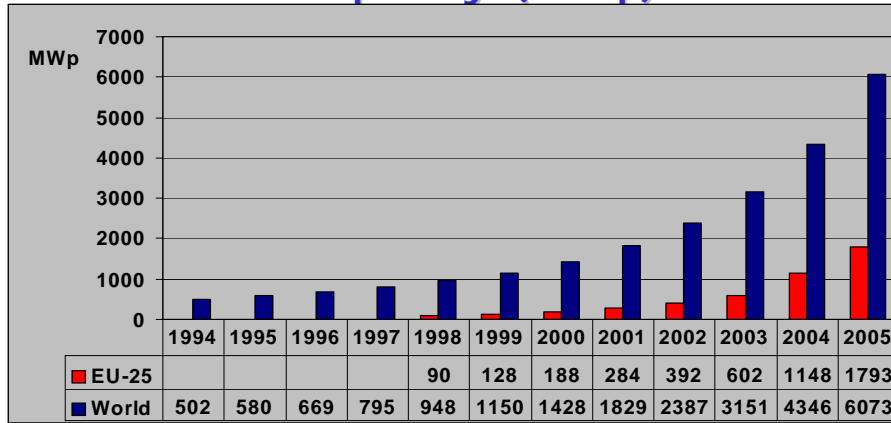
The Top-10 Markets in the World



Source: EWEA



Cumulative Photovoltaic Installed Capacity (MWp)

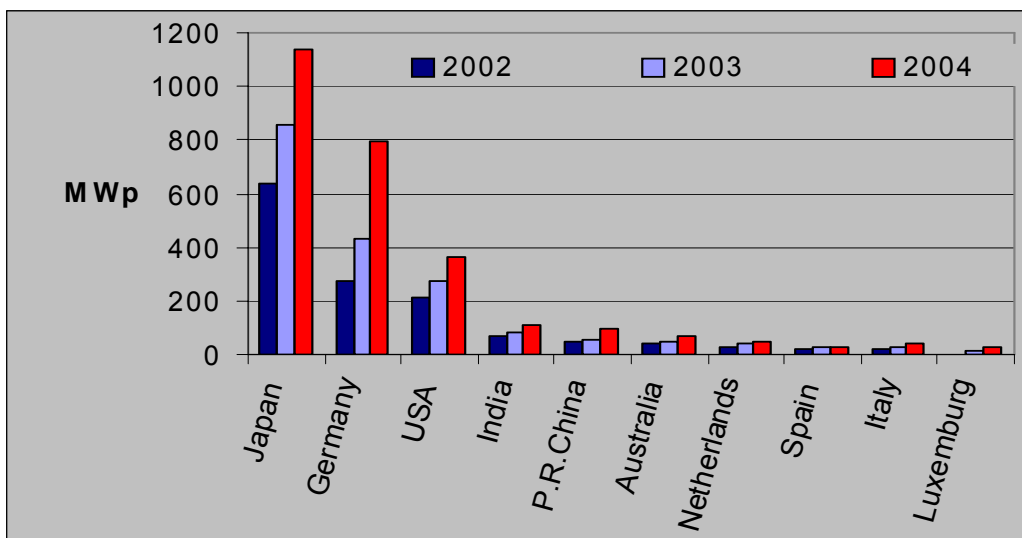


Source: Eurec Agency, EPIA, Observ'ER
Europe

Average Annual Growth rates
 World 1995-2000 19.7%, 2000-2005 33.5%
 Europe 2000-2005 57.0%



The Top PV Markets in the World

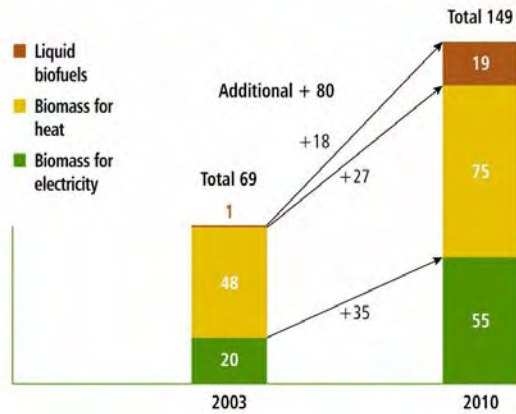


Source: EPIA, Observ'ER, IEA-PVPS

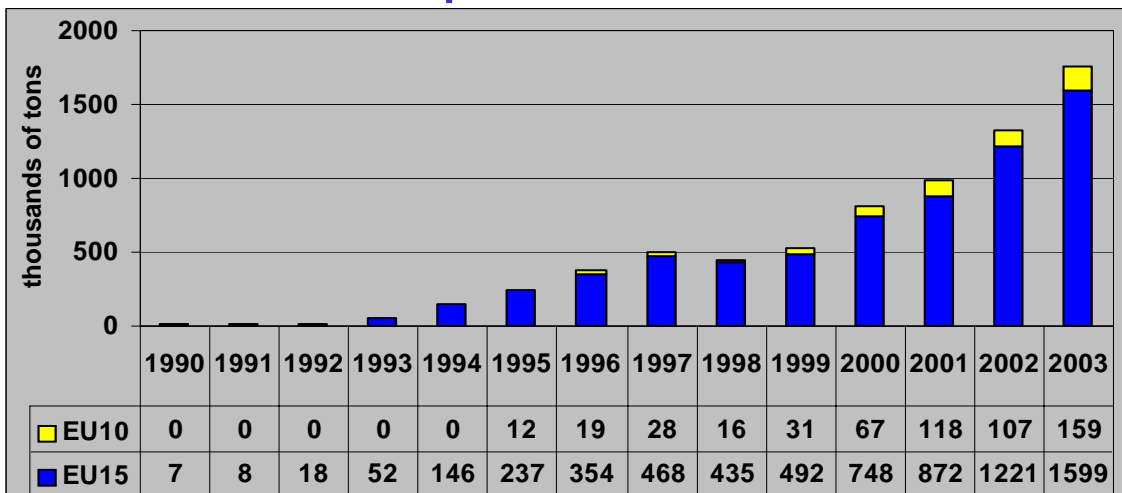


Biomass

Targets for Europe 25 according to the Biomass Action Plan (Mtoe)



Liquid Biofuels



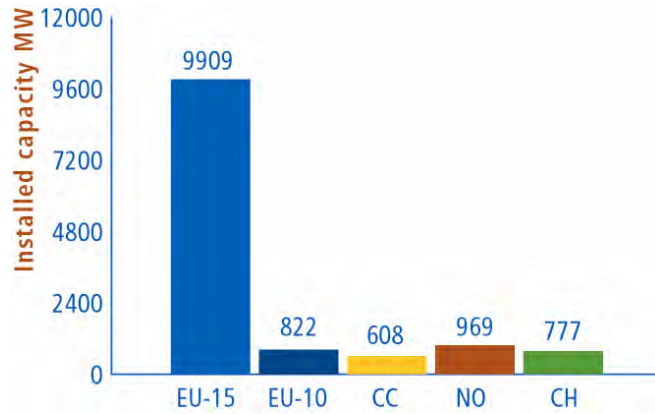
Average Annual Growth rates

1998-2003: 31.3%

Source : Eurostat



Small Hydropower (SHP)

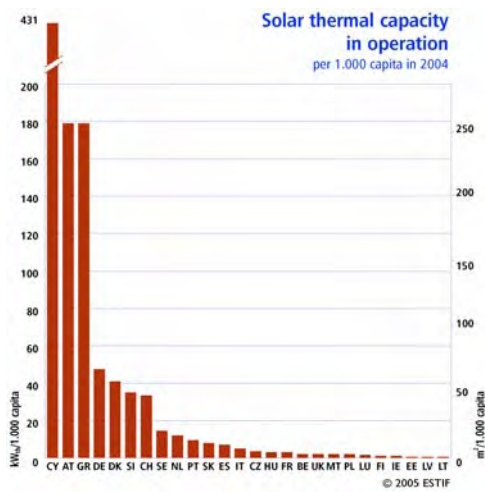


CC – Candidate Countries, NO – Norway, CH - Switzerland

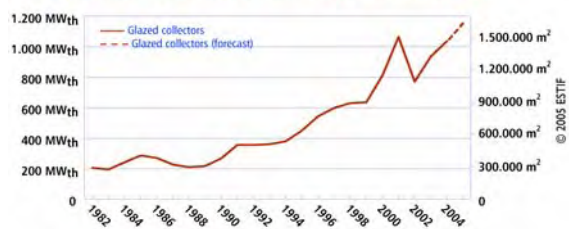
Source: ESHA



Solar thermal



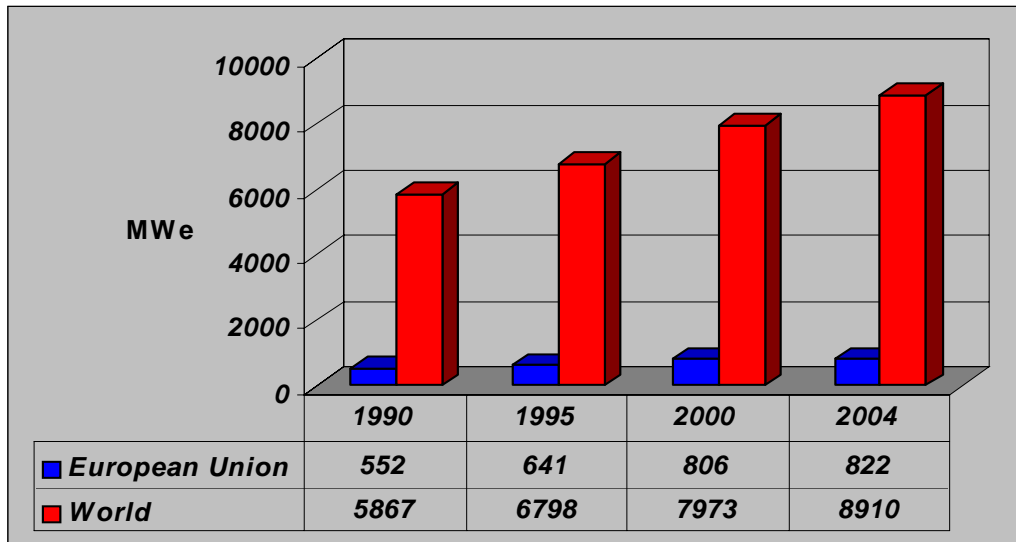
☐ Solar Thermal Market in the EU



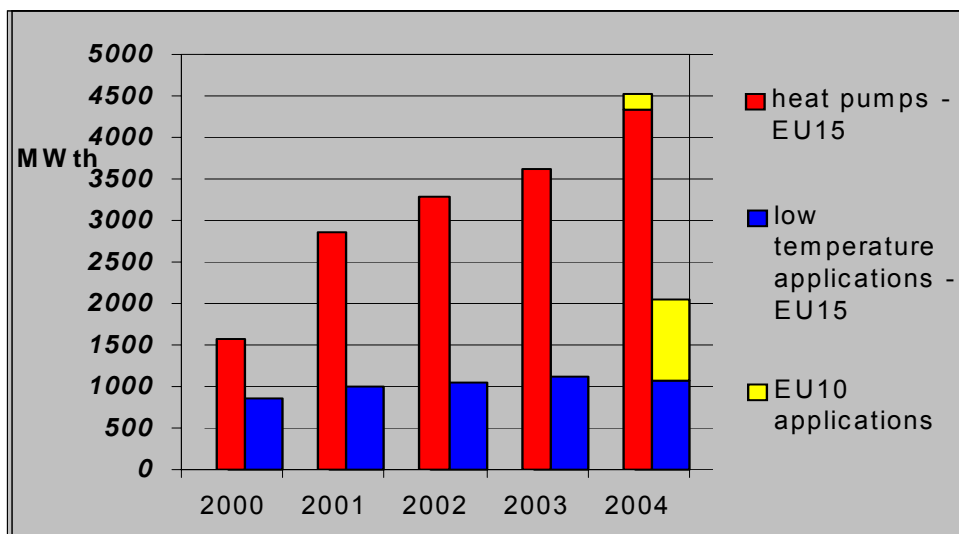
Source: ESTIF (2005)



Geothermal Electricity



Geothermal Heat





Evaluation of Development Rates of RES in Europe up to the present

- **Hydro, Geothermal & PV:**
 - Development rates as expected
 - Should reach the targets
- **Biomass & Solar Collectors:**
 - Development rates below White Paper targets
 - Stronger political support needed
 - Reaching the targets seems problematic without mobilisation of the EU Agriculture infrastructures (resource supply) and without large industries involvement (conversion & utilization)
- **Wind Energy:**
 - Development rates largely above targets
 - Should exceed target

Key role of political RES framework



Security of Supply

20 %
by 2020



20 % by 2020

- A contribution of RES to total inland consumption of 20 % by 2020 is possible.
- The contribution of RES to electricity production will be more than 33 % in 2020
- The contribution of RES to heat production will be 25 % in 2020.
- The contribution of biofuels can be more than 10% in 2020.



Contribution of RES to Total Inland Consumption - 20% by 2020

Eurostat Convention (Mtoe)

TYPE OF ENERGY	2000		TARGETS 2010		TARGETS 2020	
	Eurostat Convention	% of total	Eurostat Convention	% of total	Eurostat Convention	% of total
Total Gross Inland Consumption	1,455		1,576 (trends to 2030)		1,576	
1. Wind	1.92	0.13	14.4	0.91	38	2.4
2. Hydro	27.6	1.9	30.6	1.94	33	2.1
3. Photovoltaics	0.01		0.3	0.02	3.6	0.2
4. Biomass	54.5	3.73	125.5	7.96	205	13.0
5. Geothermal	3.32	0.22	6.2	0.4	12.4	0.8
6. STC	0.38	0.02	3	0.2	24	1.5
Total Renewable Energies	87.8	6.0	180	11.43	316	20.0



Contribution of Renewables to Electricity Production (1995-2020) (TWH)

	1995 Eurostat	2000 Eurostat	2010 Projections	2020 Projections
Wind	4	22.4	168	444
Photovoltaic	0.03	0.1	3.6	42
Biomass	22.5	39.2	141	282
Hydro	290.2	321.5	355.4	384
Geothermal	3.5	4.8	7	14
TOTAL RES in the EU 15	320.2	388	675	1166
Total Electricity Generation (Trends to 2030 - EC)	2308.3	2574	3027	3450
Share of RES (%)	13.9 %	15.1 %	22.3 %	33.8 %

Source : EREC



Contribution of Renewable Energy to Heat Production (1995-2020) Mtoe

	1995 Eurostat	2000 Eurostat	2010 Projections	2020 Projections
Biomass	37	42.9	70	100
Solar Thermal	0.24	0.38	3	24
Geothermal	0.56	0.66	2	4
TOTAL RES HEAT	37.8	44.1	75	128
Total Heat Generation (Trends to 2030)	450.1	454.4	491.1	511.6
Share of RES (%)	8.4 %	9.7 %	15.3 %	25.0 %

Source : EREC



Benefits of 20 % target

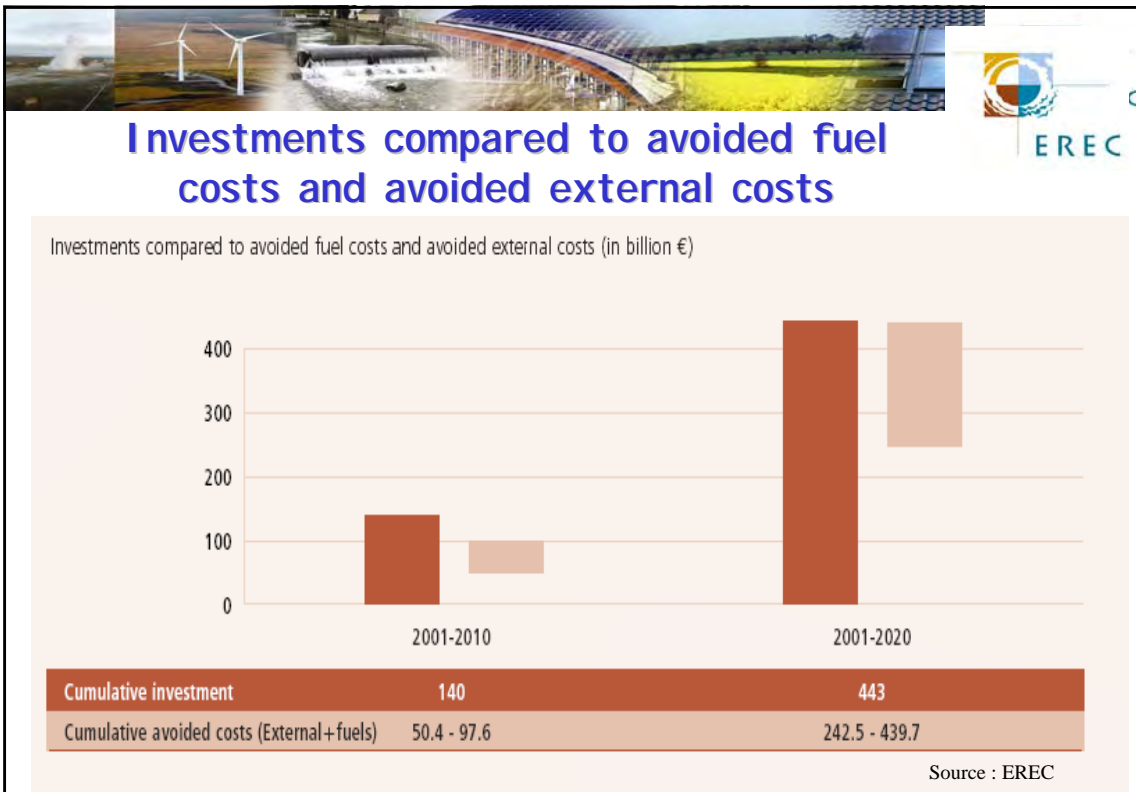
- Total RES investment of 443 billion € in the period 2001-2020
- 126,7 – 323,9 billion € of cumulated avoided external costs between 2001 and 2020
- 115,8 billion € of cumulative avoided fuel cost reduction in EU15 (2001-2020)
- 728 million tons/year of CO₂ emission reduction in 2020 – representing 17,3% of the total GHG emissions in 1990
- Creation of more than 2 million full time jobs until 2020



Total RES investment (2001 – 2020)

	2001-2010 Billion Euro	2011-2020 Billion Euro	2001-2020 Billion Euro
Wind	55	101	156
PV	10	66	76
Biomass	44	45	89
Hydro	11	9	20
Geothermal	4	7	11
Solar thermal	16	75	91
TOTAL RES	140	303	443

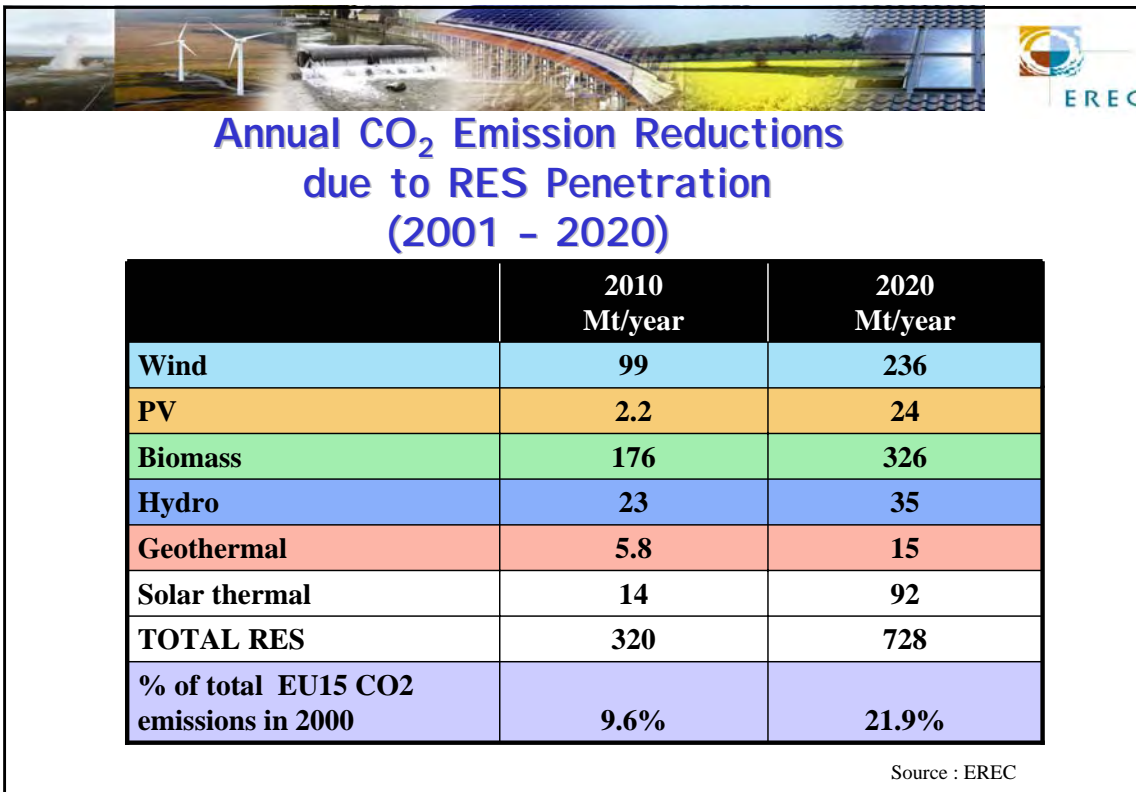
Source : EREC



RES - Full Time Employment Growth (2010 - 2020)

	2010 Jobs (FTE)	2020 Jobs (FTE)
Wind	184,000	318,000
PV	30,000	245,000
Biomass	338,000	528,000
Biofuels	424,000	614,000
Small Hydro	15,000	28,000
Geothermal	6,000	10,000
Solar thermal	70,000	280,000
TOTAL RES	1,067,000	2,023,000

Source : EREC



Market Development-Policy Link

- Renewable energy has the technological potential to play a major role in the future energy mix as mainstream energy source.
- Renewable energy is integral part of the energy supply in many countries today.
- Renewable has tangible economic, ecological and social benefit.
- **BUT: Renewable market development depends on a coherent, predictable, supportive political & legal framework, if this is in place, they will play a decisive role in the world's future energy mix.**



Ongoing Projects - the "Energy 4 Cohesion" project

Main Project Targets

- Promote innovative decentralised Renewable Energy (RE) actions in the rural environment with a focus on the new Member States (target regions) of the EU
- Support rural development in regions with economic and ecological problems due to market forces

Target Regions:

Czech Republic: Zlin Region

Lithuania: Kaunas Region

Italy: Locride

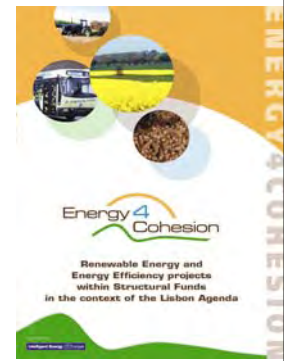
Poland: Powiat Nowa Sol

Latvia: Limbazi Region

Greece: Prefecture of Evros

Slovak Republic: Velky Krtis

Estonia: Saaremaa Region



www.e4c.org

Intelligent Energy Europe



Renewable Energy House



Before & after renovation



Ambitious energy concept integrating renewable energy and energy efficiency measures

- Insulation of roof and façade
- Double glazing
- High efficiency T5 fluorescent lamps
- Ventilation with heat recovery

- 100 % RES heating and cooling supply from RES:
 - 80 kW pellets boiler
 - 60 m² solar thermal collectors
 - 4 geothermal ground coupled heat pump with vertical borehole heat exchangers (4 x 115 m deep)

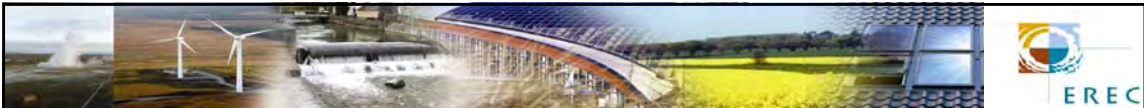
- Electricity production with PV (modules, semi-transparent, thin film)



Renewable Energy House - Key facts

- Headquarters for the European renewable energy sector
- Ambitious energy concept for renovation of a 120 year old monument protected building
- 2.000 m² of modern office building hosting currently 45 staff
- Prestigious inauguration of the Renewable Energy House on 22nd March 2006
- More than 3.000 visitors in less than 6 months





Integration of solar elements



Further information



European Renewable Energy
Policy conference
29-31 January 2007
Brussels

www.erec-renewables.org



Present and future of Renewable Energies in Europe

Arnulf Jäger-Waldau and Nicolae Scarlat
Scientific Technical Reference System on RE & EEE
Renewable Energies Unit



Scientific Technical
REFERENCE System on RENEWABLE ENERGY and
ENERGY END-USE EFFICIENCY



The Renewable Energies Unit

MISSION: By giving advice on related technology issues, the Renewable Energies Unit supports European Policies for implementing Renewables for a sustainable energy supply.

It maintains in-house research on carefully selected, forward-looking fields which need further European efforts to increase share of Renewable Energies in the competitive market





Organisation of STRS RE&EEE

Status of Renewable Energies

Analysis of implementation measures for RE

Efficient End-use of Electricity

Status

Renewable
Energies

Efficient
End-use of
Energy

Monitoring of Policies

Stand by loads

Codes of conduct

Analysis of
implementation
measures for RE

New MS

Renewable
Energies Resources

Energy in
Buildings

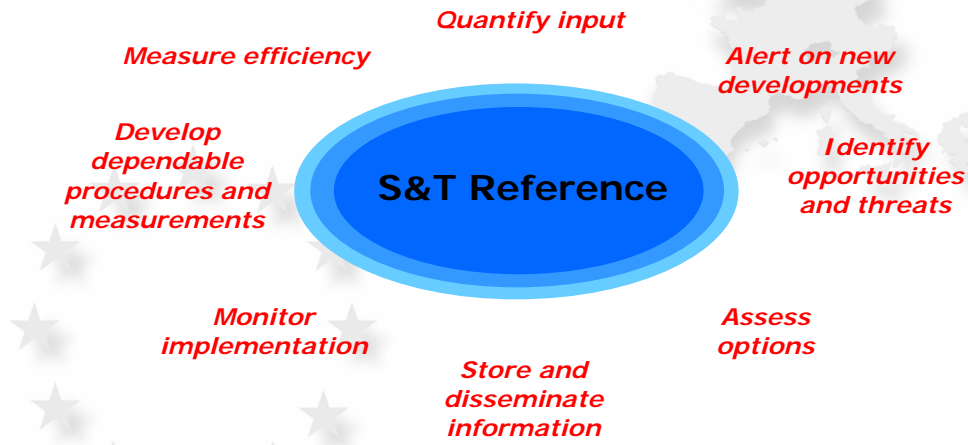


Why STRS RE&EEE ?

- Commission has the task and the mandate to **continuously monitor** and evaluate the progress achieved in implementing Renewable Energies and Energy End-Use Efficiency.
- *Renewable Electricity Directive:*
Indicative renewable energy and energy efficiency targets for each of the 25 Member States.
- Larger frame is:
European energy strategy and policy: the twin objectives of **sustainability** (incl. environmental aspects) and **security of energy supply**.

A Common System of S&T Reference


The complexity of governance requires a broad knowledge base



The Energy Challenge



2050: 10 billion people in the World

- Energy Needs:
 - 2002: 10,230 Mtoe/year = 13.6 TW
 - 2050: > 25,000 Mtoe/year = > 33.2 TW
- Electricity 2002: 1.8 TW, of which 0.3 nuclear
- Transport 2002: 2.5 TW
- If 50% of new capacity in 2050 nuclear = 10 TW:
 one reactor every second **DAY**



The Energy Challenges

- Sustainability
 - De-coupling of economic growth from depletion of resources and global warming
- Security of Supply
 - Ensuring long term availability of energy sources
- Safety of the Energy Chain
 - Accidents, political stability, import dependence
- Growing Demand in Developing Countries
 - 2000 million with no basic electricity service
 - Distribution grid never economically viable



Options

- Decrease Energy Intensity (Mtoe/GNP)
 - Increase Efficiency of Energy End-use
 - Domestic, Industry, Transport
 - Increase Efficiency of Electricity Generation

- Increase [indigenous] Supply
 - New and Renewable Energies
 - Examine Nuclear Option



Renewable Energies: Options

Electricity

- Wind
- Solar Photovoltaics
- Geothermal
- Agro-Biomass
- Waste-Biomass
- Wave/Tide

Heat

- Solar Thermal
- Geothermal
- Biomass
- Waste-Biomass

Transport

- (electric car)
- (electric car)
- Biofuels



The Policy Frame



Policy Frame

"Green Paper" of the European Commission:

- Supply-dependence (50% imported now, with New Member States and Candidate Countries 80%)
- Targets to reduce Greenhouse-Gas emissions (- 8%)
- Uncertain future of nuclear energy
- Liberalisation of electricity markets
- Increasing demand of transport sector (+50% until 2010)
- Increasing demand in developing countries

*Green Paper Towards a European strategy for the security of energy supply COM(2000) 769

Renewable Energy: Indicative Targets

White Paper*: Double Share of Renewable Energy Sources by 2010, from 6% to 12%

Year	Electricity Produced [TWh/a]		
	Biomass	Wind	Photo-voltaics
2010	230	80	3
x2	x10	x20	x100 !
↑	↑	↑	↑
1995	23	4	0,03
Progress until 2005	69	83	1,50

*White Paper for a Community Strategy and Action Plan Energy for the Future: Renewable Sources of Energy COM(97)599 final (26/11/1997)

♻ Renewable Energies



Instruments

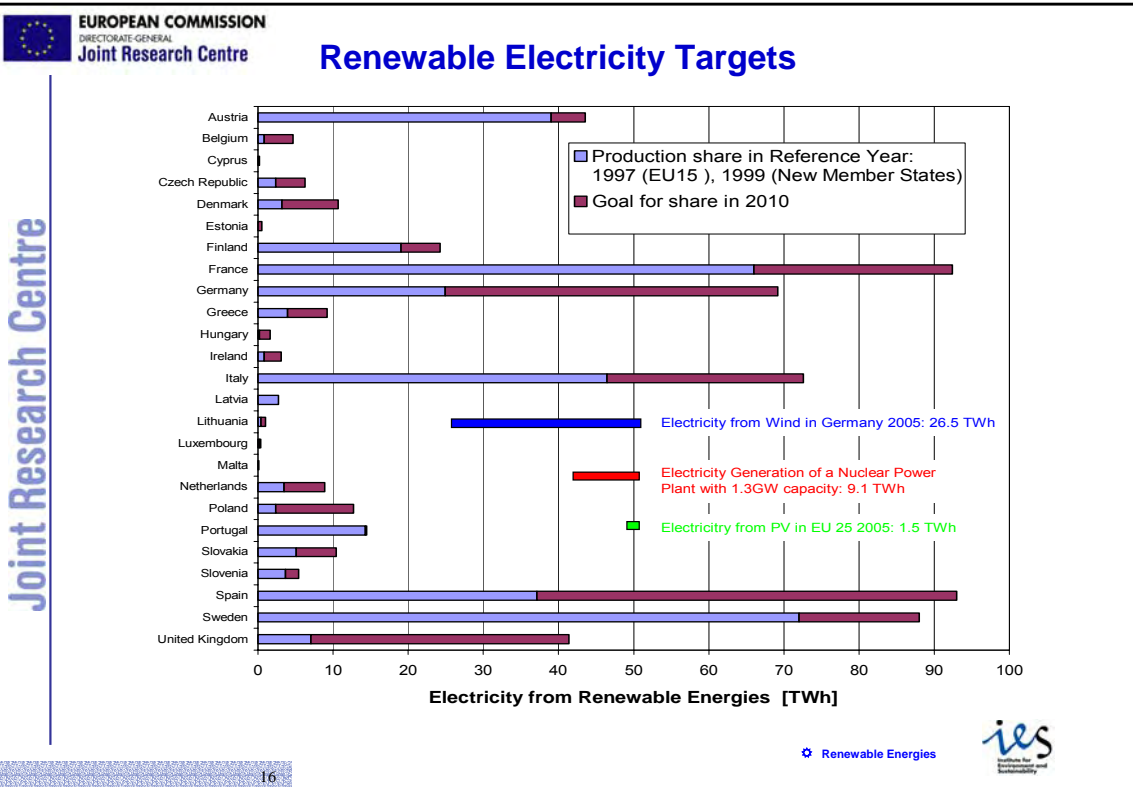
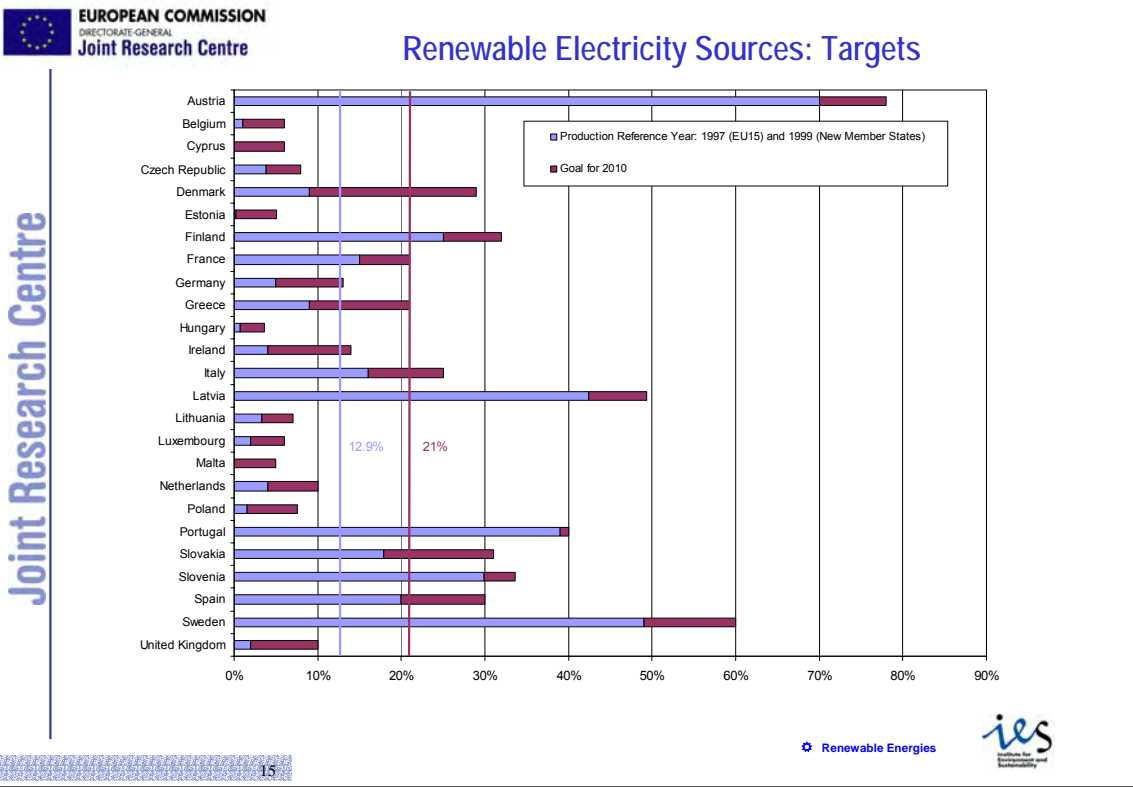
- Directive 2001/77/EC (27.10.2001) on the *Promotion of Electricity Produced from Renewable Energy Sources in the Internal Electricity Market.*

Elements:

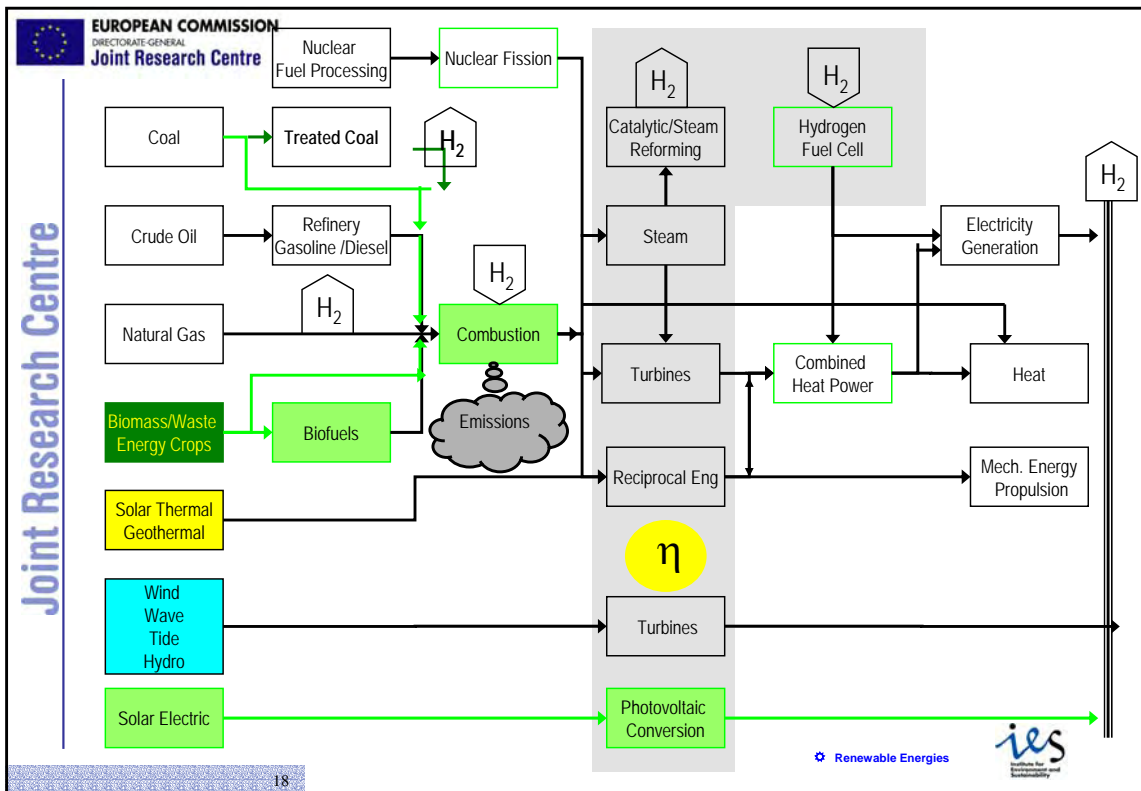
- Indicative targets for Member States
- Regulates Grid-Access
- 2-year progress reporting intervals
- 2006 decision point on Implementation schemes

♻ Renewable Energies





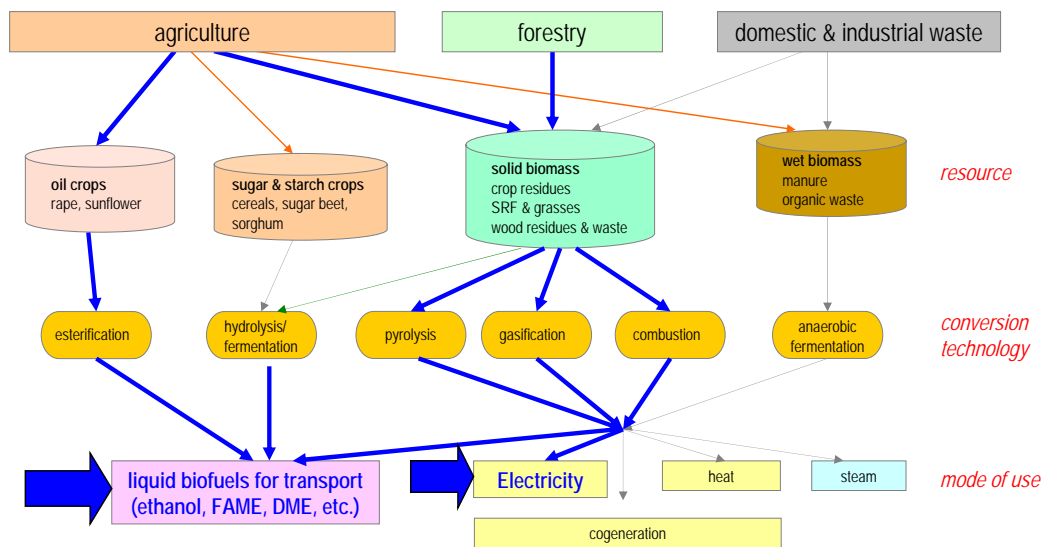
Technology Options

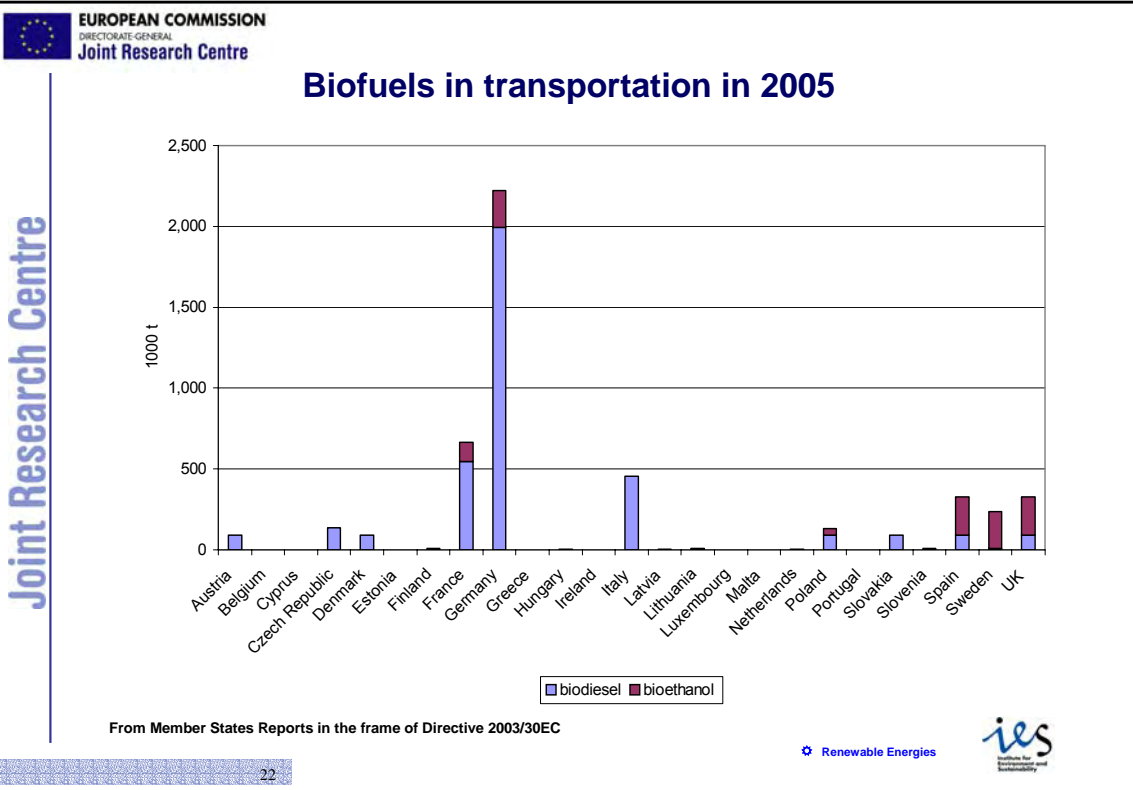
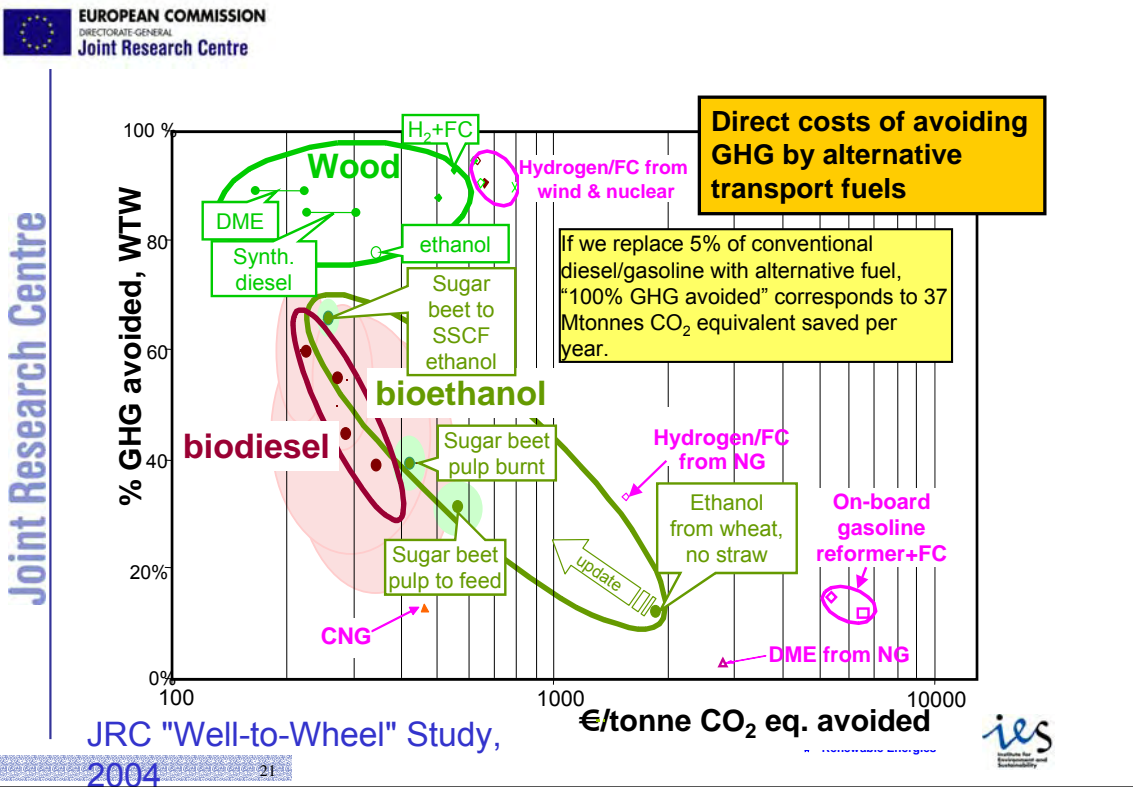


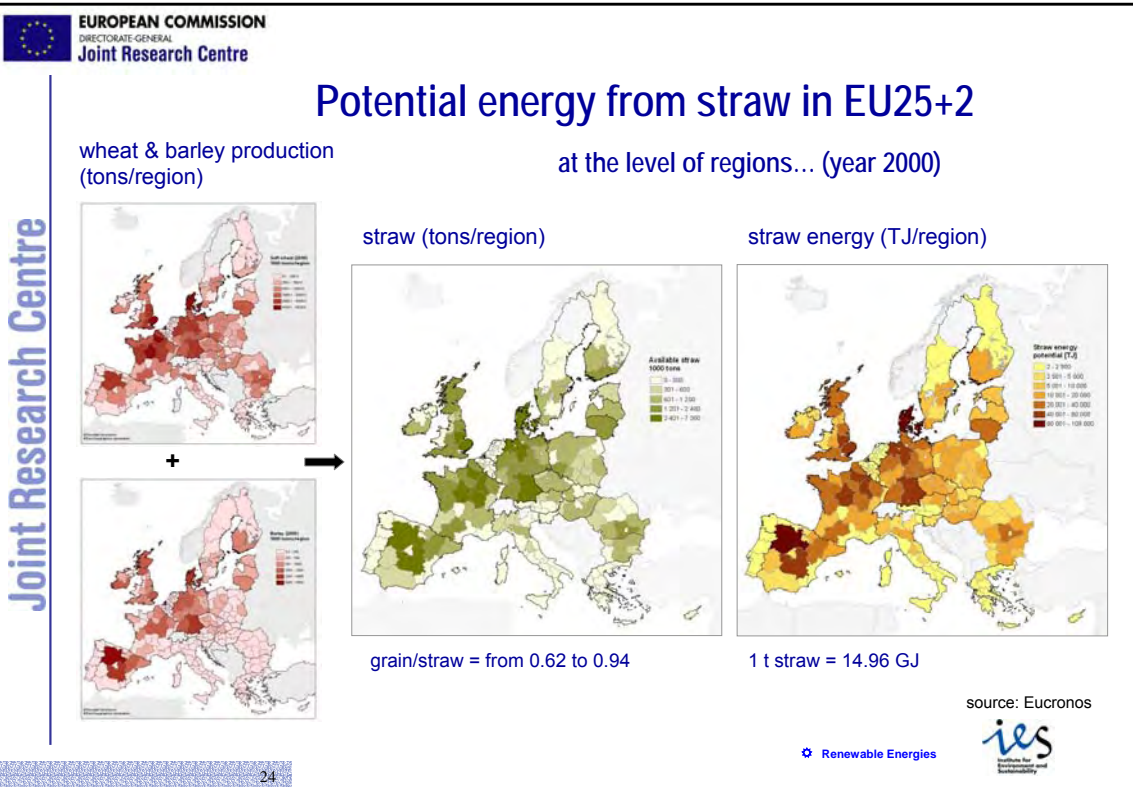
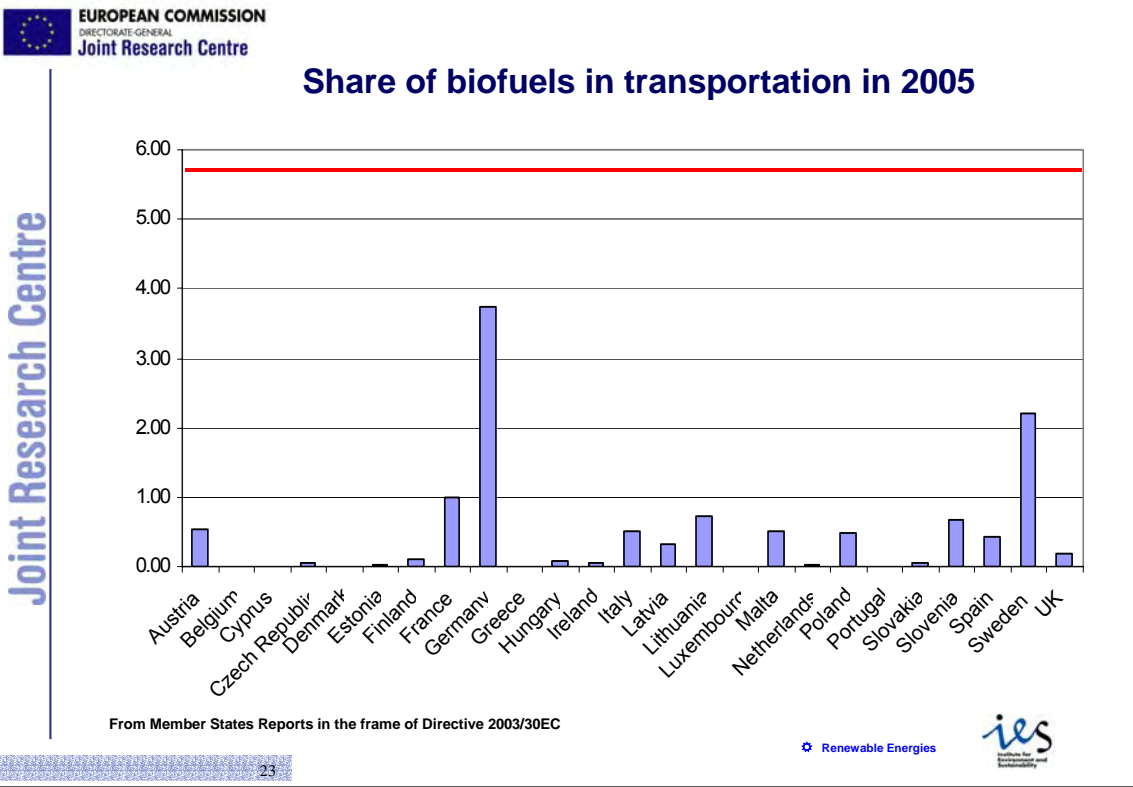
Biomass



Bioenergy pathways









Biomass: Strategy

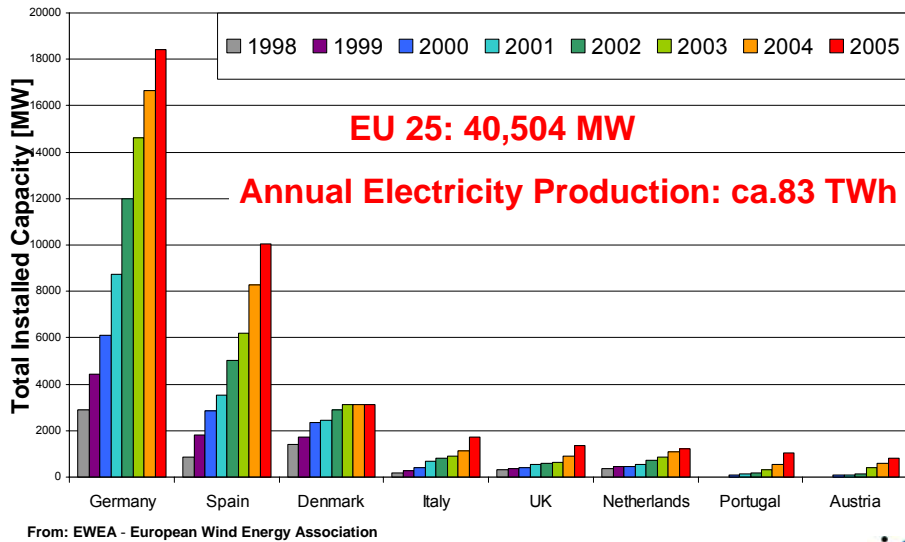
- Biomass Action Plan (2005)
- Secure existing Bioenergies in agricultural areas
 - Sustainable forestry and agriculture
- Establish new technologies in existing Markets
 - Introduction of Bioenergy crops (10% of European agricultural area can replace 10% of Diesel fuel)
- Exploitation of innovation and research results
 - Hydrogen from Biomass



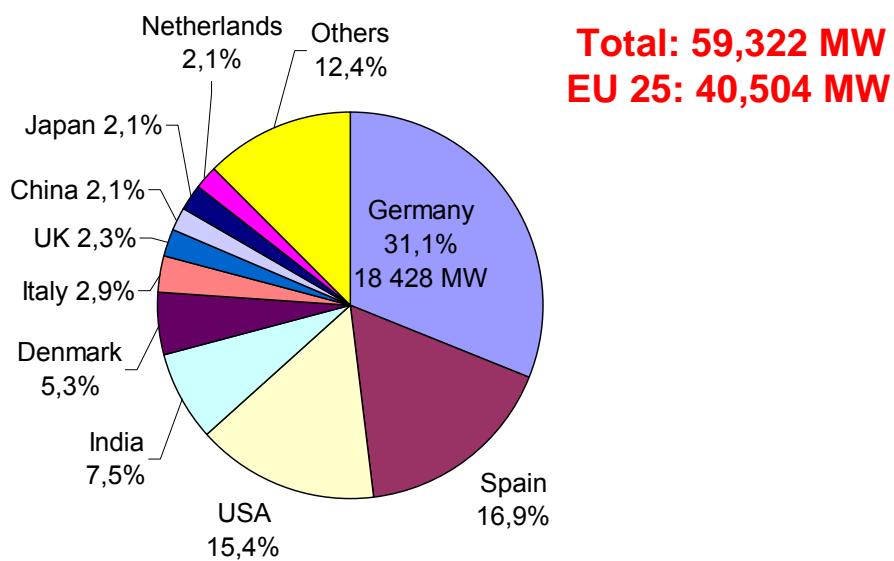
Wind Energy



Wind Energy Growth in EU Top 8



Wind Energy World Wide 2005





Electricity Production and Wind Energy 2005

Annual Electricity Production from Wind 2005

Total: ca. 120 TWh

EU 25: ca.83 TWh

Annual Electricity Production

Total: 16,000 TWh

Wind: ca. 120 TWh (0.75%)

EU 25

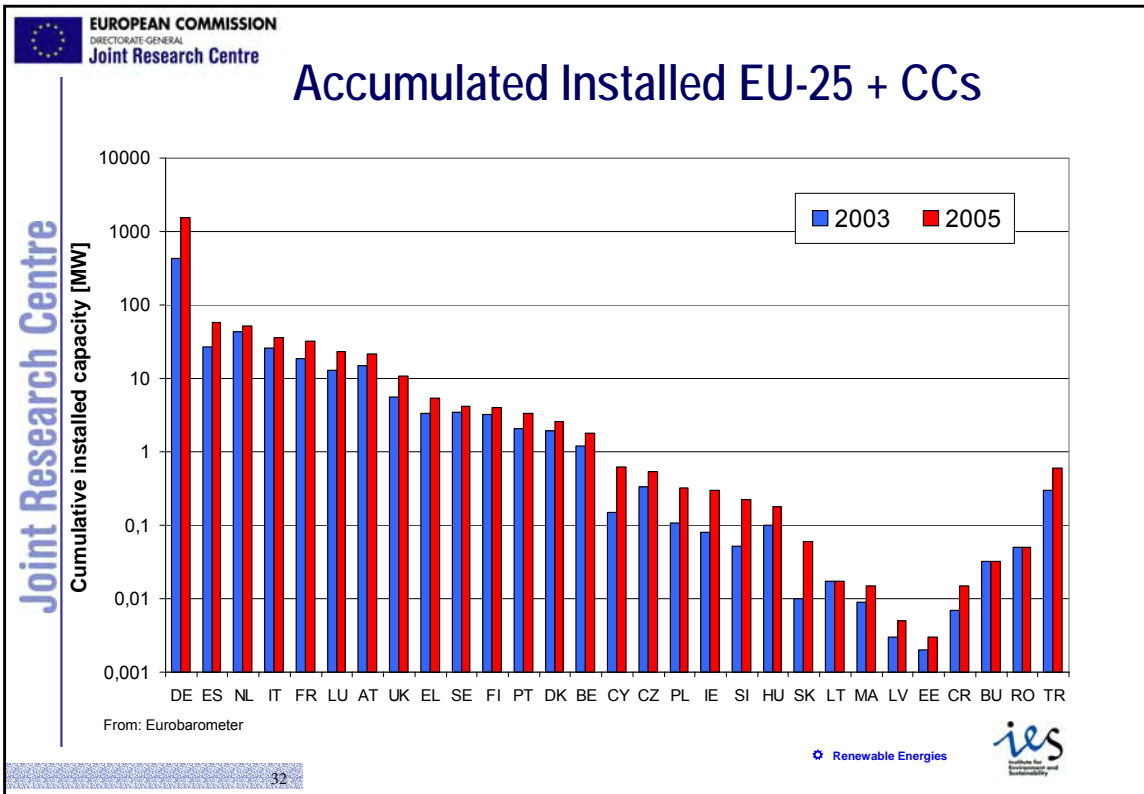
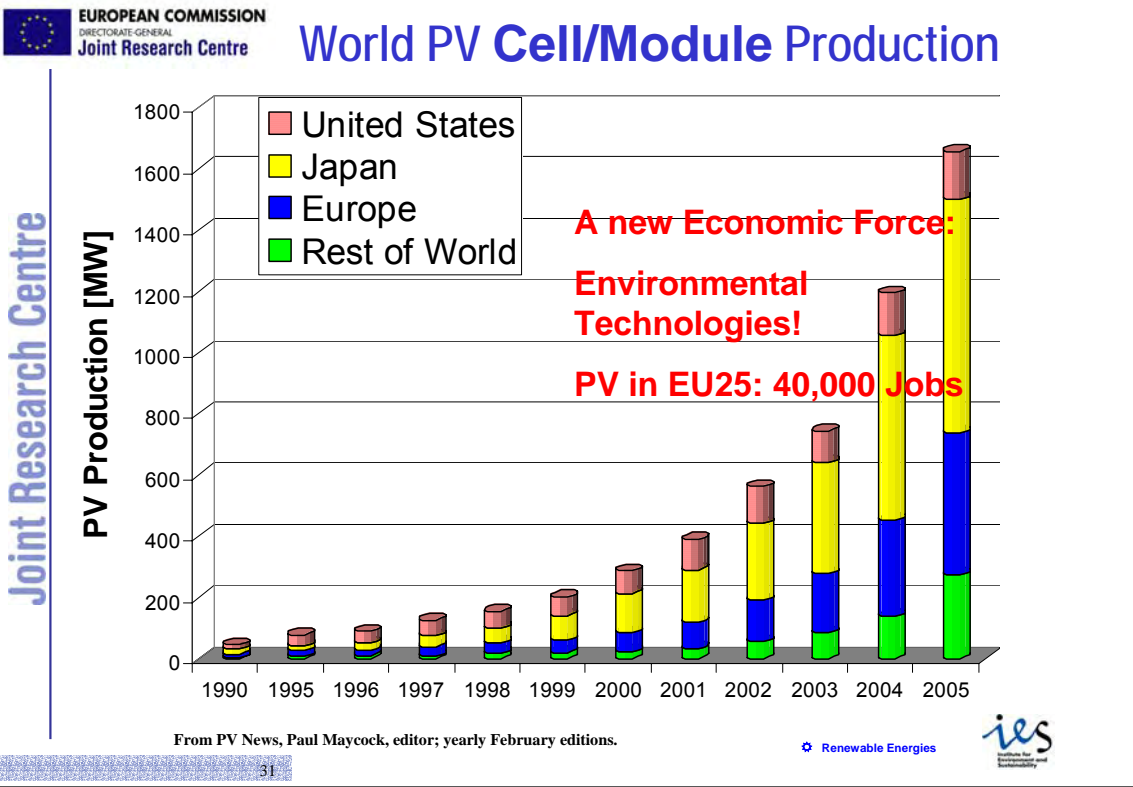
Total Electricity: 3.000 TWh

Wind: ca.83 TWh (2.8%)

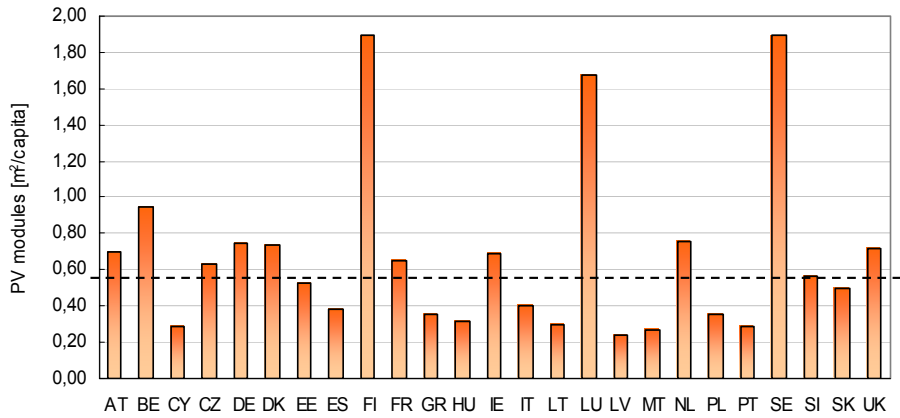


Photovoltaic

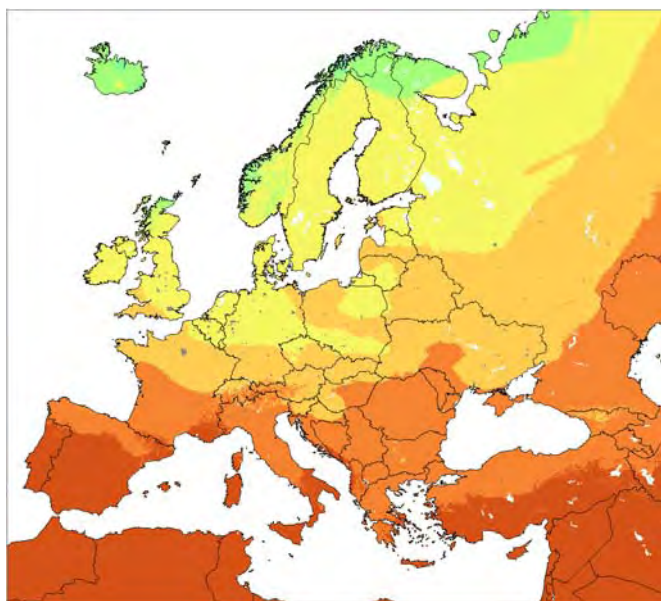




Surface area needed to reach 1 % of the national electricity consumption with Photovoltaics



2004 Generation costs of solar electricity from large central PV power station (5 MWp)

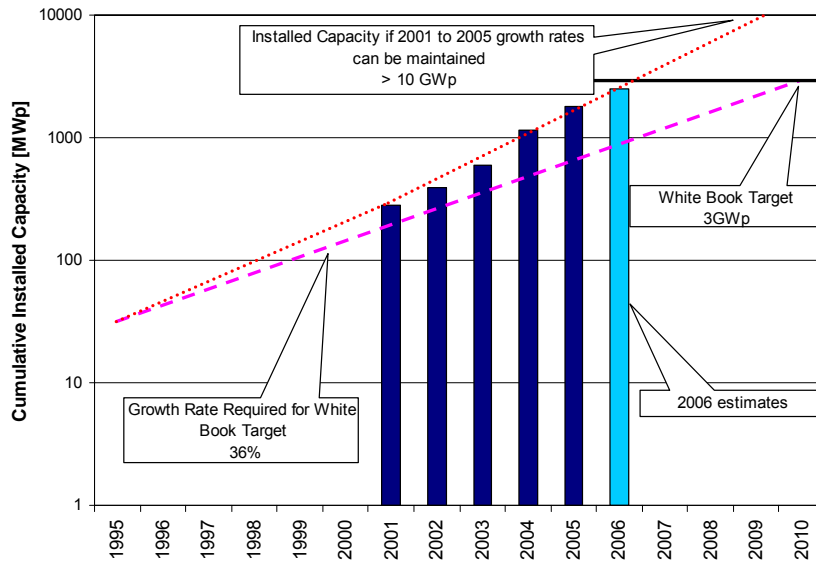


EU25 Average Electricity Price

- system costs: 4 eur/Wp
- capital investment payback time: 20 years
- interest rate: 3%
- inflation: 2%
- yearly maintenance costs 1% of the investment
- mounting at an optimum angle

EU Projections up to 2010

Joint Research Centre

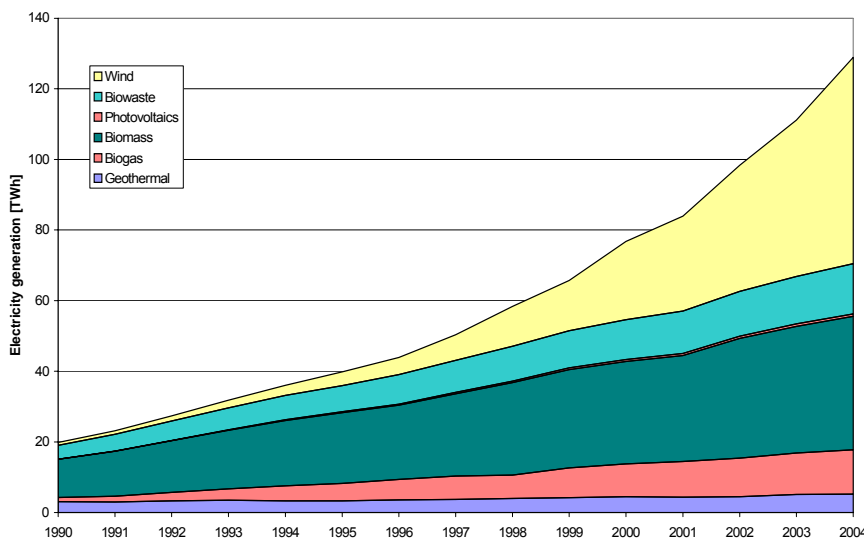


Renewable Energies



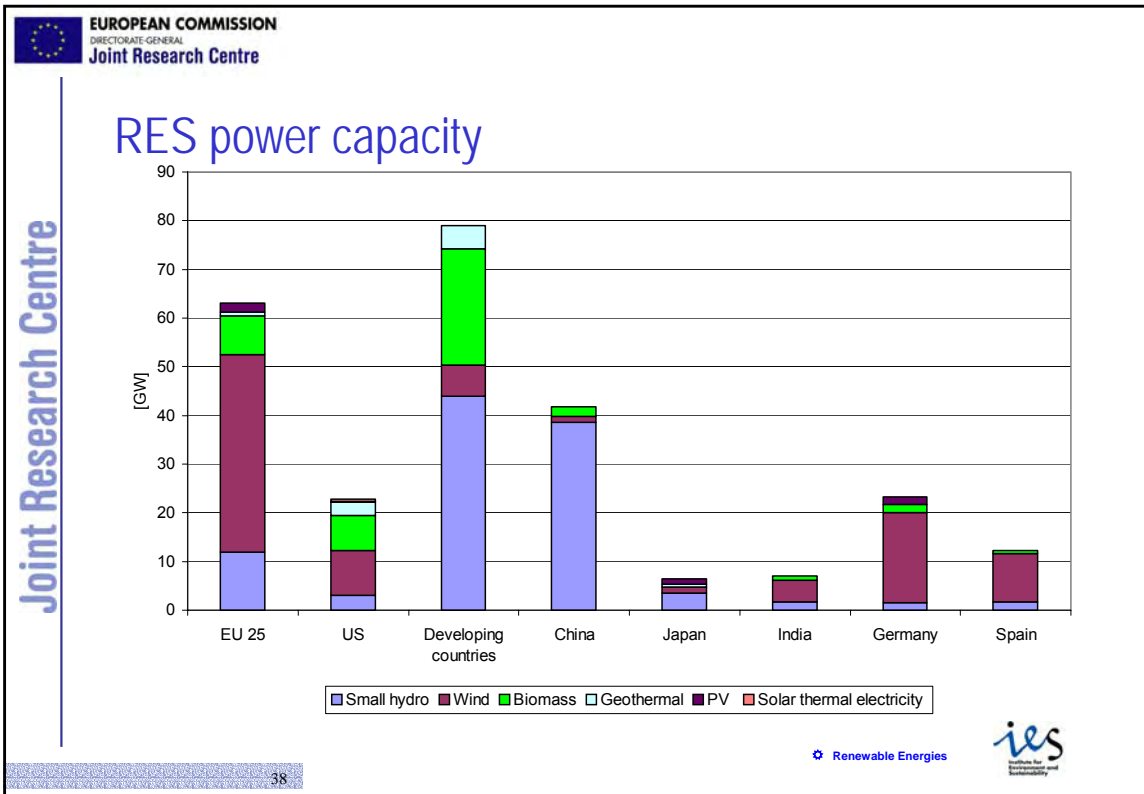
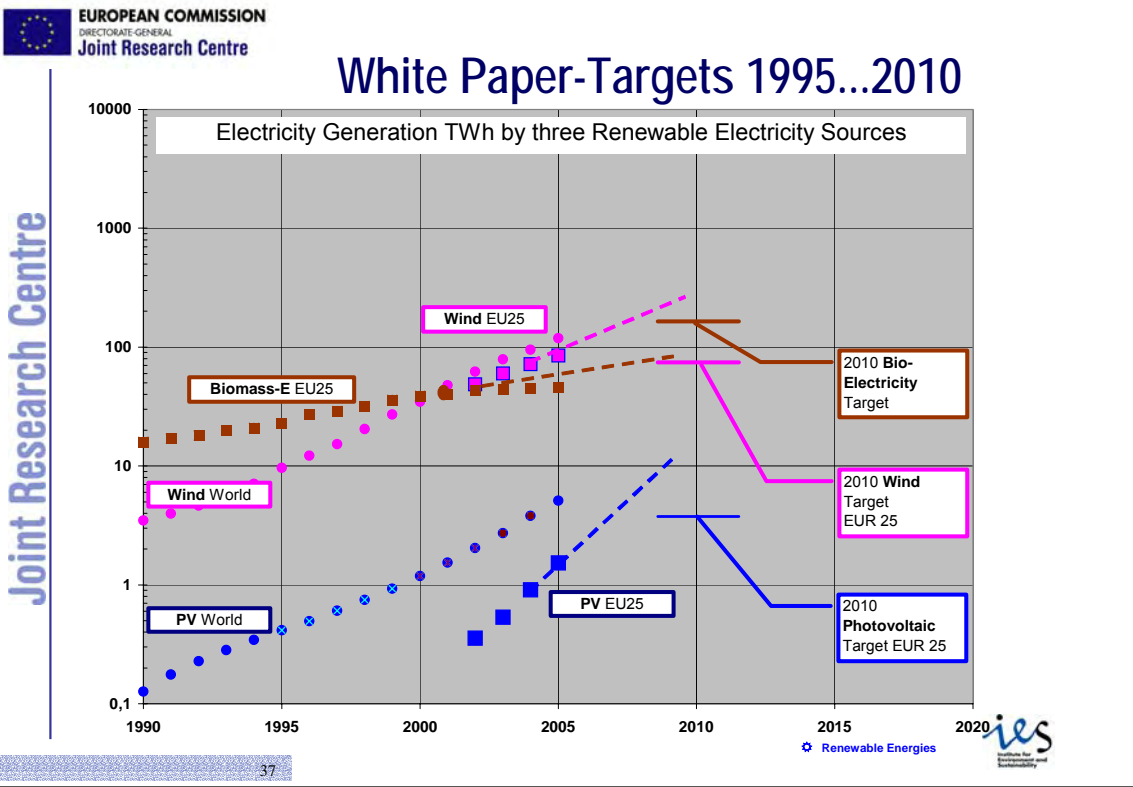
Electricity generated from RES in EU 25

Joint Research Centre

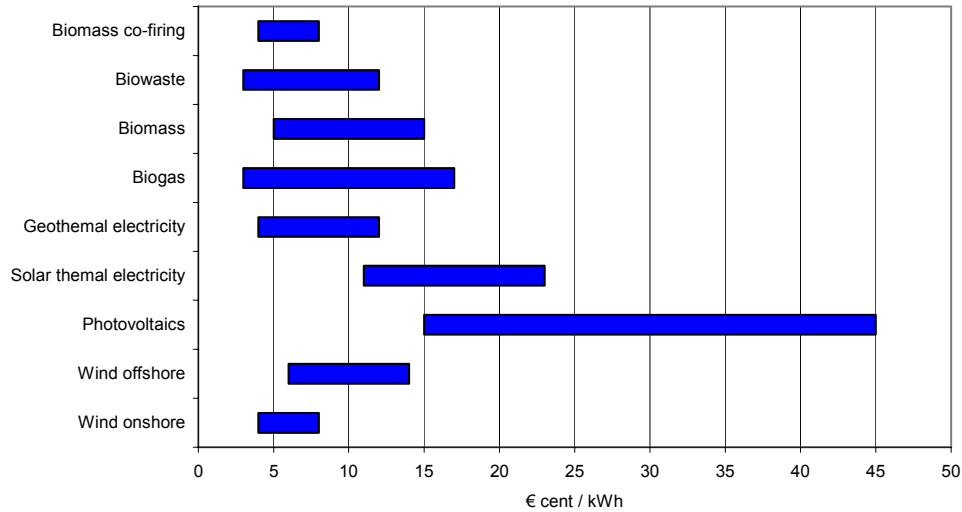


Renewable Energies





Direct Generation Costs



Renewables: Trends (RefSys)

- EU targets 2010 (12% of all Energy, 21% of Electricity) probably reached with current trends:
 - Wind: by 2005/6
 - PV: by 2007
 - Biomass slow, major impact expected from Biofuel directive
- Revision of RES-E Directive
- A RES-Heat Directive ?
- Energy source with decreasing cost-trend



The questions we will try to answer with our Reference System are:

Not anymore How much Renewables will **COST**

But:

How much will Renewables **SAVE**

How much the new economy will **GROW**

IEA data collection on RES

Samantha Ölz
Renewable Energy Unit

Workshop on "Data Gathering on Renewable Energies for
New Member States and Candidate Countries"

Scientific Technical Reference System on Renewable Energy
and Energy End-Use Efficiency

Cavtat-Dubrovnik, 15-16 November 2006

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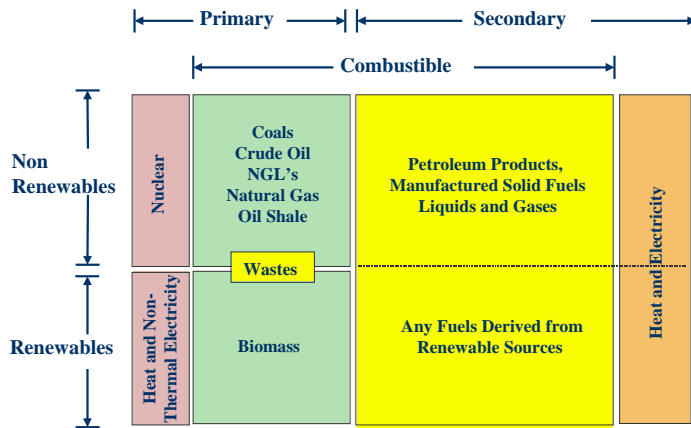
INTERNATIONAL
ENERGY AGENCY 

Presentation outline

- IEA statistics: techno-physical data
- RES Policies and Measures
- RD&D expenditures
- IEA Implementing Agreements
- What the future holds

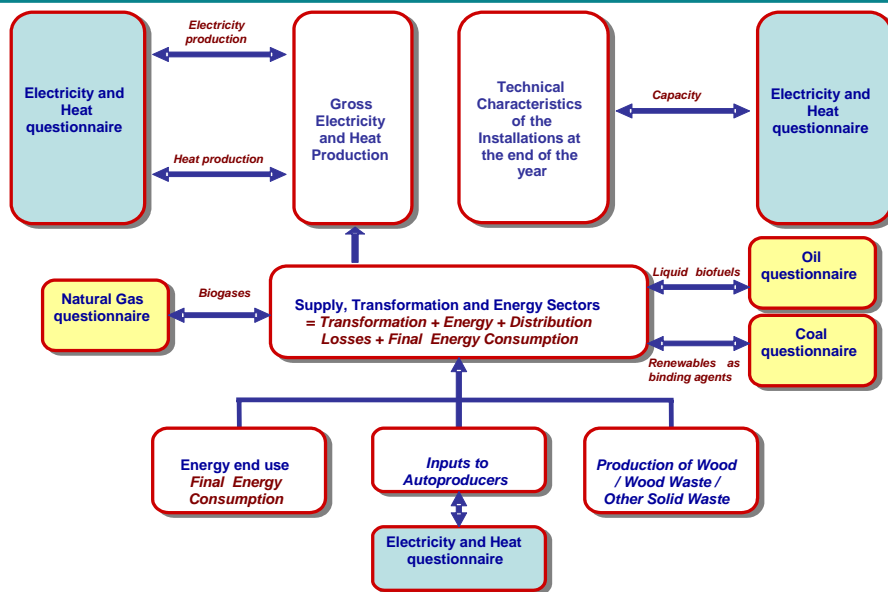
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Energy Commodities: Non-Renewables vs. Renewables



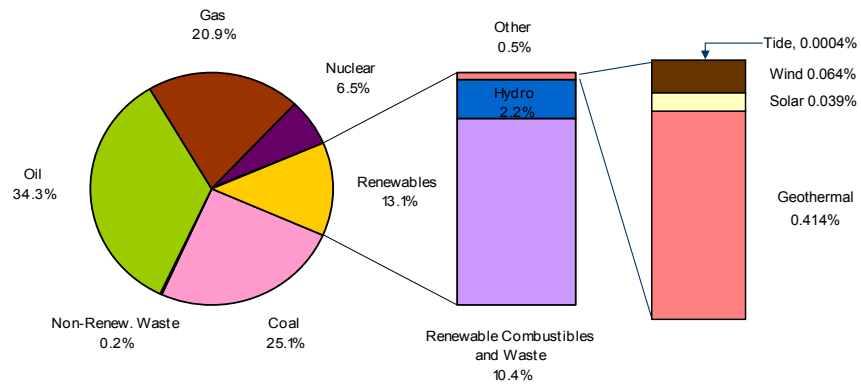
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Renewables and Wastes Questionnaire



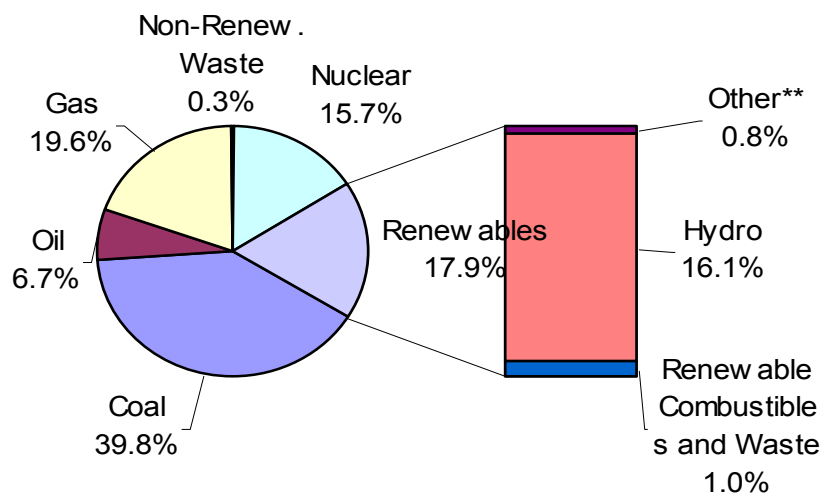
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Fuel Shares of World Total Primary Energy Supply, 2004



© OECD/IEA - 2006

Fuel Shares of World Electricity Generation, 2004

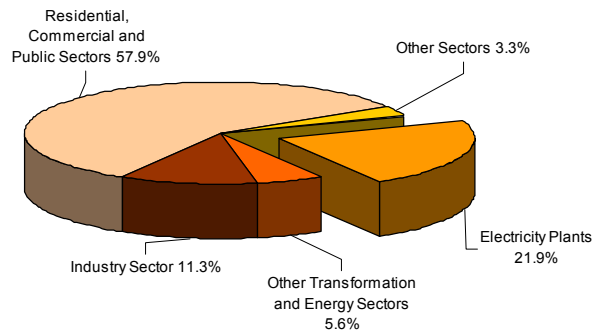


** Other: Geothermal, Wind, Solar, Tide

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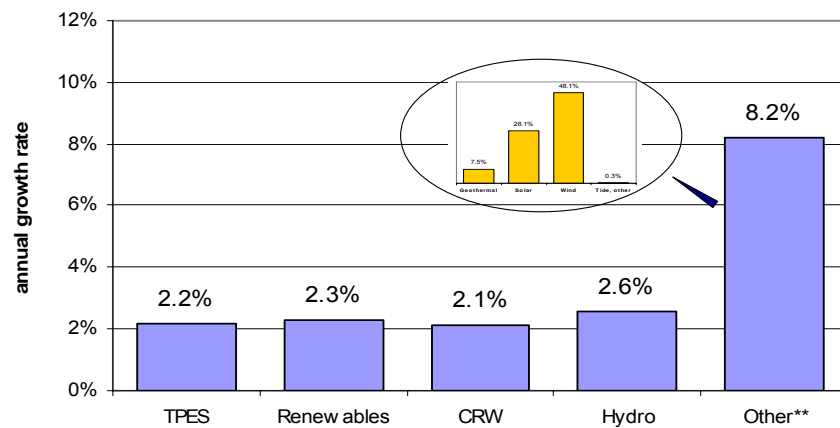
World renewable energy consumption by sector, 2004

- Worldwide, 22% of RES use is for electricity generation
- In OECD countries it accounts for more than 50%



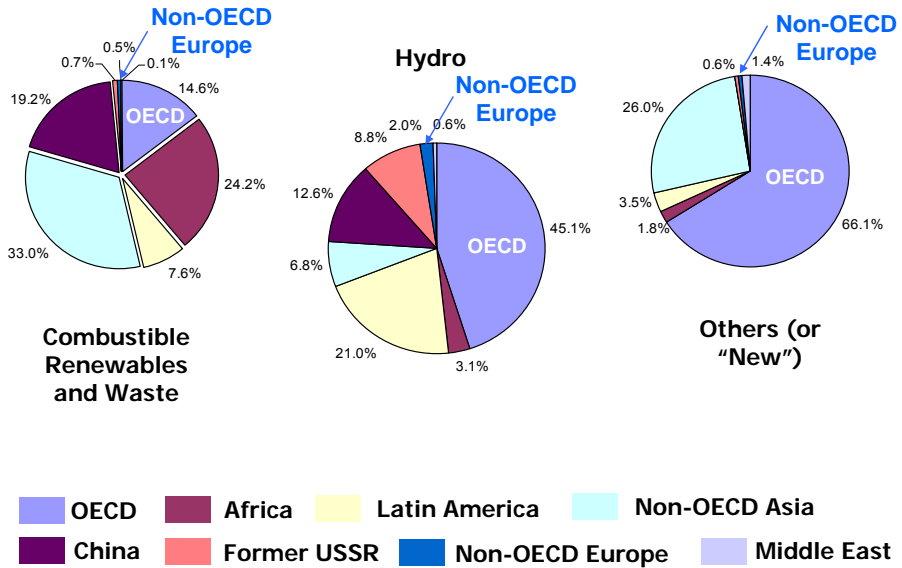
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Annual Growth of Global Renewables Supply, 1971 to 2004



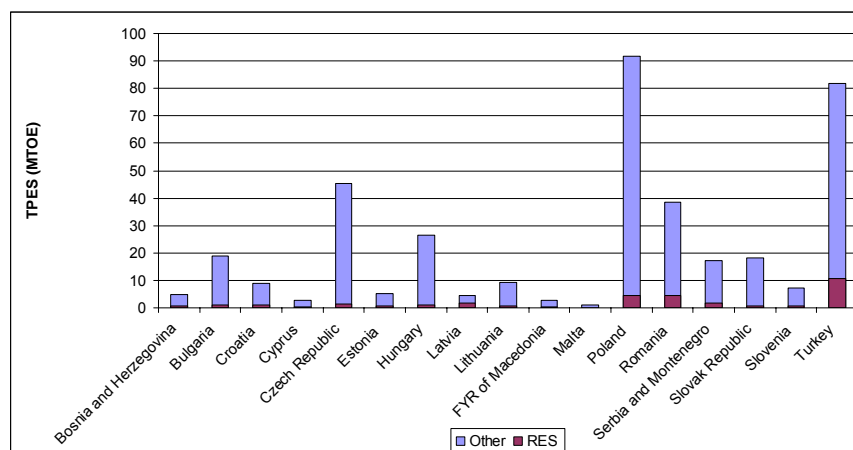
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Regional shares 2004



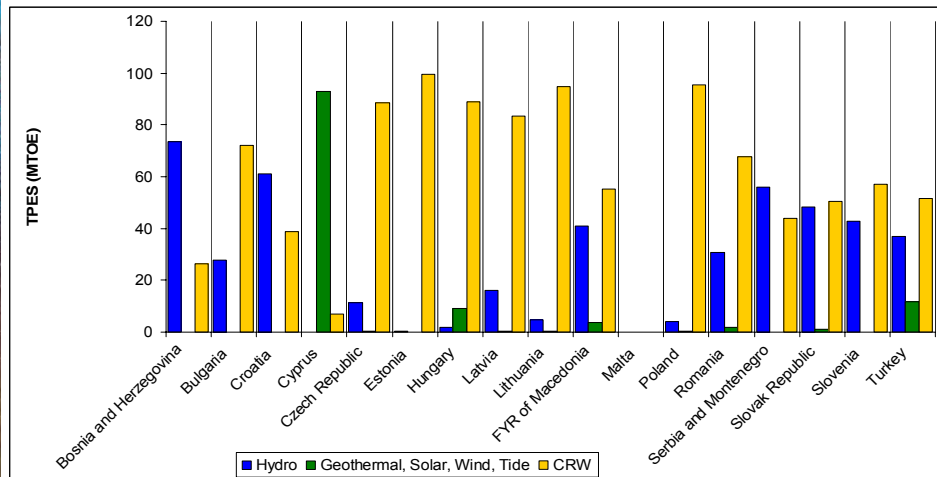
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Renewables' Contribution to TPES in EU-10 & Candidate Countries



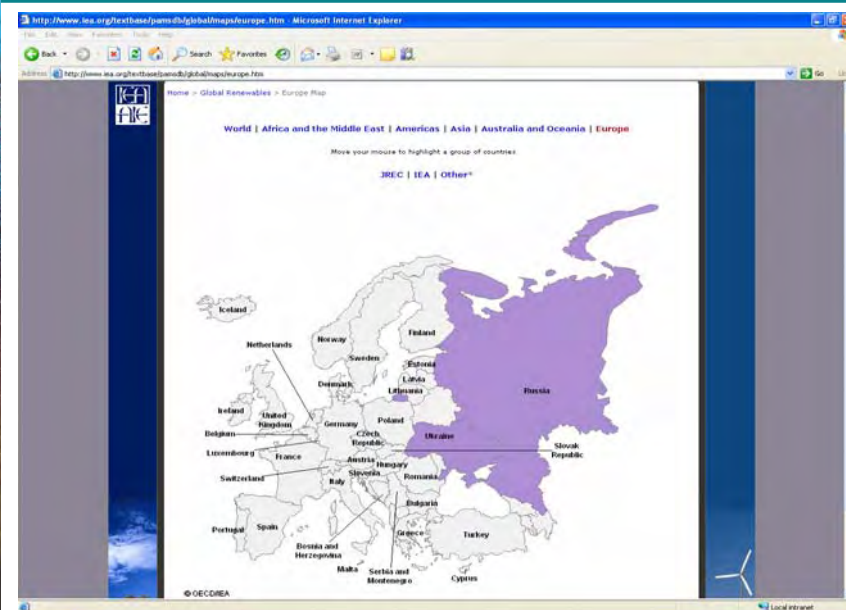
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Which RE technologies?



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IEA JREC Renewables Database



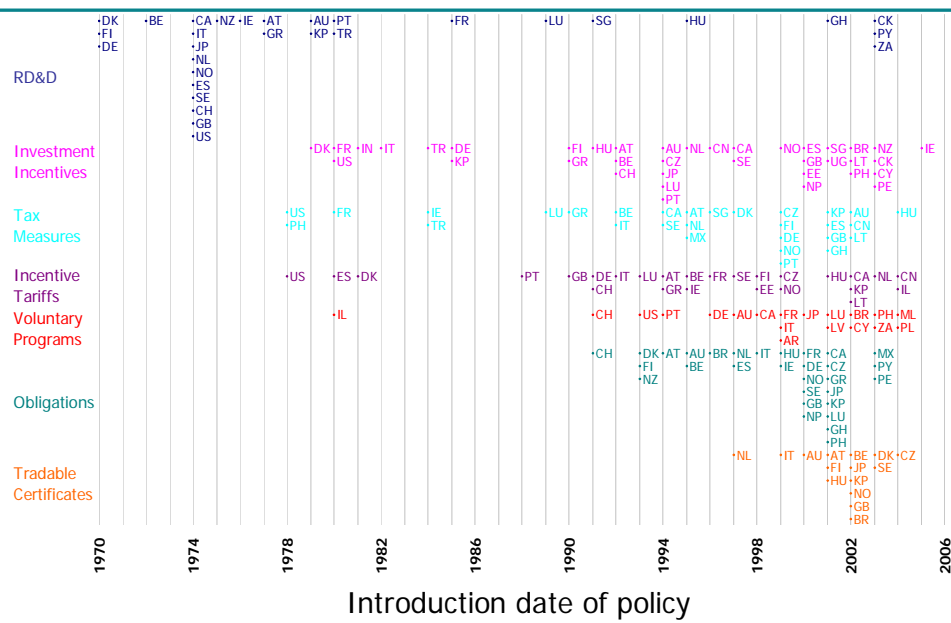
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Example: Turkey

The screenshot shows a web browser displaying the IAEA's database entry for Turkey's Law No. 5346. The page includes the IAEA logo, the title of the law, the country (Turkey), the effective date (2005), and a detailed description of the law's purpose and provisions. It also lists the policy type as 'Renewable energy' and 'All technologies simultaneously'.

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Policy Chronology



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Measures Today

Category	Number of Measures/Actions	% of Total
Policy Actions including Laws	185	29
Information	29	5
Financial/Economic	227	35
Regulatory/Administrative	78	12
Voluntary	13	2
RD&D	77	12
Targets	34	5
Total	643	

47 countries reporting

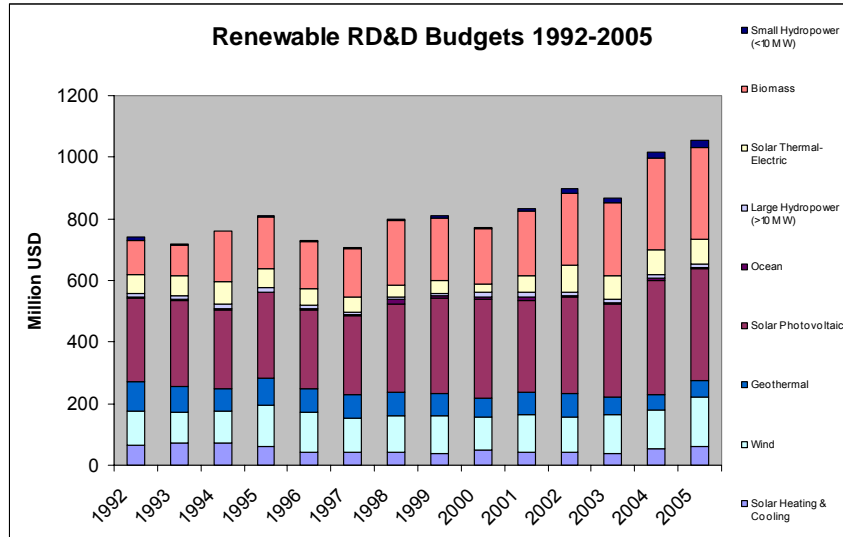
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Policy analysis

- Cost-effectiveness of various types of policies at various levels of market growth;
- Investment towards mainstream;
- Scenarios for renewables: implications for fossil fuel demand and reduced CO₂ emissions; and
- Energy security implications
- Final report: Trends in Global Renewable Energy Markets and Policies
 - Publication: 1st semester 2008

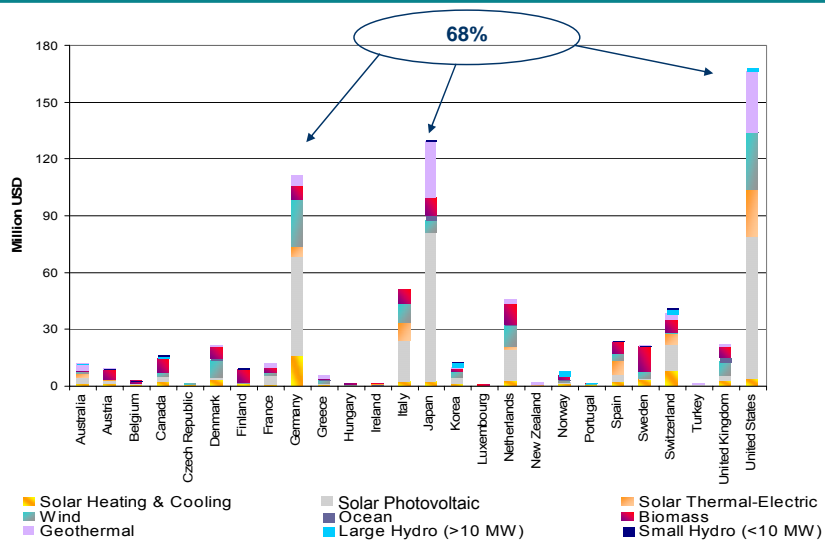
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Renewable RD&D budgets, IEA 1992-2005



© OECD/IEA - 2006

Average annual renewable RD&D budgets, IEA 1990-2003



© OECD/IEA - 2006



RD&D priorities - key messages

- Renewables are one important means to improve energy security and to mitigate CO₂ emissions.
- RD&D leads to cost reduction and makes renewables competitive.
- Market deployment policies are key for the realization of renewable energy potentials.
- Strategies need to be developed further since most renewables have not reached their potential.

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IEA Technology Collaboration Programme (Implementing Agreements)

- 9 focusing on renewables out of 41 current Agreements (ImpAgs)
- Over 100 tasks
- Nearly 500 participating institutions
- Average 12 countries per Agreement
- USD 120-150 million spent each year under the collaborative programme
- Non-IEA Member countries and industries can and do participate

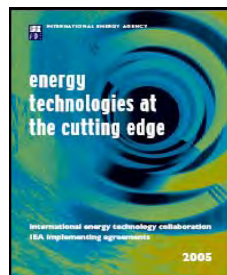
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IEA Network for Technology RD&D and Deployment

- Renewable Energy Working Party (REWP) oversees ImpAgs on Renewables:
 - Bioenergy
 - Hydropower
 - Geothermal
 - Photovoltaic
 - Solar Heating and Cooling
 - SolarPACES
 - Ocean Energy
 - Wind Energy
 - Renewable Energy Technology Deployment **New**

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ImpAg data on RES



- Annual reports and task publications
- Joint ImpAG – IEA Secretariat workshops
 - Techno-physical data
 - Socio-economic data: market developments

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Future possible pathways

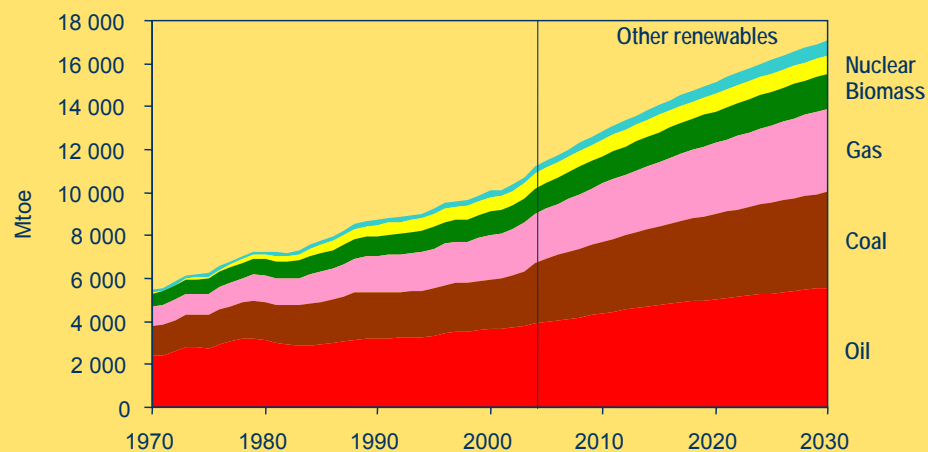
IEA projections

- World Energy Outlook: to 2030
- Energy Technology Perspectives: to 2050

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World
Energy
Outlook
2006

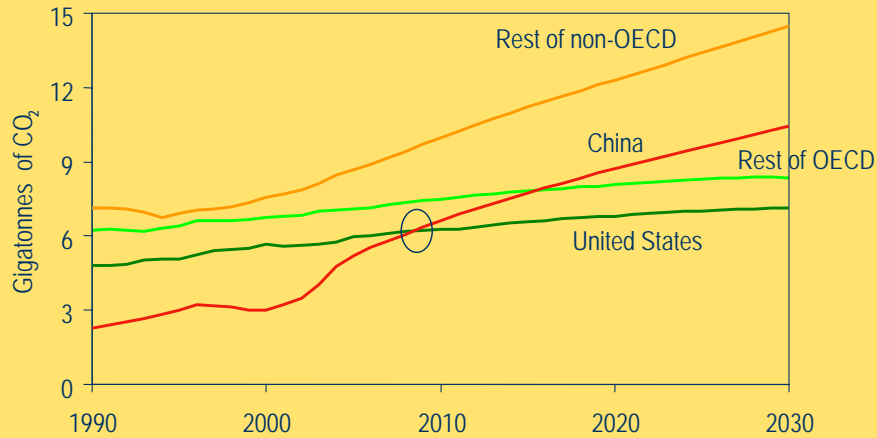
Reference Scenario: World Primary Energy Demand



Global demand grows by more than half over the next quarter of a century, with coal use rising most in absolute terms

© OECD/IEA - 2006

Reference Scenario: Energy-Related CO₂ emissions by Region



China overtakes the US as the world's biggest emitter before 2010, though its per capita emissions reach just 60% of those of the OECD in 2030

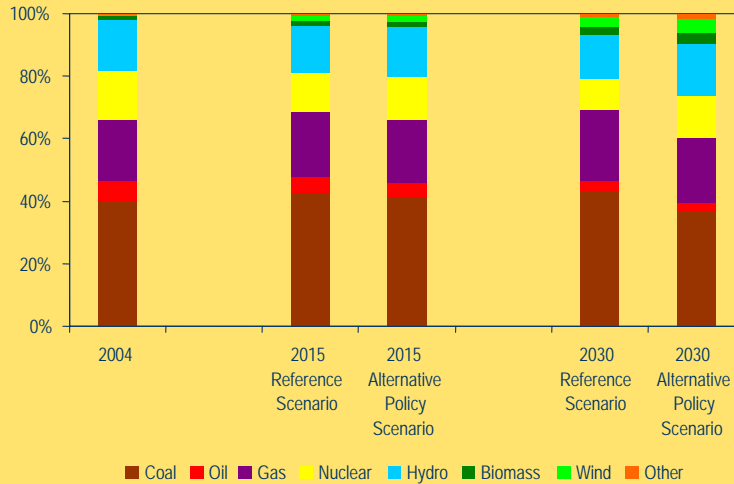
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Alternative Policy Scenario

- Examines the effects of policies presently under consideration by governments, aimed at encouraging energy efficiency and the uptake of non-fossil fuel energy technologies
- Objective: to reduce energy demand, anthropogenic greenhouse gas emissions; to increase energy security through geographic and fuel-supply diversity

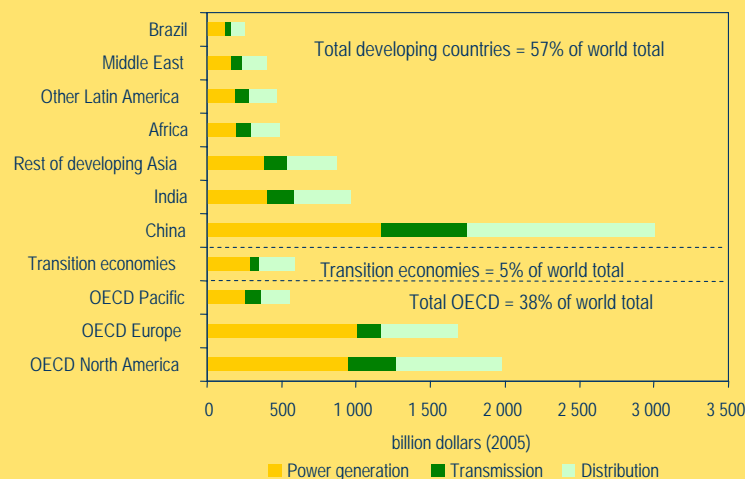
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**Alternative Policy Scenario:
Global Fuel Shares in Electricity Generation**



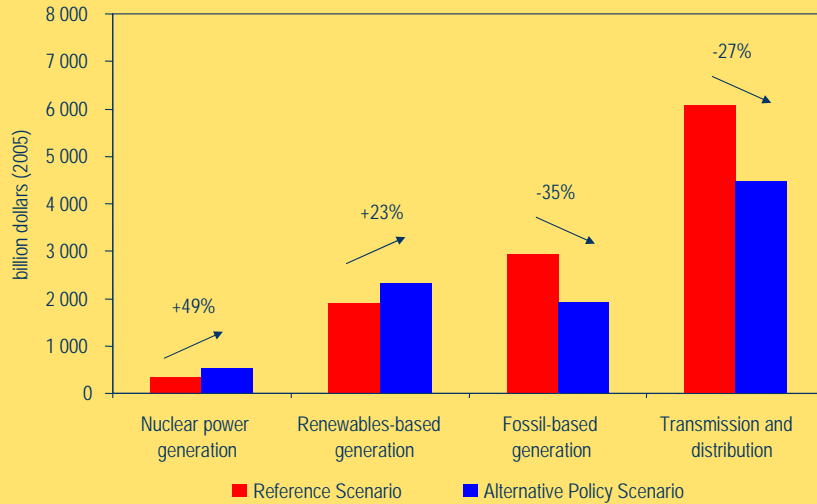
Over a quarter of global electricity comes from renewable energy sources in 2030 in the Alternative Policy Scenario

**Reference Scenario:
Cumulative Power-Sector Investment by Region, 2005-2030**



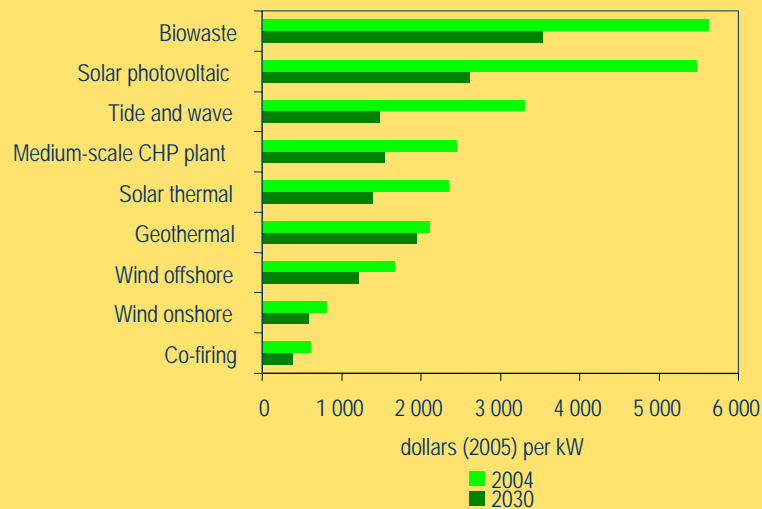
Most power-infrastructure investment goes to developing countries, with China alone investing \$3 trillion

The Alternative Policy Scenario: Electricity-Supply Investment, 2005-2030



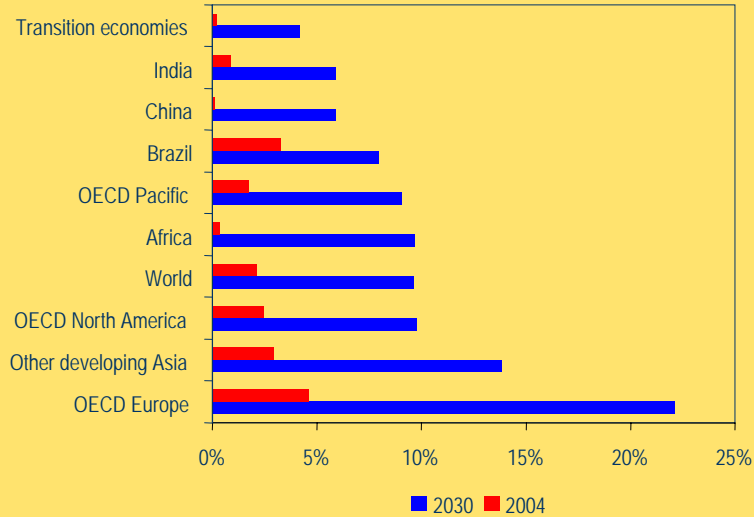
Electricity-supply investment are \$2.1 trillion lower than in RS, but renewables and nuclear investment are higher

Alternative Policy Scenario: Capital Costs of Renewables-Based Technologies



The capital costs of renewables fall over time, with wind power the most competitive for new plant

Alternative Policy Scenario: Shares of non-Hydro Renewable Energy in Power Generation by Region



Most of the growth in non-hydro renewables use occurs in OECD Europe, where incentives are the strongest

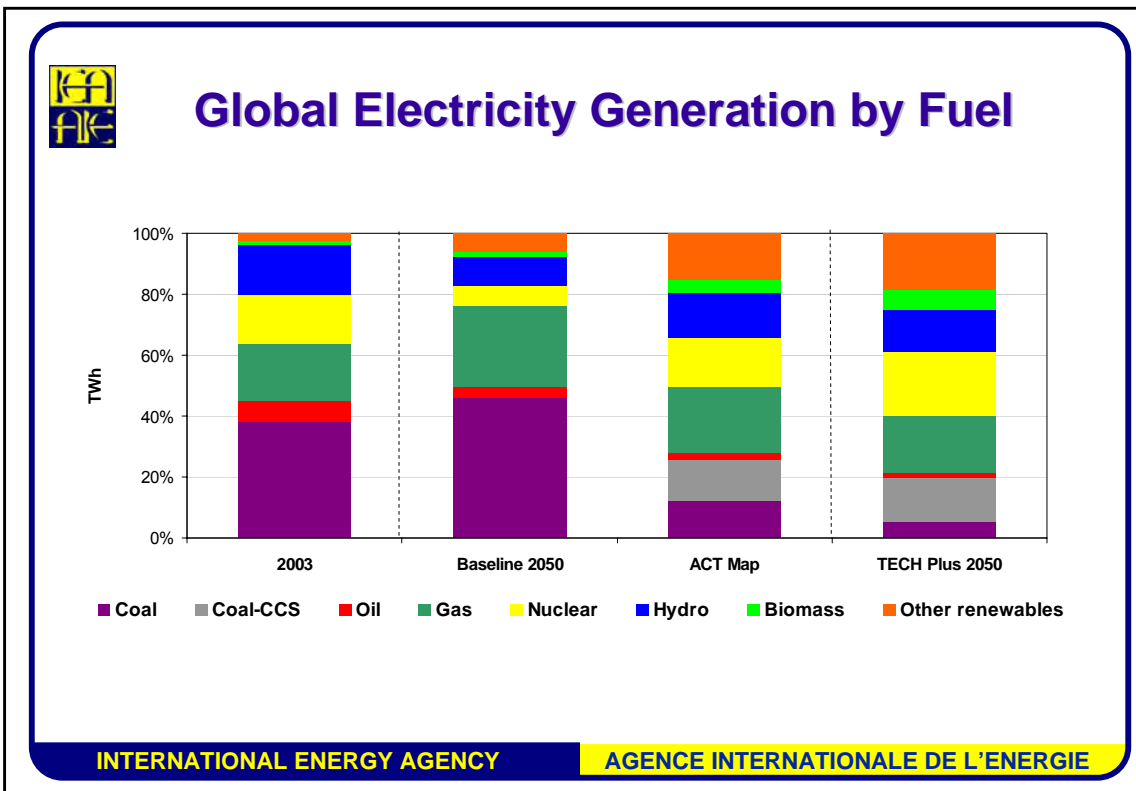
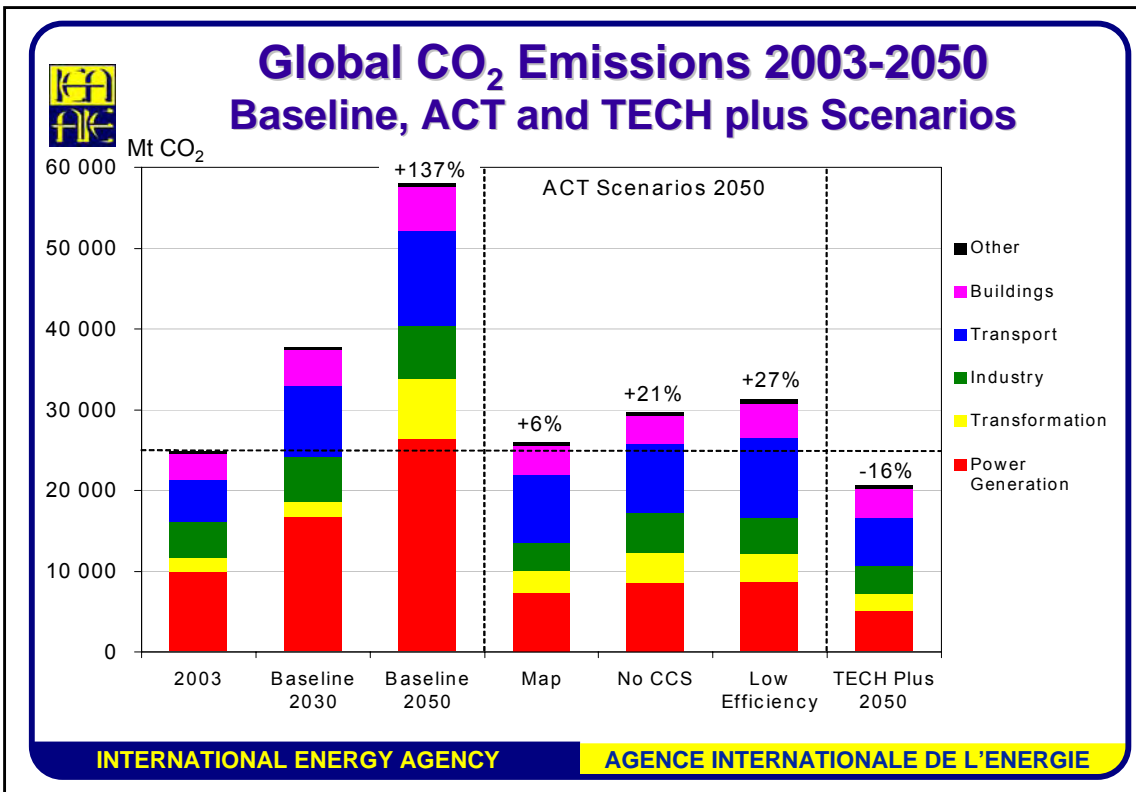
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Energy Technology Perspectives Scenarios & Strategies to 2050

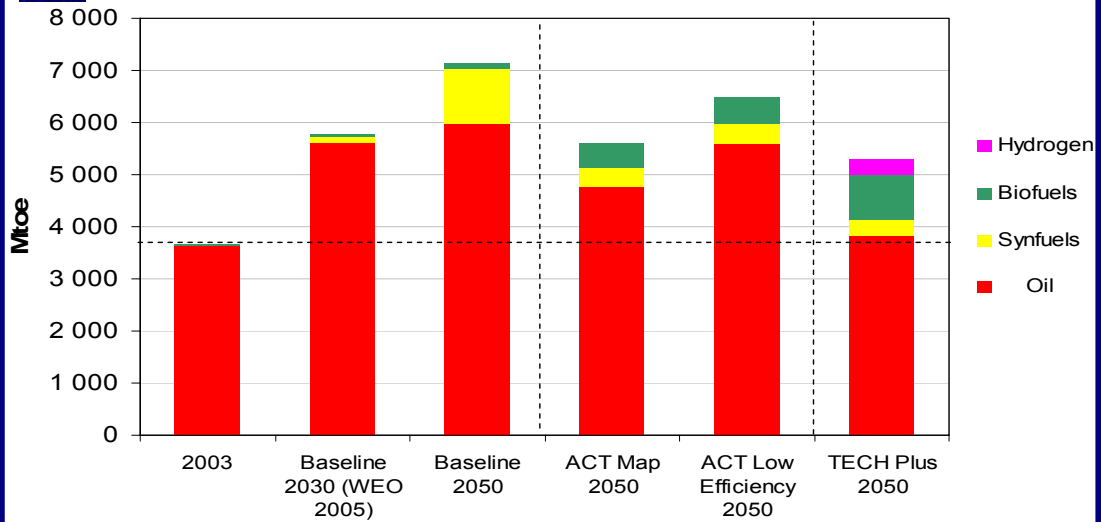


- Our current energy path is unsustainable
- Five Accelerated Technology Scenarios (ACT)
- A portfolio of current and emerging technologies can enhance energy security and avert the trend of increasing CO₂ emissions.
- Much can be done even if certain key technologies would not deliver – but a CO₂ reduction incentive is necessary.
- A sustainable energy future is achievable!





World Liquid Fuel Supply by Scenario 2003-2050

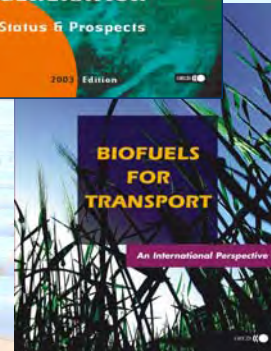
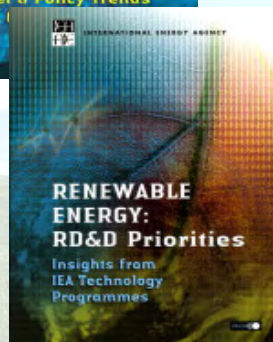
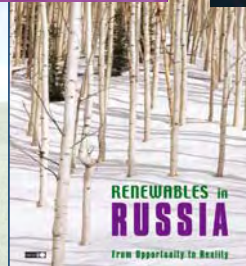
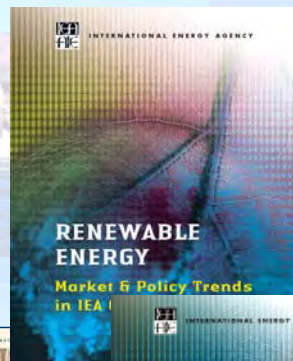
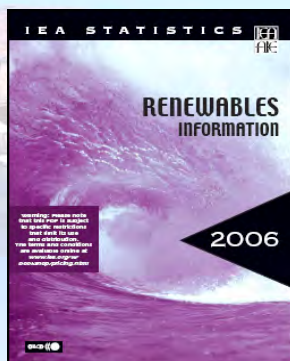


Primary oil demand is below 2030 baseline level and returns to today's level in TECH Plus

INTERNATIONAL ENERGY AGENCY

AGENCE INTERNATIONALE DE L'ENERGIE

IEA Renewable Energy Publications





Contacts

- <http://renewables.iea.org>
- IEA Technology Agreements:
<http://www.iea.org/textbase/techno/index.asp>
- Samantha Ölz:
samantha.olz@iea.org



Data Gathering on Renewable Energies for New Member States and Candidate Countries“



15-16 November 2006, in Dubrovnik-Cavtat, Croatia.

ΚΥΠΡΟΣ ΚΥΠΡΟΣ



CYPRUS INSTITUTE
OF ENERGY

Christodoulos PHARCONIDES
Renewable Energy Systems Engineer
Energy Officer
Cyprus Institute of Energy

November 2006



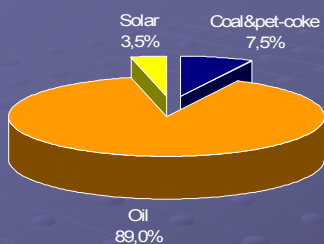
ENERGY POLICY

The main objectives of the Cyprus Energy Policy are

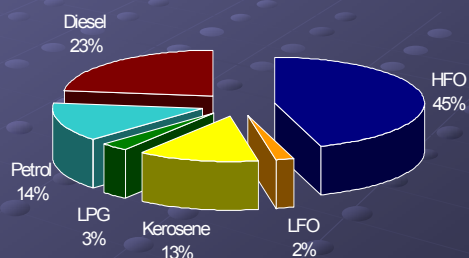
- Securing energy supply.
- Meeting energy demand.
- Harmonisation of the island energy sector with the Acquis-Communautaire.
- **Energy conservation.**
- **Development of Renewable Energy Sources**
- Mitigation of energy consumption impacts on the environment
- Diversification of primary energy sources for electricity production (coal, LNG)

Energy Balance (2004)

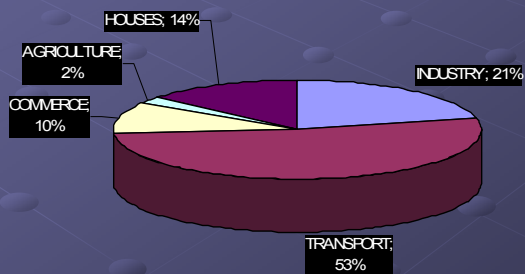
PRIMARY ENERGY CONSUMPTION



FOSSIL FUEL IMPORTS



Final Energy Consumption by sector



ELECTRICITY GENERATION

Three conventional power stations.
Total installed capacity of 988 MW.

Vasilikos Power Station	2 x 130 MW	oil/steam	260 MW
Vasilikos Power Station	1 x 38 MW	gas turbine	38 MW
Dhekelia Power Station	6 x 60 MW	oil/steam	360 MW
Moni Power Station	6 x 30 MW	oil/steam	180 MW
Moni Power Station	4 x 37,5 MW	gas turbines	150 MW
Total Installed Capacity			988 MW

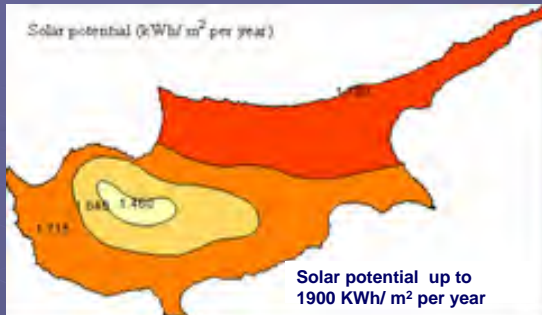


THE ELECTRICAL TRANSMISSION SYSTEM

R.E.S. potential

- Solar → Extensive use for water heating in the domestic sector, further prospects in the tourist sector and for electricity production.
- Wind → Unexploited available wind potential.
- Biomass → Unexploited available biomass potential.
- Small Hydro → Limited unexploited available potential.

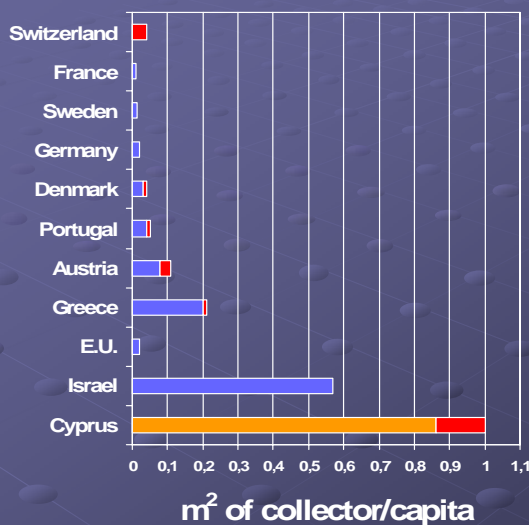
SOLAR POTENTIAL



The highest solar radiation in Europe

- Extensive use of solar water heaters in domestic sector
About 90% of individual houses, 80% of apartments, and 50% of hotels are equipped with solar water heating systems
- Approximately **1 m²** of installed solar thermal collectors per capita:
- Prospects exist for further 40,000-80,000 m² until 2010

Solar Thermal Energy Market Solar collectors per capita



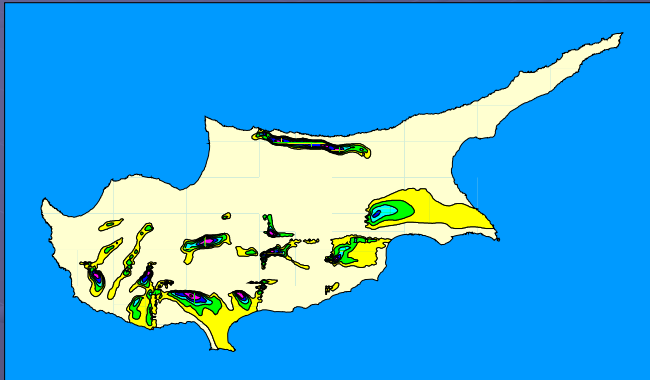
■ Cyprus is the first country in the world with respect to installed solar collectors per capita.

■ The EU Study "Sun in Action" ranks Cyprus first with approximately **1 m²** of installed solar collector per capita.

Latest figures show that more than **730 000 m²** of solar collectors are installed in Cyprus.

WIND POTENTIAL

- Some areas with mean wind velocity 5-6m/sec
- Few areas with 6,5-7m/sec
- Estimation of exploitable potential: 150-250 MW



© Dr. Ioannis P. Glekas



POLICY INITIATIVES REGARDING RES IN THE REPUBLIC OF CYPRUS



IMPLEMENTATION OF ENERGY POLICIES FOR THE DEVELOPMENT OF RES STARTED IN 1985

- Formulation of Renewable Energy and Energy Conservation Action Plan (1985) which was Revised in 1998
- Following the above was the establishment of
 - The Applied Energy Centre (A.E.C.) and
 - The Cyprus Institute of Energy (C.I.E.)
- Operation of a first Grants Scheme
- EAC agreement to purchase electricity generated from Renewable Energy Sources
- Then procedures were specified for licensing and interconnecting wind and photovoltaic installations to the national grid
- Lately came the formulation of an Action Plan (2002-2010) for RES in Cyprus.

E.A.C. & R.E.S.

- The EAC, in line with the government's energy policy is obliged to buy electricity produced from renewable energy sources at a fixed price.
(currently set to 3.7 CY cents per KWh)
- Currently EAC installs dual meters in the cases of electricity production with photovoltaics in the domestic sector.

EAC : Electricity Authority of Cyprus

FORMULATION OF AN ACTION PLAN FOR R.E.S. IN CYPRUS

- The MCI&T in an effort to fully harmonise its RES policy with that of the European Union, with the assistance of EU specialists (Dr. A. Zervos), has prepared a study on the formulation of a supportive frame work for RES applications in Cyprus. The study has addressed pricing, incentives, licensing and ways of complying with EU related policies.
- Based on the findings of the above study an Action Plan (2002–2010) for supporting RES applications in Cyprus has been prepared. The Action Plan calls for doubling of RES contribution to the national energy balance by 2010 and the establishment of the supportive environment for the materialization of RES investments in the country.

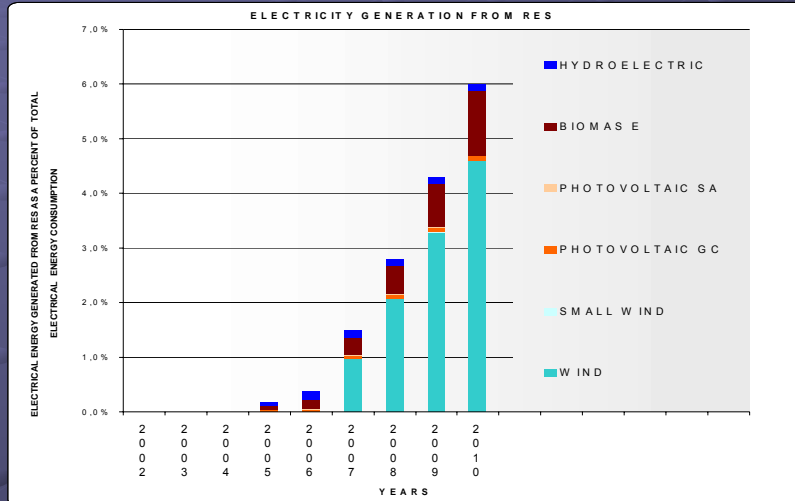
ACTION PLAN 2002-2010 MAIN OBJECTIVES



1. INDICATIVE TARGETS FOR ELECTRICITY FROM RES

Increase in electricity generation from RES, to reach a **6%** of the total electricity consumption in **2010**.

*This will lead to a significant reduction on oil imports.
85.000 tones of oil equivalent, worth approximately 11 million CYP annually.*



2. INDICATIVE TARGETS FOR THE TOTAL CONTRIBUTION OF RES TO THE ENERGY BALANCE

Promote the use of Renewable Energy Sources

Contribution of RES to the total energy consumption to reach 9% by 2010

*This will lead to a significant reduction on oil imports.
280.000 tones of oil equivalent, worth approximately 31 million CYP,
will be saved annually.**

** Based on current oil prices*

3. INDICATIVE TARGETS FOR ENERGY CONSERVATION

Reduction of the total energy consumption by 1% per annum, with energy conservation measures.

*This will also lead to a further reduction of oil imports
28.000 tones of oil equivalent worth 3,5 million CYP annually**

** Based on current oil prices*

GRANT SCHEMES

- The Aim of the **first scheme** (energy conservation) was to provide financial incentives in the form of governmental grants for the materialization of investments in the field of energy conservation and the substitution of conventional fuels with renewable energy sources.
Beneficiaries of the Scheme were only existing enterprises, which operated in the sectors of the manufacturing industry, hotels and agriculture.
The grant was set at 30% of the total investment cost, with the maximum amount of grant not exceeding £30.000.
The scheme was in operation from 6/1999 – 2/2003.
- The scheme was **revised 2004**. Under the revised scheme a substantially higher number of entities are eligible to apply for a grand including the domestic sector.
- The **upgraded scheme 2005** provides financial incentives in the form of governmental grants/subsidies for the installation and operation of energy saving systems and renewable energy systems.

Grant Schemes

Two Investment Categories

CATEGORY A:
Energy Conservation



CATEGORY B:
Renewable Energy Sources (R.E.S.)



The one scheme, became two!

GRANT SCHEME for Energy Conservation and the Promotion of Renewable Energy Sources (RES) Utilization














For individuals / households and non profitable organisation, to the degree that they are not engaged in any economic activities.





For companies and other legal enteritis

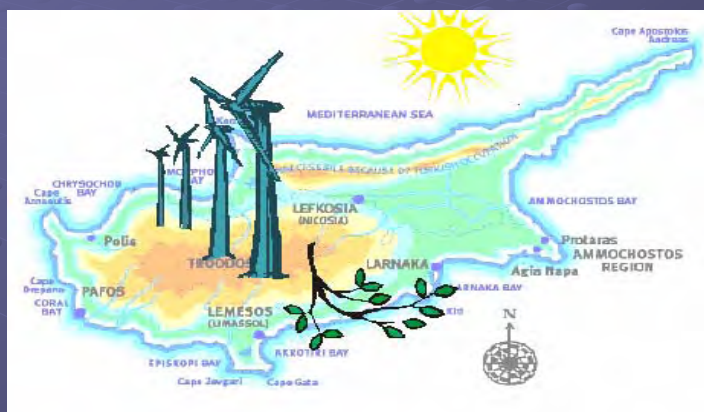








Category A Energy saving








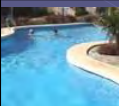

I/No	INVESTMENT	% SUBSIDY of eligible costs	Total Purchase Price per KWh (incl. subsidy)
A1. 	Energy conservation in existing enterprises and non profitable organizations 	30% Maximum amount of grant £50,000	
A2 	Insulation of Existing households 	30% Maximum amount of grant £1,000 For households above 600m 100% for the first £ 800 30% for the rest up to a maximum amount of grant £1,500	
A3 	Cogeneration    (utilizing renewables or conventional fuels)	45% Maximum amount of grant £50,000 30% Maximum amount of grant £100,000	 Day Rate: 3.82 cent Night Rate: 3.35 cent EAC Day Rate 1.71 cent EAC Night Rate 1.5 cent Day=07:00-23:00 Night=23:00-07:00
A4 	Hybrid and other vehicles running on alternative fuels 	Initial Subsidy £700 for Hybride and vehicles running on alternative fuels, and £400 for electric cars. Maximum number of cars for enterprises 7	



No	INVESTMENT	% SUBSIDY of eligible costs	Total Purchase Price per KWh (incl. subsidy)
	Geothermal heat pumps 	45% of eligible cost Maximum amount of grant £ 9,000	
		30% of eligible cost Maximum amount of grant £50,000	

Category B RENEWABLE ENERGY SOURCES





WIND ENERGY SYSTEMS FOR ELECTRICITY PRODUCTION			
B1	INVESTMENT	% Subsidy	Price of kWh
	B1.1 Large commercial Systems - For the first five years		5,40 cent
	- For the next 10 years		5,40 370 =1,70 cent subsidy From 2,80 cents up to 5,40 cents according to wind resource
	B1.2 Small systems of up to 30 KW capacity 	40%- 55% Maximum amount of grant £10,000	3,70 cent No operating support is offered
	B1.3 Small water pumping systems 	40%- 55% Maximum amount of grant £10,000	-

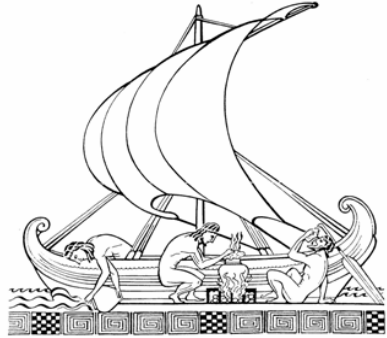
SOLAR SYSTEMS		
B2	INVESTMENT	% SUBSIDY
	B2.1 Central water heating systems 	30%-45% of eligible costs Maximum amount of grant £10,000
	B2.2 Space heating and cooling 	40%-55% of eligible costs Maximum amount of grant £50,000
 	B2.3 Domestic solar systems 	20% of eligible investment, maximum amount £100 for category B2.3a and £200 for categories B2.3b and B2.3c
	B2.4 Swimming pool water heating systems 	30%-45% of eligible investments, maximum amount of grant £10,000

BIOMASS UTILISATION			
			
	INVESTMENT	% SUBSIDY	Price of KWh
B3 	Biomass utilisation	<p>Grants of 40%-55% of eligible costs The maximum amount of grant is £68.750 district heating £11.000 for households £400.000 enterprises</p> <p>New, more generous, scheme is being developed for the promotion of energy production from biomass.</p> <p>Generous support is offered for the produced electricity. Up to 7,5 cents per KWh according to the category of investment)</p>	<p>3,7 cents per KWh</p> <p>No operating support is offered With current scheme</p>


PHOTOVOLTAIC SYSTEMS

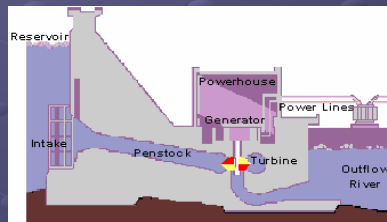
	INVESTMENT	% SUBSIDY	Price of KWh
B4	Photovoltaic Systems		
B4.1	<p>Small photovoltaic systems of 5 KWp capacity, connected to the grid.</p> 	<p>For households and other entities and enterprises not engaged in economic activities the grant is set to 55% of eligible costs. The maximum amount of grant £9.500</p> <p>For enterprises the grant is 40% of eligible costs. The maximum amount of grant is £7.000</p> <p>NEW Scheme will allow investors to select between subsidy on initial investment or only running support</p>	<p>12 cents EAC 3.7cents SF 8.3cents</p> <p>Or</p> <p>22.4 cents For households</p> <p>19.6 cents For companies</p>
B4.2	<p>Autonomous / hybrid (not connected to the grid), of up to 5KWp capacity.</p> 	<p>For households and other entities, organizations not engaged in economic activities, the grant is set to 55% of eligible costs. The maximum amount of grant £9.500</p> <p>For enterprises the grant is 40% of eligible costs. The maximum amount of grant is £7.000</p>	-

R.E.S. DESALINATION

	INVESTMENT	% SUBSIDY
B5	<p>Desalination using R.E.S.</p> 	<p>40%-55% of eligible costs.</p> <p>The total amount of grand should not exceed the amount of £100.000</p>

HYDROELECTRIC SYSTEMS

	INVESTMENT	% SUBSIDY	Price of KWh
B6	Small Hydroelectric systems 	40%-55% of eligible costs. The maximum amount of grant is £30.000	3,70 cent per KWh No operating support is offered



Current RES-e

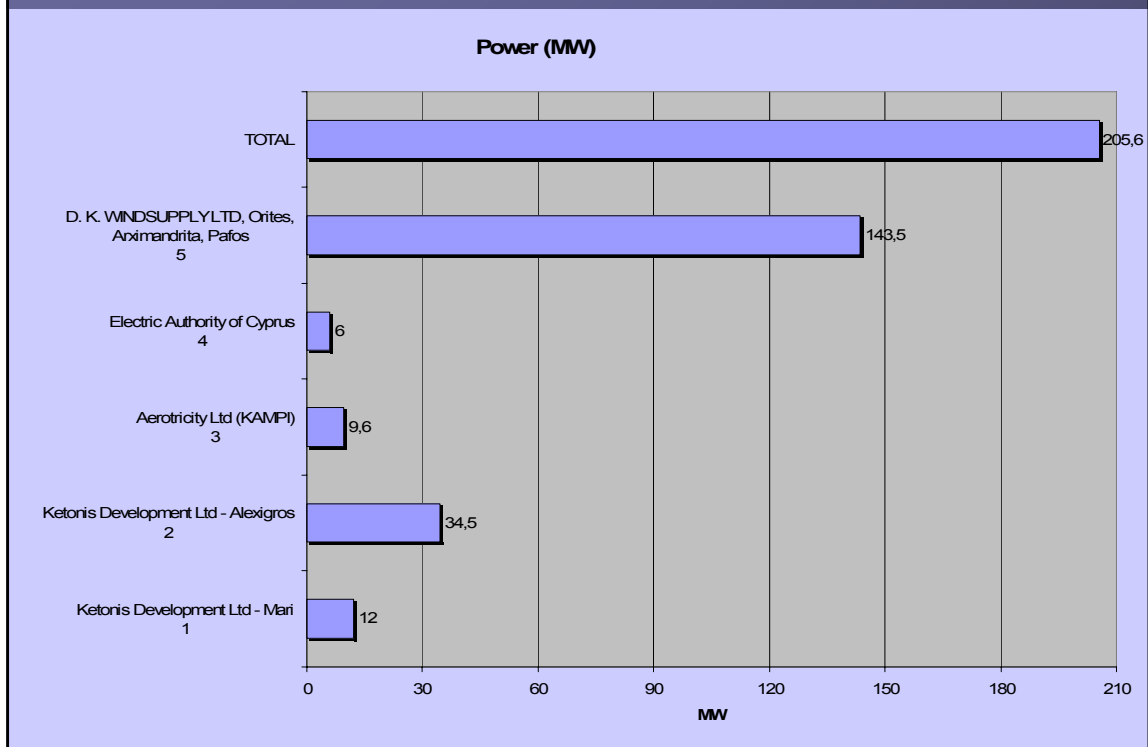
0,04% March 2006

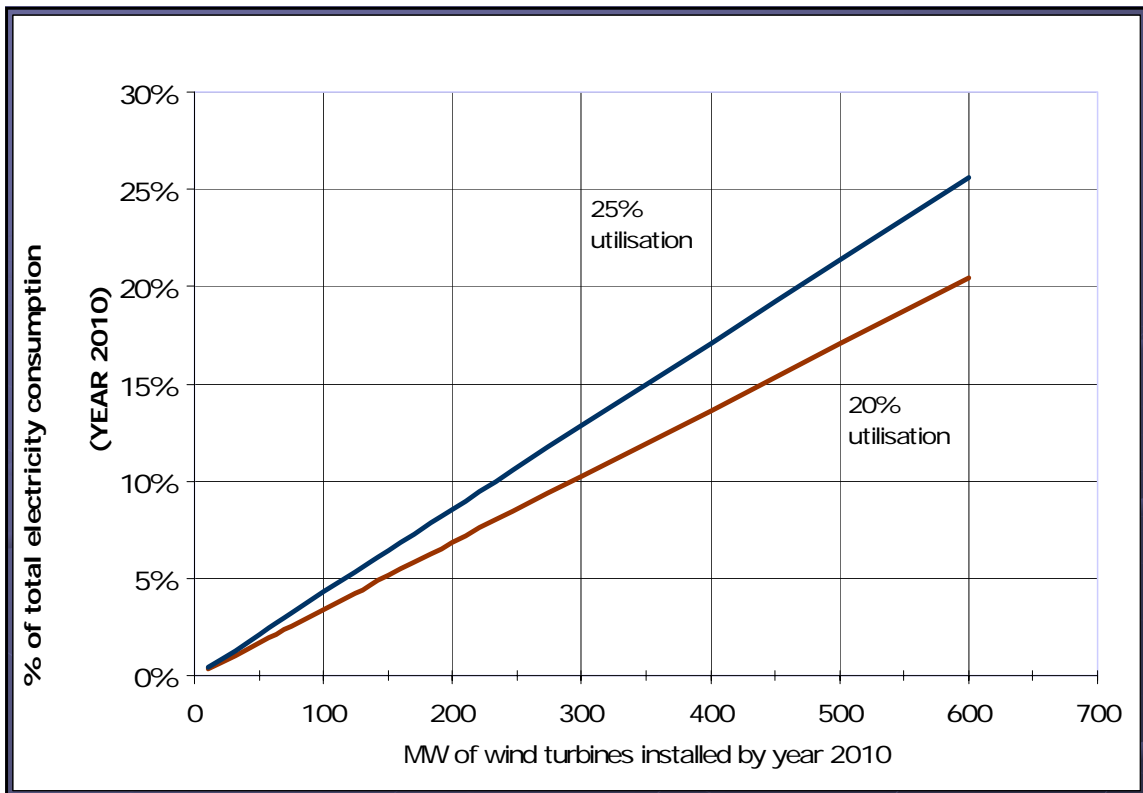
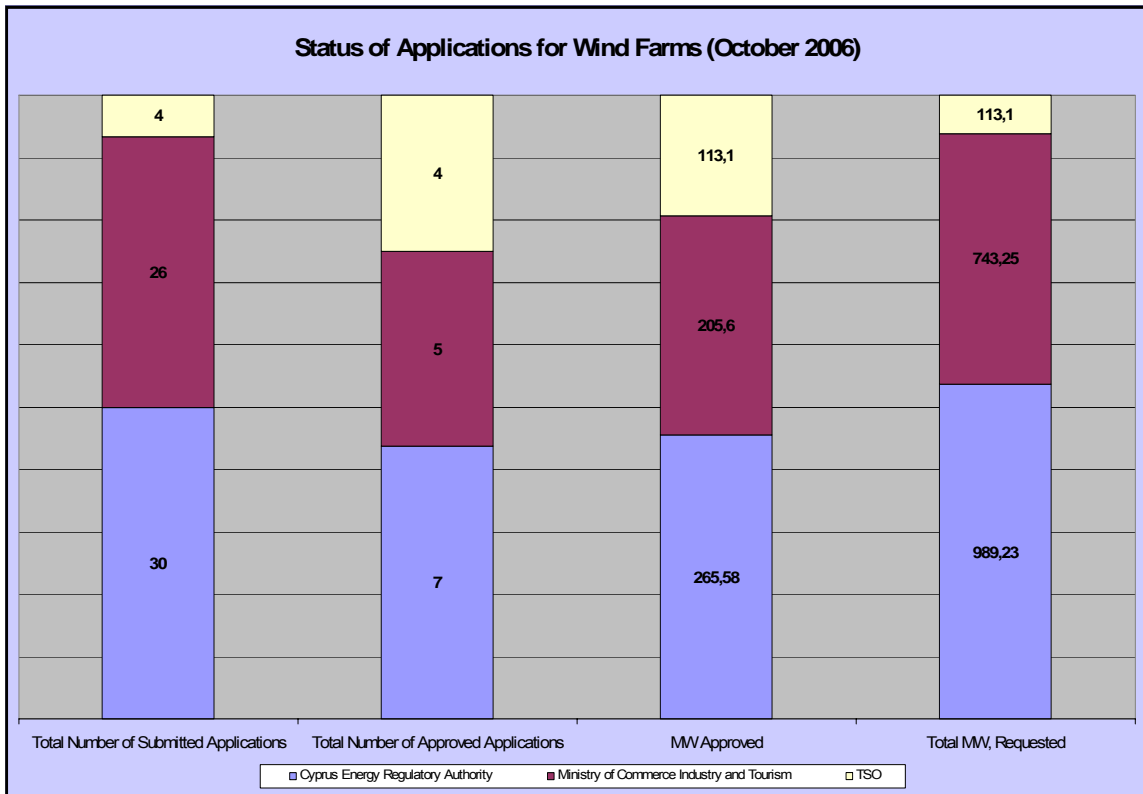
But...

SUPPORT SCHEME FOR ENERGY SAVING AND THE PROMOTION OF RES UTILISATION / RESULTS 01/03/2004 - 10/11/2006

A/A	Category	Submitted applications	Applications examined and approved	Approved Subsidy in Cy pounds	Applications already paid	Amount of subsidy already paid	Applications still under evaluation	Application with missing or incomplete submitted documents
1	Energy saving in existing enterprises	157	130	£801.535	59	£182.481	23	4
2	Thermal insulation in households	2951	1824	£1.295.235	621	£474.194	1077	50
3	Cogeneration (heat and electricity)	4	0	£0	0	£0	0	4
4	Large commercial wind parks	Analysed separately						
5	Small wind turbines up to 30 kW	10	1	£900	0	£0	0	9 (building permit)
6	Large / central, solar hot water systems	91	76	£347.907	18	£77.932	5	10
7	Solar space heating/cooling	80	35	£109.615	6	£14.953	27	18
8	Traditional solar hot water systems for households	3.725	2666	£1.125.616	747	£236.336	705	354
9	Solar heating of swimming pools	30	20	£44.961	8	£14.873	6	4
10	Biomass utilisation	69	10	£81.342	0	£0	54	5
11	Photovoltaic grid connected systems up to 5KW	387	272	£1.806.052	54	£363.114	60	55
12	Stand alone photovoltaic systems up to 5 KWp	193	158	£423.785	53	£172.300	13	22
13	Geothermal heat pumps	11	10	£20.306	0	£0	1	0
14	Electric and hybrid vehicles	74	56	£37.600	50	£34.200	18	0
	Total	7.708	5.202	£5.857.254	1566	£1.536.183	1.971	526

APPLICATIONS APPROVED BY MCIT (SPECIAL RES and RUE FUND COMMITTEE)





TOTAL INSTALLED CAPACITY 11/2006						
WIND systems	Submitted Applications		Approved	Installed	Existing	Total installed capacity
Large commercial Systems	990 MW Sufficient for approximately 40% of total electricity Consumption by 2010		206 MW Sufficient for More than 6% of total electricity Consumption by 2010	None	None	None
Small systems of up to 30 KW capacity	10 applications 24 KW		24 KW (pending building permit)	None	203 KW	227 KW
PV systems	Average size	Submitted Applications	Approved	Installed	Existing	Total installed capacity.
Grid connected	4.31 KWp	387 applications 1,67 MWp	272 applications 1,17 MWp	440 KWp	86 KWp	526 KW
Stand alone	≤ 1.2 KWp	193 applications 110 KWp	100 KWp	80 KWp	370 KWp	450 KW
Domestic solar heating systems		Thermal Applications More than 730,000 m ² of solar flat plate collectors are in place.				

BIOFUEL PRODUCTION 11/2006									
A/A	AREA	USE	MODEL /MANUFACTURER	MAXIMUM POSSIBLE PRODUCTION (Lt/hr)	BIOMASS UTILISED PER YEAR (m ³)	BIOMASS ORIGIN	TYPE OF BIOMASS	BIO DIESEL PRODUCTION PER YEAR (m ³)	BIO DIESEL PRODUCTION PER YEAR (toe)
1	AGIANAPA	OWN USE	FUELMEISTER 300 LE, GREEN FUELS LTD	416	60	INDIGENOUS	USED COOKING OILS	60	46,80
2	PARAMTHA, LEMESOS, INDUSTRIAL ZONE	OWN USE	FUELMEISTER 150 LE, GREEN FUELS LTD	208	24	IMPORTED	REPAIRED IMPORTED COOKING OILS	24	18,72
3	CHIROKITIA, LARNACA	OWN USE	FUELMEISTER 600 LE, GREEN FUELS LTD	416	264	INDIGENOUS	USED COOKING OILS FROM 16 RESTAURANTS OWNED BY THE COMPANY	240	187,20
4	LARNACA INDUSTRIAL ZONE	SALES	CPU 1000, BIO DIESEL TECHNOLOGIES	1000	7500	IMPORTED	REFINED SEED OILS	8000	6240,00
5	PAPHOS INDUSTRIAL ZONE	SALES	-	-	2160	IMPORTED	Palm Oil, Rapeseed Oil, Soyoil		1980,00
6	VASILIKO	SALES	-	-	20000	IMPORTED	-		20000
TOTAL				2.040	30.008			8.324	28.473

General Remarks on Biofuels

- **The potential of biofuels from the domestic biomass is limited.**
- There is however, the **possibility of the production of certain quantities of bio-fuels from imported raw materials** and especially from seed oils.
- **The standard for the transport Biodiesel (EN 14214) shall be revised** in order to include the utilization of other biomass forms **taking into account the differentiation of the climate conditions of the MS** (i.e. the iodine value 140 g iodine/100g instead of 120 g iodine/100 g).

NEW SUPPORT SCHEME FOR ELECTRICITY GENERATION FROM BIOMASS

- The proposed scheme aims to support with operating state aid the generation of electricity from biomass (in accordance with biomass definition in Directive 2001/77/EC on the promotion of electricity produced from renewable energy sources in the internal electricity market).

The key priority objectives are:

- To contribute to the achievement of the national targets regarding electricity generation from Renewable Energy Sources (RES) until 2010, in line with the sustainability objectives of the Lisbon Strategy and the EU Strategy on Sustainable Development.
- To contribute to the reduction of the national greenhouse gas emissions.
- To promote the management and utilization of suitable biomass waste in sustainable processes.
- To contribute to arresting and reversing the current trend of rural depopulation, by providing employment opportunities in sustainable economic activities.

The scheme will provide operating state aid of 0,3 to 3,5 CY cent per kWh generated, depending on the class of investment (defined in the scheme in accordance to the technology and size of the generation facilities). For further details, please see the complete Support Scheme.

The operating aid is provided as a supplement to the market price, in order to establish reasonably compensative tariffs. The Electricity Authority of Cyprus (EAC) has agreed to purchase the electricity produced from RES at an initial rate (market price) of 3.7cent/kWh (which could change in time with decisions of the electricity regulating authority).

The Scheme will be introduced for an initial short period, from the date of final approval until the end of 2007, during which the results will be evaluated and further decisions will be taken. Should the scheme be subsequently renewed, it is estimated that by 2010 the scheme will facilitate the generation of 60GWh of renewable electricity, substitute the burning of approximately 12 thousand tons of heavy fuel oil and reduce the Cypriot greenhouse gas emissions by 36 thousand tones of carbon dioxide.

CONCLUDING REMARKS

- Today Cyprus is almost entirely dependent on imports of fossil fuels. It is therefore very important for Cyprus to utilize all the available RES potential of the island and achieve high levels of energy conservations in order to comply with the relevant European Directives, secure energy supply, continue to meet energy demand, reduce the impact on the environment from energy consumption and most importantly reduce the dependence on imported energy.
- At present the 6% target for RES electricity contribution, by year 2010, **is considered to be attainable**. It is envisaged that by proper implementation of the relevant legislation, continues reinforcing and upgrading of the various Grant Schemes and by creating the various mechanisms that will reduce the administrative obstacles, the target will be achieved.

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Web Links www.mcit.gov.cy
www.cie.org.cy

Data Gathering on Renewable Energies for New Member States and Candidate Countries

Update on RES Policy, Implementation and Planning in Malta

M.Fsadni

Dubrovnik, Croatia November 2006

with Energy Institute Hrvoje Pozar



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Location and vital statistics of Malta



Population:	400,000
Area:	312 sq km
Population density:	1273 / sq km
Households	130,000
Electricity generated	2000 GWh
Domestic consumption	30%
Commercial consumption	25%

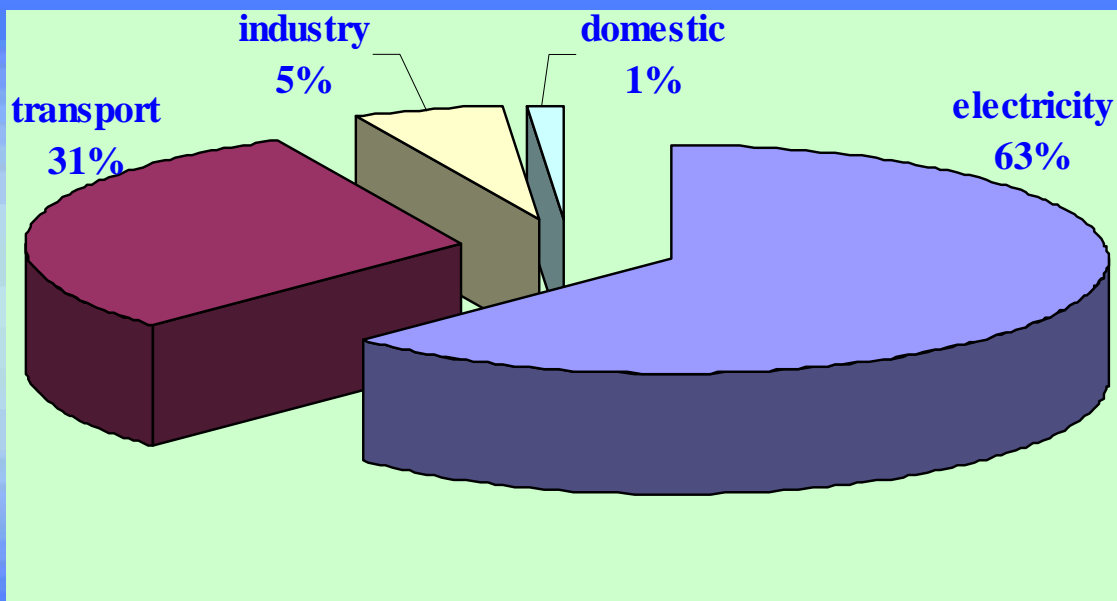


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Utilisation of fuels in 2003



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Electricity generation in Malta for 1999/2000

		capacity	capacity	generation	
		MW		MWh	efficiency
Plant		installed	relative	of total	
Marsa	total	247			
Tosi ('66)	steam : oil	2 x 30	38.1%	53.0%	24.5%
GE/Ansaldo ('56)	steam : oil	3 x 30			
Parsons ('59)	steam : oil	1 x 60			
Alsthom	gas turbine : diesel	37	6.7%	0.1%	24.1%
Delimara	total	304			
Behel	steam : oil	2 x 60	21.8%	29.8%	28.6%
J. Brown	gas turbine : diesel	2 x 37	13.4%	0.8%	28.8%
Nuovo Pignone	combined cycle diesel	110	20.0%	16.3%	40%

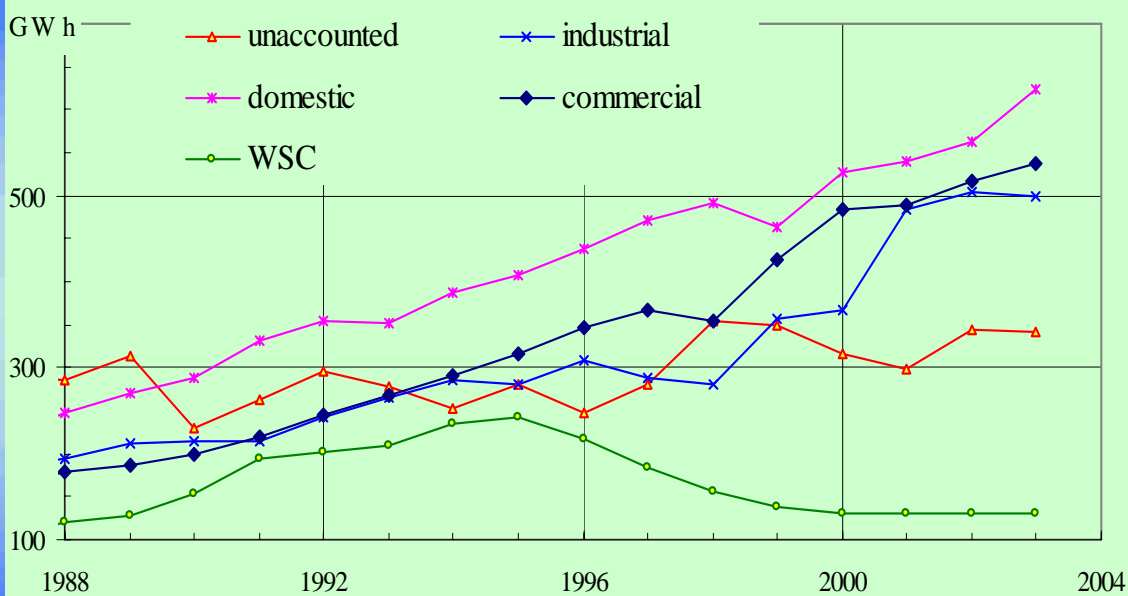


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Electricity consumption by sector



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Draft National Communication to EC

RES

% contribution of electricity
consumption in 2010

- Large scale wind 1.06
- Solar photovoltaic 0.02-0.04
- Medium scale wind 0.05
- Solid waste 0.24

National indicative target 1.37%

A more realistic target without large scale wind is 0.31%



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Positive trends

- An energy regulator—the Malta Resources Authority (MRA) has been set up;
- Promise of a public consultation document by October 2005
- 2006 Budget:
 - Surcharge of 60% on electricity may promote of SWH;
 - Enemalta offers €162 for SWH installation for new customers only;
 - 15% up to €230 grant towards installing a SWH (for households);
 - 20% grant for roof top PV installations and micro-wind turbines;
 - Net metering is for electricity from PV systems yields € 12.6/kWh ;
 - Surplus exported to the grid at € 6.3/kWh - but there is a one-off charge of €46 for the extra meter.



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Estimated RE Potential of Malta *

RES	% contribution of electricity consumption in 2010
• Solar photovoltaic	
domestic rooftop	5.6
industrial rooftop	1.2
public building rooftop	0.1
• Onshore wind	4.1
• Offshore wind	2.6
• Solid and liquid waste	4.2
• SWH (displaced electricity)	3.7
Estimated total potential	21.5%

* The Renewable Energy Potential of Malta, Farrugia et. Al. WREC IX 2006 Florence



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Draft Energy Policy

- The draft is being reviewed after public consultation. IET in a seminar gathered recommendations such as:
- Include quantitative targets for different RE technologies;
- Present a more positive outlook for RE;
- Increase in the maximum capacity of RES that qualify for grants etc.;
- Set up and evaluate demonstration projects;
- Environmental issues have a major influence on energy policy;
- The proposed interconnection with the European electricity grid not to be related to future RES installations;



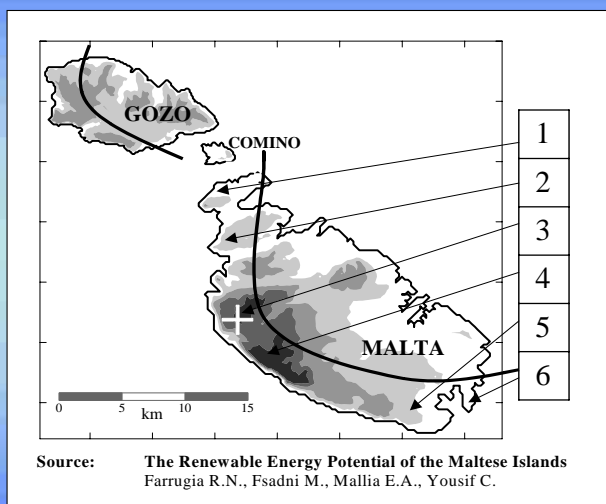
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THE ONSHORE WIND RESOURCE POTENTIAL

1	<i>Marfa Ridge</i>
2	<i>Mellieha Ridge</i>
3	<i>Bahrija Area</i>
4	<i>Area SW of Dingli</i>
5	<i>Hal Far Area</i>
6	<i>Delimara</i>



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Draft Renewable Energy Policy

The draft is being reviewed after public consultation. IET formulated recommendations such as:

- Put wind energy in a more positive light;
- Recognise the major role of private investment for RES;
- Clarify and improve the feed-in system proposed;
- Recognise that even small contributions are significant;
- Consider realistic turbine sizes not just extremes (micro and 2-5MW);
- Recognise that the RE potential is significantly higher than that set in draft;
- Set realistic though attainable targets;
- Policy must be consistent with the Draft Energy Policy;



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Draft Renewable Energy Policy /cont.

- The limit of 3.7kWp for PV systems that can be grid connected should be raised;
- ;
- ;
- ;
- Consider realistic turbine sizes not just extremes (micro and 2-5MW);
- Recognise that the RE potential is significantly higher than that set in draft;
- Set realistic though attainable targets;
- Policy must be consistent with the Draft Energy Policy;



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Budgetary Incentive Measures

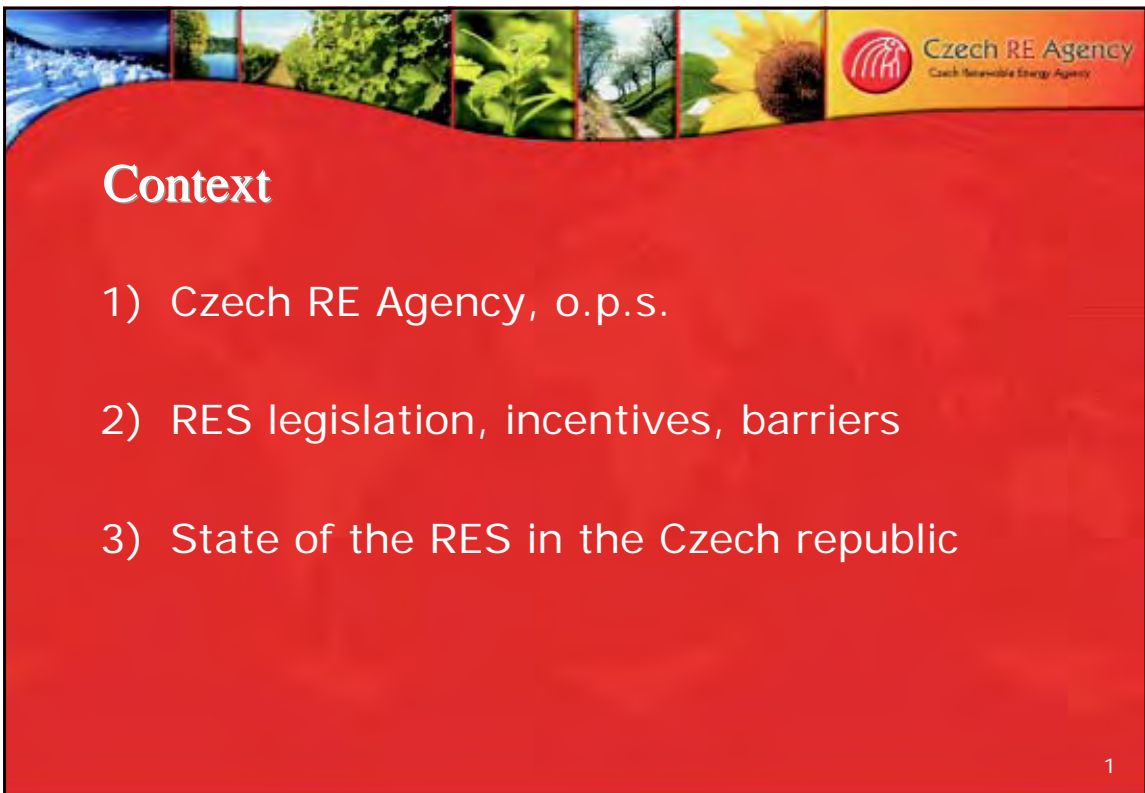
- The last Government budget included incentives in the form of grants that there but now extended to apply to most energy saving or electricity displacing systems
- There are indications that some grants are being absorbed by retailers and full benefit not being passed on to customers;
- In spite of incentives only 1000 SWH units installed this year – at this rate it will take 100 years for widespread application;



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Czech RE Agency General Informations

- non-government organization for development of renewable energy sources (RES) established in April 2004
- representation of policy in RES area in the Czech Republic
- participation on development and amendments of legislation making process
- consulting and guidance services in the field of RES, especially photovoltaic




2



Czech RE Agency General Informations

- holding exhibitions, conferences and workshops in order to promote RES and sustainable development




- close cooperation with plenty of Czech and foreign partners, organizations and scientific institutions
- creation and support R&D projects of new technologies and materials in the RES area

3



Legislation and Financial Incentives



Financial Incentives

- feed in tariff and green bonuses
- no income tax in the year of putting in operation and for following 5 years
- subsidies – national programmes (no legal claim, low budget)
- subsidies – Operational programmes => Eko-energy (MPO), (MŽP), (MZE)

5



Legal regulation
Act on Promotion of Use of Renewable Sources

This Act regulates, in accordance with the legislation of the European Communities (Directive 2001/77/EC)
 – in force from August 1st 2005

- promote the use of renewable energy sources
- contribute to economical use of natural resources and sustainable development of society
- create conditions for fulfilment of the indicative target for the share of electricity from RES in the gross consumption of electricity in the Czech Republic amounting to **8% in 2010**

6



Legal regulation
Act on Promotion of Use of Renewable Sources

Main principles:

- preferential connection to the transm. system or to the grid systems plants for green el. plants
- obligation for operators of the regional grid systems and the operator of the TS to purchase all electricity from renewable sources
- two main financial incentives – **feed-in tariff** or system of **green bonuses** (producers can choose if they sell electricity for purchase prices or offer it to trader for market-price and simultaneously get extra green bonuses – paid by the operator of the relevant regional GS or the operator of TS)

7




Legal regulation

Act on Promotion of Use of Renewable Sources

Main principles:

- purchase prices as well as green bonuses are set up by energy regulator (ERU) on a yearly basis
- purchase prices guaranteed for 15 years (in contrast to green bonuses), taking into account the price index of industrial products
- fifteen-year period of recovery of investment should be "guaranteed"

8




Feed-in tariff x Quota system for 2006

RES	Feed-in tariff CZK/kWh	Feed_in tariff €/kWh	Green bonus CZK/kWh	Green bonus €/kWh
Small hydro (new locations)	2,34	0,08	1,43	0,05
Combustion of landfill gas	2,23	0,08	1,26	0,04
Wind energy	2,46	0,09	2,02	0,07
Geothermal energy	4,50	0,16	2,64	0,09
Photovoltaics	13,20	0,46	12,59	0,44

Exchange rate 1EUR=28,5 CZK

9



Eko – energy programme

- managed by Ministry of Industry and Trade in the frame of OPBI
- 4 mld CZK (cca 140 mil €) – 2007-2013
- 2 forms – soft loan or subsidy
- subsidies up to 100 mil CZK (cca 3,5 mil €) and up to 60 % of investment costs
- soft loan only for SME, 1 %, 15 years (life of loan), max 50 mil CZK (cca 1,75 mil €), 30 % of loan could be remitted

10



MZP programme

- Managed by Ministry of Environment in the frame of OP Environment
- 17,5 mld CZK (614 mil €) 2007-2013
- entrepreneur – subsidy up to 45 %
- not entrepreneur – subsidy up to 90 %
- level of subsidy will depend upon financial and economic analysis

11



Obstacles to remove

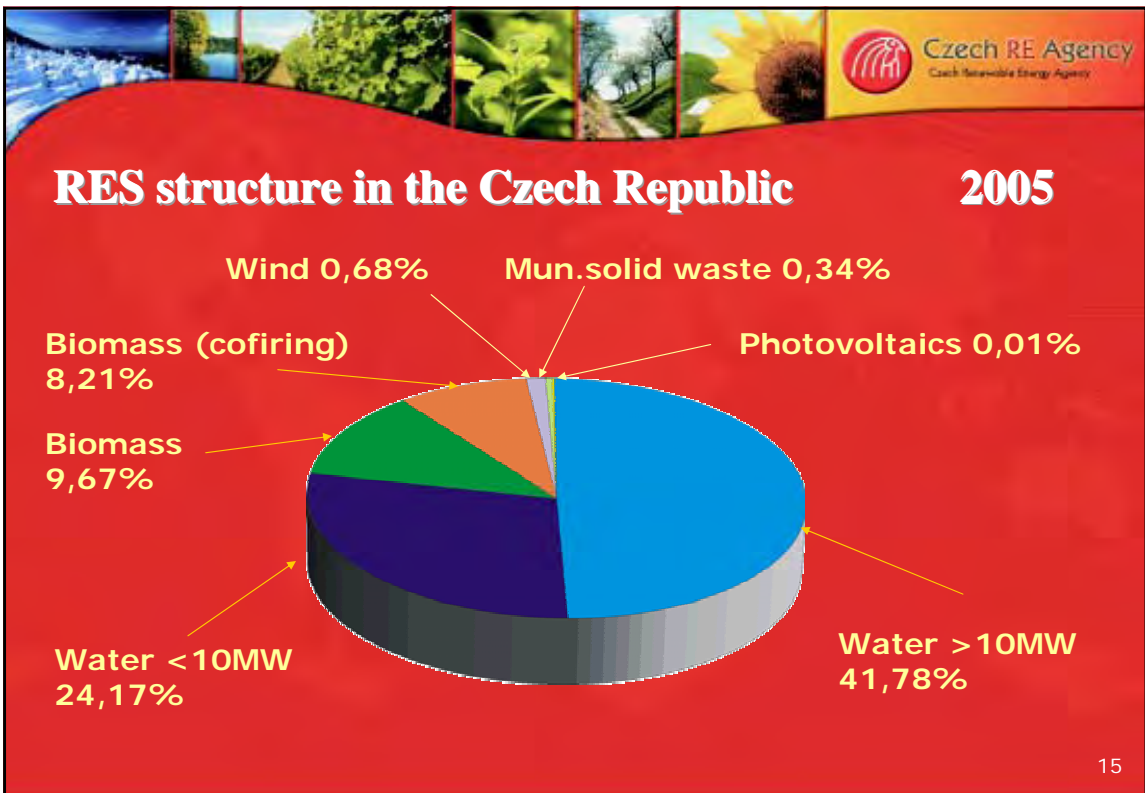
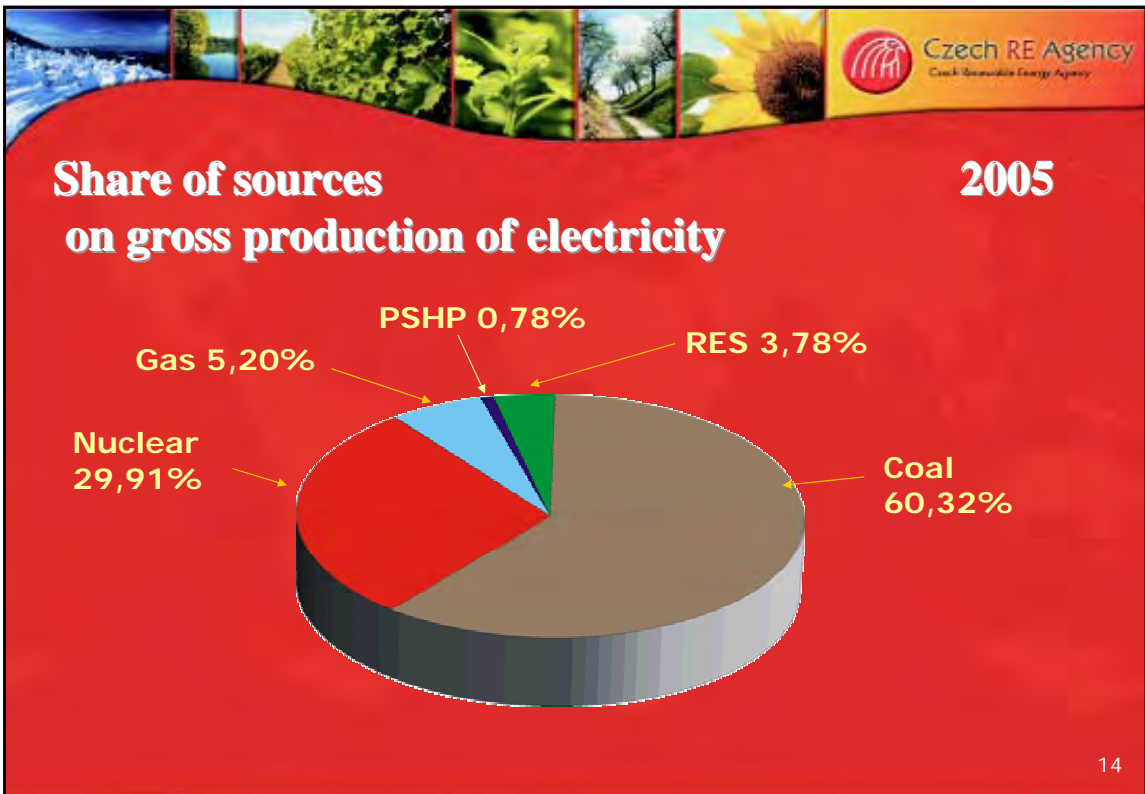
- Legislative (legal uncertainty)
- Administrative (permissions)
- Economic conditions (bank sector)

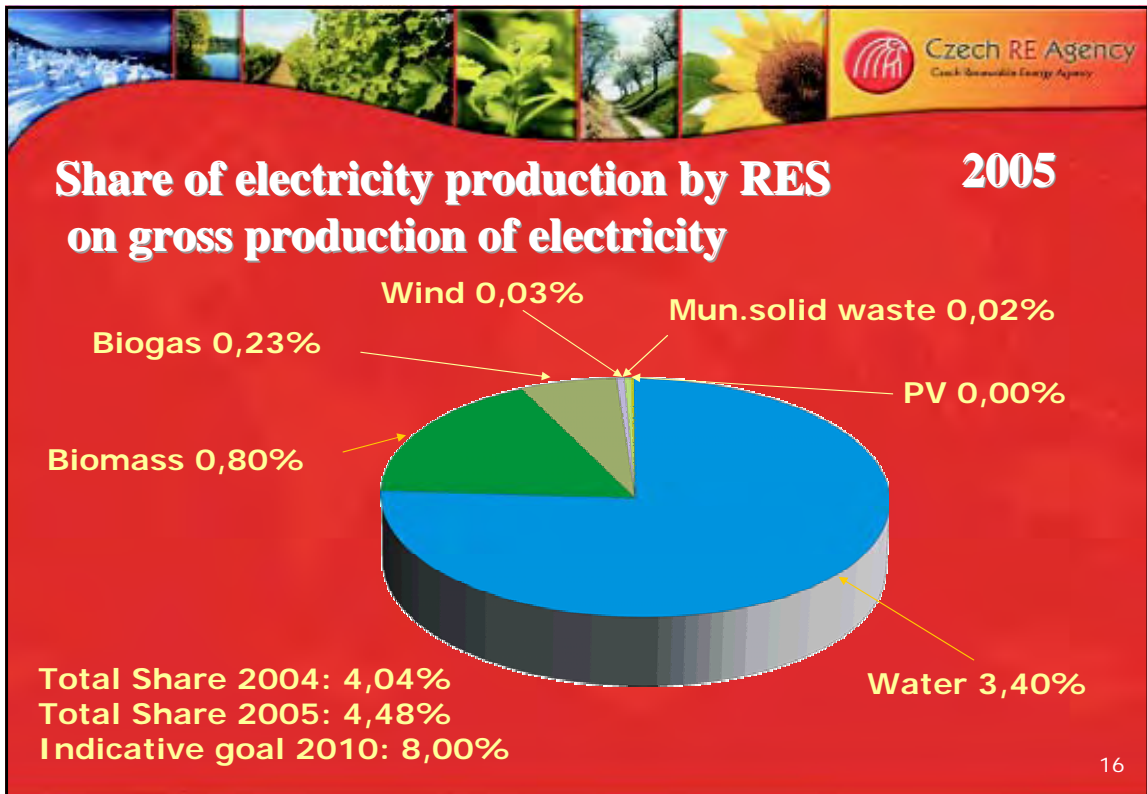
12



**Renewable energy sources
in the Czech Republic**







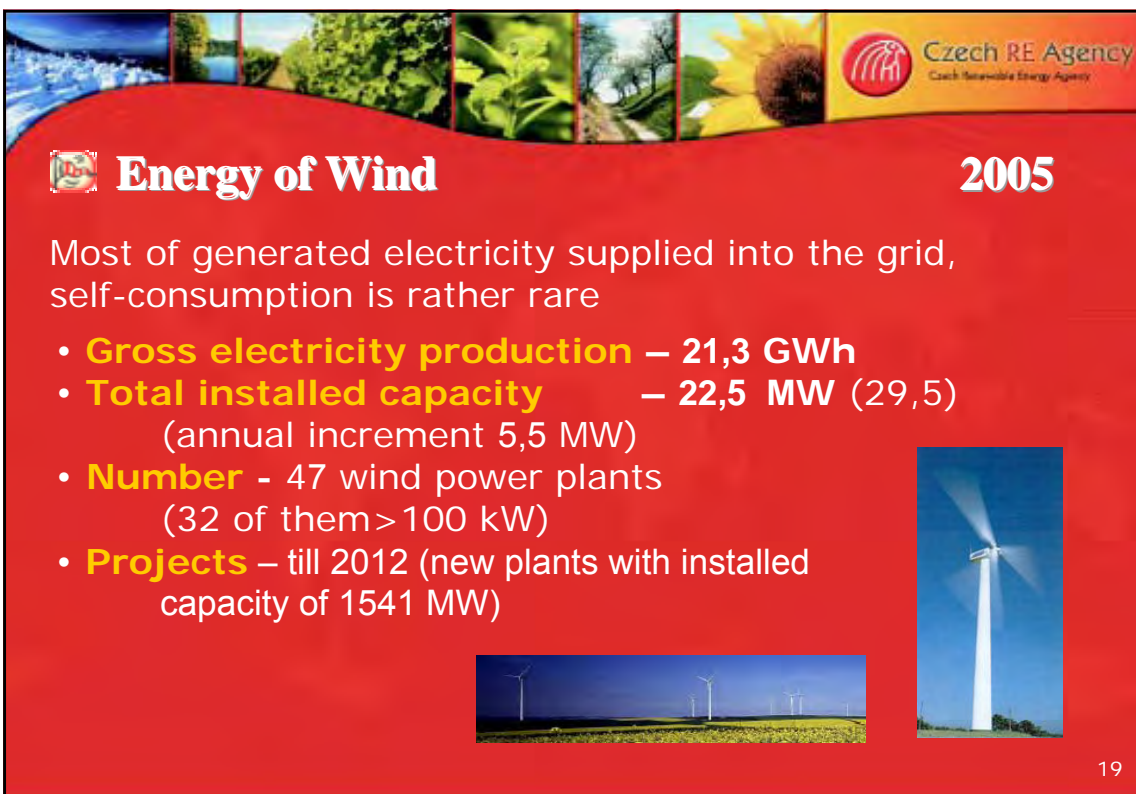
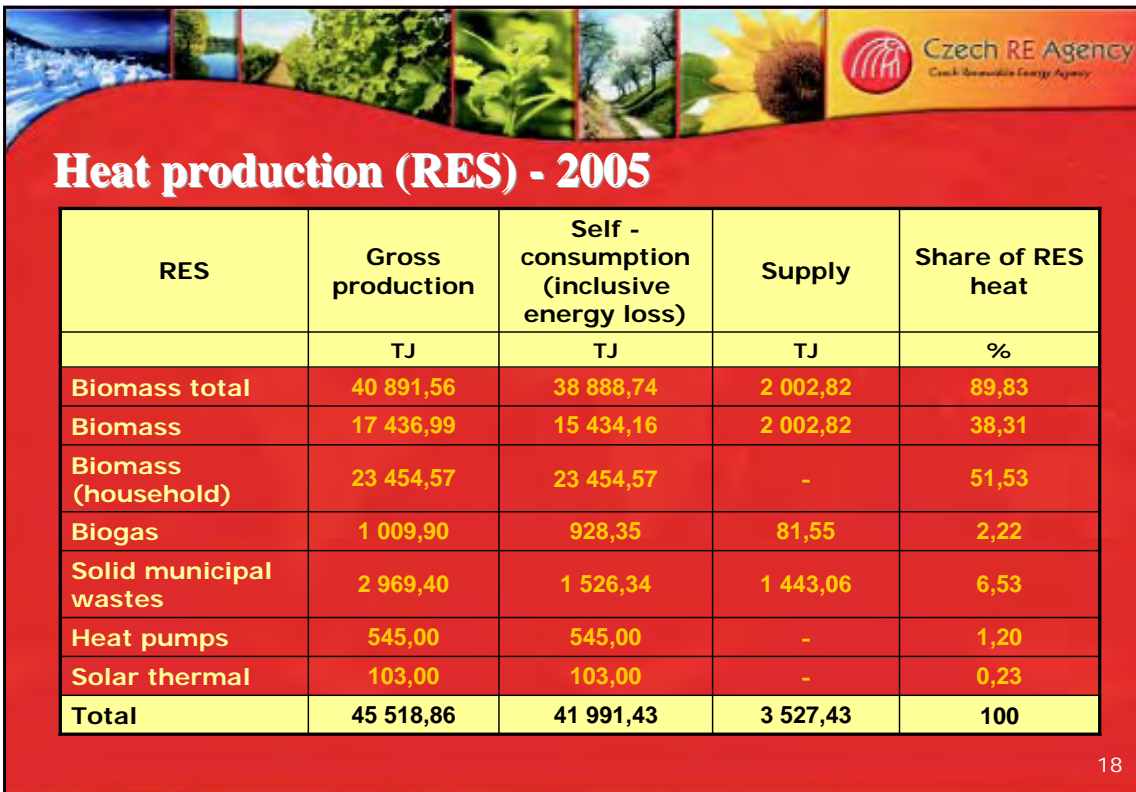
16

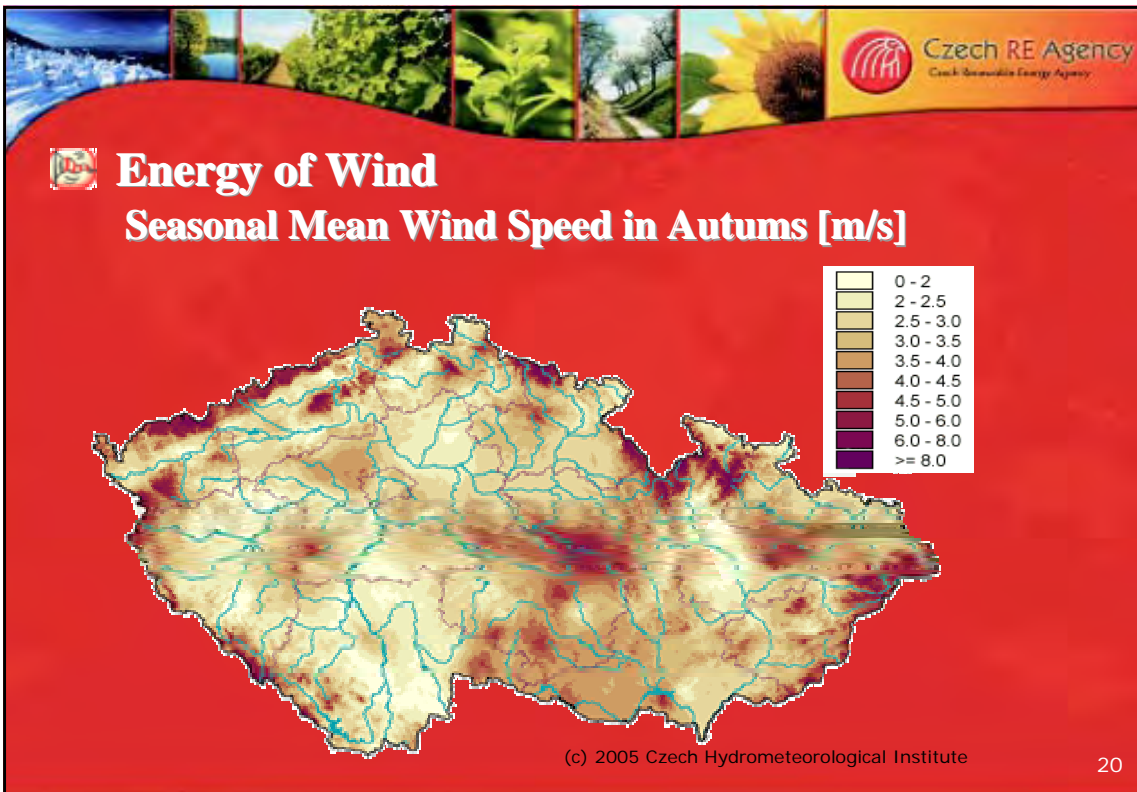
Production of electricity (RES) - 2005

RES	Gross production	Grid supply	Share of green electricity	Share of gross domestic consumption	Share of gross production
	GWh	GWh	%	%	%
Hydro electric power plants	2 379,91	2 370,30	75,95	3,40	2,88
Solid biomass	560,25	310,38	17,88	0,80	0,68
Biogas	160,86	93,41	5,13	0,23	0,19
Municipal wastes	10,61	3,83	0,34	0,02	0,01
Wind power plants (up 100 kW)	21,44	21,26	0,68	0,03	0,03
Photovoltaic systems	0,39	0,05	0,01	0,00	0,00
Total	3 133,46	2 699,24	100	4,48	3,79

Czech RE Agency
Czech Renewable Energy Agency

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Energy of Water

2005

Traditional type of (natural) energy source for long time

- **Gross electricity production** - 2 380 GWh, (annual increment about 18 %)
- **Total installed capacity** - 1 019,50 MW (1359 power plants), share of big hydro plants is 73 %
- **80 %** of electricity production is supplied into public grid



22



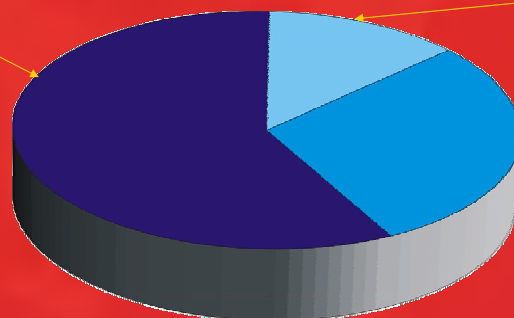
Energy of Water

Production of electricity hydro-electric power plant

10 and more MWe
55%

Up to 1 MWe
14%

1 – 10 MWe
31%



23




Energy of Sun Photovoltaic 2005

- Photovoltaic technology is in the market development stage
- **Gross electricity production - 120 MWh**
- **Total installed capacity (only selected systems) – 166,9 kWp**

Source – Ministry of Industry and Trade

Most of important instalations are situated at the universities (VŠB v Ostravě, ZČU v Plzni, TU v Liberci, MF UK v Praze and so on), realization within the frame of programme „Sun to schools“

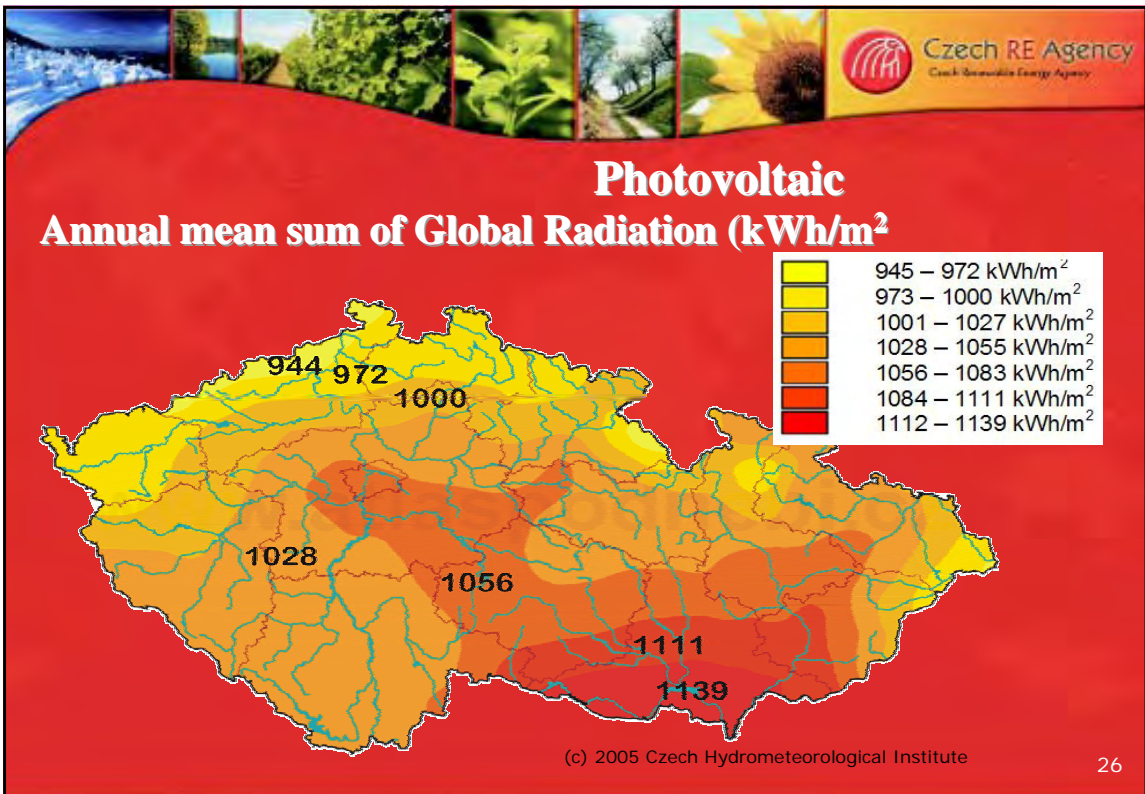
24



Energy of Sun Photovoltaic

- ☀ **Annual mean sum of solar energy - 1m² (horizontal) Ø 950 – 1340 kWh**
- ☀ **Annual mean sum of sun hours Ø 1331 – 1844 (ČHMÚ) vs Ø 1560 – 2150**
- ☀ **In practice you can gain from 1 kWp approximately Ø 800 – 1100 kWh**

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Energy of Sun **Photovoltaic**
“Sun to School” programme

100Wp and later **200Wp** PVS for basic schools

1,2kWp PVS for bigger basic schools and secondary schools




Czech RE Agency
Czech Renewable Energy Agency

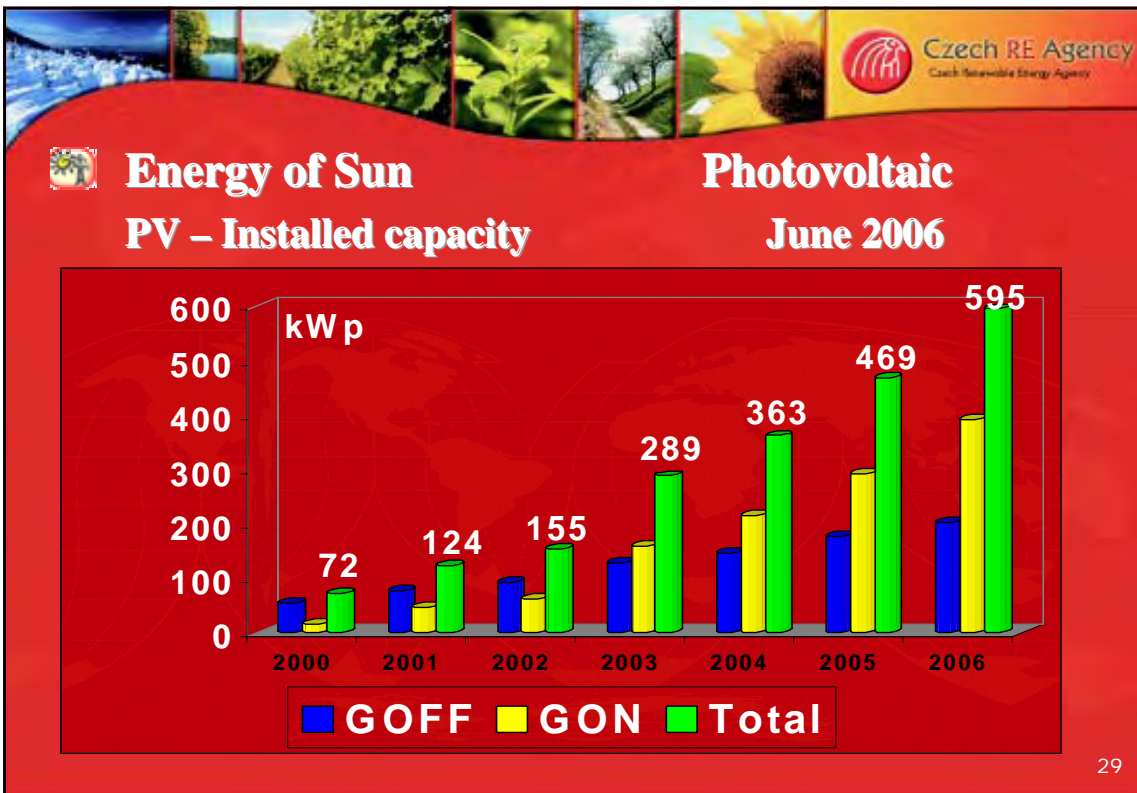



Energy of Sun **Photovoltaic**

“Sun to School” programme
3, 20 and later 40 kWp PVS for universities



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Energy of Sun **Solar Thermal**

- problems to get reliable information
- more than 200 firms on the small market
- wide variety of products
- 85 000 m² - glazed collectors (2005)
- potential – 40 % of heat consumption in EU25 is heat within the range of 250 °C
- supply of collectors on the czech market – 15 500 m² (2005)

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Biomass **2005**

Most often used fuel – wood waste, wood chips, cellulose leach, bark (tentatively pellets)

- **Gross electricity production - 560 GWh** in 2005, that`s the same as in 2004 (565 GWh).
- **Total installed capacity - 1 182 MW** - most of these plants are also used for electricity production using coal (20 % of el. produced by ČEZ – cofiring)
- favourable purchase prices for cofiring – 15 years guarantee for the biggest czech energy provider ČEZ (ČR owns 67 %), practically no control – biomass market destruction

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Biomass

- many specific problems – „no market“, small projects (low efficiency, big investment cost), big projects (transport, uncertainty of accessible biom.)
- **17 500** TJ of heat energy produced in 2005, almost everything used for self-consumption
- fuel - low share of energetic plants (1 %)
- insufficient subsidy for cultivation of en. plants (2 000 CZK/ha – 70 €) + agriculturists – conservative, no-confidence, lack of information, administrative problems



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Biogas

2005

Most used method - anaerobic fermentation in municipal waste treatments plants

- **Gross electricity production - 160 856 MWh** (development of using landfill gas – feed in tariff)
- Agriculture biogas stations nonsignificant – rapid change recently (good conditions of czech agriculture)
- For energetic needs used **107 760 535 m³ (13%)**
- Energy almost used for self-consumption



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Energy of Environment – heat pumps

- no reliable information, investigation in progress
- **Number** - **726 units** of heat pumps (2004, except households)
- **Installed capacity** – **36,5 MW** in 2004
- estimation – use of 500 TJ (2004, including households)
- In 2005 were delivered on the market 1410 pcs of heatpumps (could be also installed)

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Liquid biofuels

2005

- share of fuels from RES 2010 - 5,75 % (Directive 2003/30/ES), goal for 2007 – 2 % at minimum
- biofuels should be generally fade in fuels from June 2007
- 3 scenarios - no consumption tax, subsidies for producers or no support
- goverment has decided for no support
- 4th biggest producer of rapeseed oil methylester in Europe (133 000 t, almost everything exported)
- production of mixed diesel fuel with 30% rapeseed oil methylester – 10 223 t (2005)
- bioethanol – just a few producers, affair

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Czech RE Agency

Czech Renewable Energy Agency

www.czrea.org



Czech RE Agency

Czech Renewable Energy Agency

www.czrea.org

Czech RE Agency, o.p.s.

Residence:

Televizní 2618
756 61 Rožnov pod Radhoštěm

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Americká 17, 120 00 Praha 2,
Tel: 222 512 764, Fax: 222 512 774

E-mail: office@czrea.org



RES update - Hungary

The Regional Environmental Center
for Central and Eastern Europe

Peter Bodo

15 November 2006

Dubrovnik-Cavtat, Croatia



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Major issues

- Convergence programme
Changing gas price politics
- New National Development Plan
- New Energy Strategy
- New CO₂ emission allocation
- No major regulatory changes (though plans exist)



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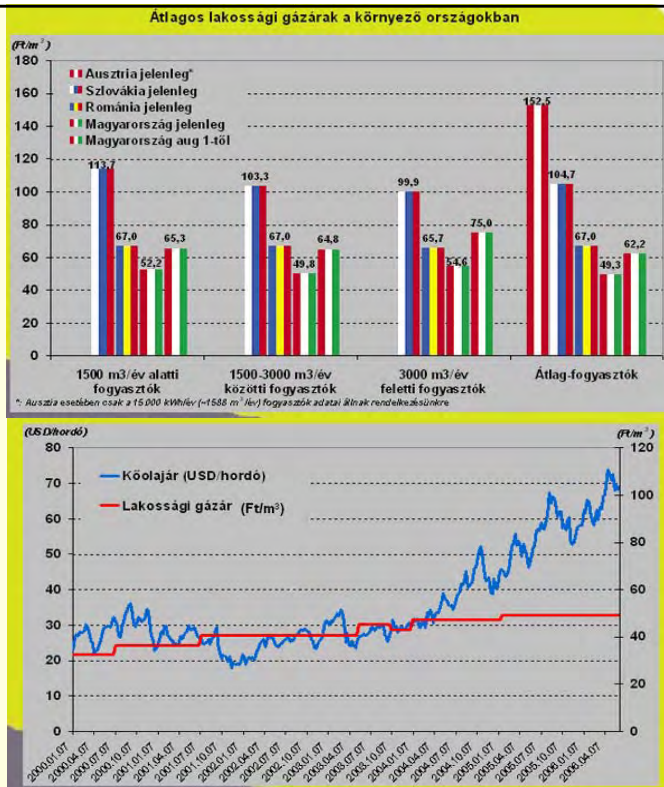
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State and budget reform

- Problems about state deficit
- Serious reforms announced
 - Mostly increasing revenues (e.g. tax increases)
 - Gas price – politically very sensitive area

Gas prices for residents – A barrier for RES

- World oil prices and natural gas price for residents



Gas price reform (1)

- Reduced and differentiated support (as of 1 Aug)
- VAT increase from 15 to 20% (as of 1 Sept)

		Unit	Before 1 Aug	From 1 Aug	From 1 Sep
Gas price	Basic fee	HUF/Yr	4030	5244	5472
	Gas fee	HUF/m3	71.87	93.57	97.63
Price support	<1500 m3/yr	HUF/m3	25.43	35.84	40.22
	Btw 1500 and 3000 m3/yr	HUF/m3	20.43	20.60	24.27
	>3000 m3/yr	HUF/m3	4.76	0.00	0.00



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Gas price reform (2)

- From 1 Jan 2007
- Support exclusively on social base
- Further price increase



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Renewables



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Support - Feed in Tariff system

- Act on Electricity 110/2001 amended by 79/2005 Act
- the 78/2005. (X.7) Decree of Ministry of Economy and Transport (amending 56/2002 (XII.29) Decree on regulations of feed-in and pricing
- 23 HUF/kWh (9.05 c/kWh); 23.83 in 2006 (increased by inflation)
- Of which around 13 HUF is subsidy
- Source 2,07 HUF levy on consumption per kWh
- Obligatory purchase is valid until 30 December 2010

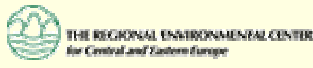
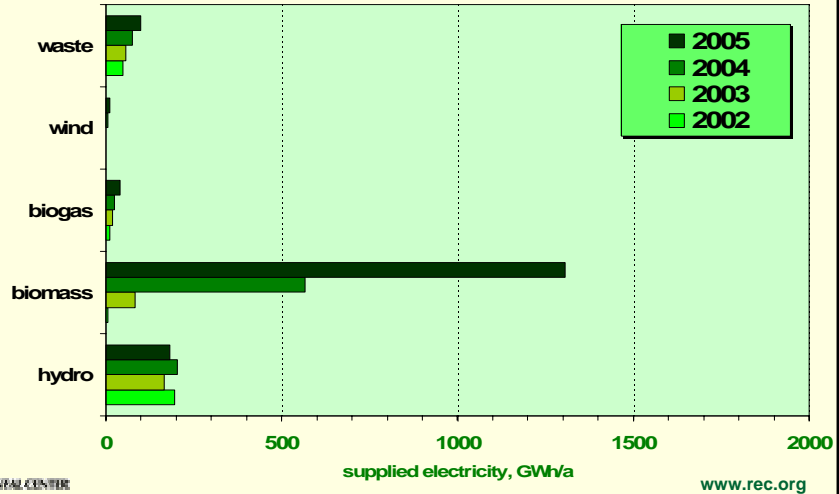


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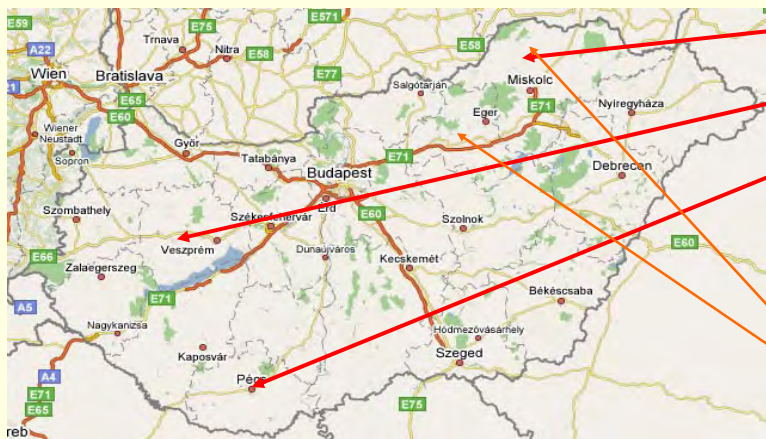
RES penetration

- Total electricity consumption (2005): 41.27 TWh
- RES-E share (2005): 4.5% 1726.9 GWh (4.8% incl waste incineration)

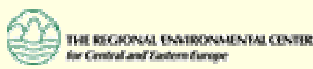


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Biomass plants in Hungary



- Kazincbarcika 30 MW
- Ajka 20 MW
- Pécs 49 MW
- Mixed fuel
- Tiszapalkonya
- Mátra



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Biomass demand

- Total wood extraction in 2005: 5.9 M m³
- Extraction for energy and pulp and paper: 3.9 M m³
- Of which 7 biomass plant: 1 M m³
- Growing natural gas price for residents: new demand for fire wood
- Fire wood price – up by 40% - need for import

- Extraction is on maximum capacity
- Therefore **need for energy plantations** →



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Energy plantations

- 2006: few hundred hectares
- 2015 goal: 100.000 hectares

Zoltán Gőgös, State Secretary of the Ministry of
Agricultural and Rural Development

More than 50% state and EU support for low quality
agricultural lands for transition

Critics on biomass use

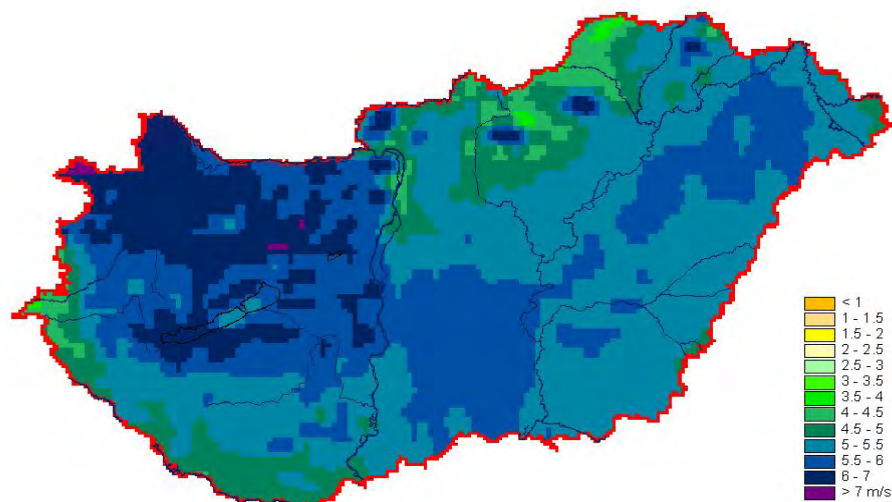
- Not sustainable forest management
- Less than 20% efficiency power plants



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Wind map at 100 m



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Wind PPs in Hungary (end 2005 + 2006)

Operator	location	MW	network	Network permit.	launch	Type
Bakonyi Erőmű Rt.	Inota	0,250		ÉDÁSZ	2000.	NordexN29/250
Első Magyar Szélerőmű Kft.	Kulcs	0,600	20 kV	DÉDÁSZ	2001. május 23.	E-40
Netpoint Bt.	Mosonmagyaróvár	0,600	20 kV	ÉDÁSZ	2003.	E-40
Thera Bt.	Mosonmagyaróvár	0,600	20 kV	ÉDÁSZ	2003.	E-40
E-ON. EÜT Kft.	Mosonszolnok	0,600	20 kV	ÉDÁSZ	2002. december 19.	E-40
E-ON. EÜT Kft.	Mosonszolnok	0,600	20 kV	ÉDÁSZ	2002. december 19.	E-40
Paczig Kft.	Erk	0,800		ÉMÁSZ	2005. május 1.	E-48
LÉG-ÁRAM ALAPÍTVÁNY	Újronafő	0,800	20 kV	ÉDÁSZ	2005. június	E-48
PRECÍZ Kft.	Szápár	1,800	20 kV	ÉDÁSZ	2005. augusztus 9.	V90NH80
Szélerő Vép Kht.	Vép	0,600	20 kV	ÉDÁSZ	2005. július 10.	E-40
Nagy-Ferenczi Kft.	Bükkaranyos	0,225		ÉMÁSZ	2005. december	VestasV27
Thera Bt.	Mosonmagyaróvár	2,000		ÉDÁSZ	2005. december	E70
Hoffer Kft.	Mosonmagyaróvár	2,000		ÉDÁSZ	2005. december	E70
Lenteam Kft.	Mosonmagyaróvár	2,000		ÉDÁSZ	2005. december	E70
Harsányi Kft.	Mosonmagyaróvár	2,000		ÉDÁSZ	2005. december	E70
Netpoint Bt.	Mosonmagyaróvár	2,000		ÉDÁSZ	2005. december	E70
Összesen		17,475				

MezőWind Kft	Mezőtúr	1.500	20kV	E.ON Tiszsz	2006. augusztus	Fuhrlander MV77
GyulaWind Kft	Törökuszenniklos	1.500	20kV	E.ON Tiszsz	2006. augusztus	Fuhrlander MV77
Kavicsbánya Kft	Mosonmagyaróvár	10.000	22 kV	ÉDÁSZ	2006 augusztus	Vestas V90 2,0MW NH105
Sajócsúti Transzit Kft	Felsőszőlca	1.800	35 kV	E.ON Tiszsz	2006szeptember	Vestas V90 1,8MW NH105
Preciz Kft	Csetény	4.000	22 kV	ÉDÁSZ	2006szeptember, októ	Vestas V90 2,0MW NH105

Wind problems

- 1687 MW permit request
- Only 330 MW permitted (up to 2010) because of system management limits

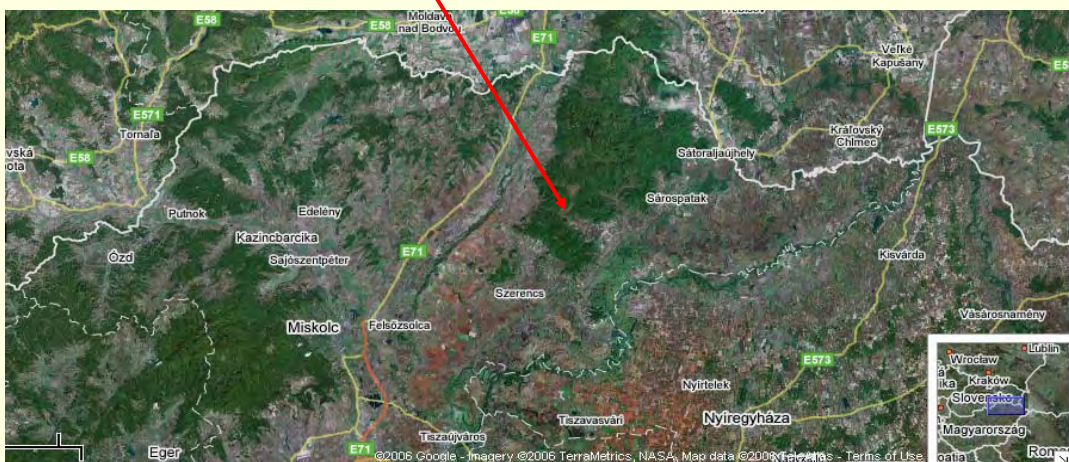


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Planned (!) pumped storage water plant

- Sima settlement – 1000 MW – altitude diff: 220 m



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Technology Prices

- Solar electricity 1.200 kHUF/kW
- Biogas 800 kHUF/kW
- Wind 200-300 kHUF/kW

- Natural gas CHP 150 kHUF/kW



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Support Schemes

- National:
 - Residential EE and RES support
Was open for **11 days (!)** from 31 March to 10 April
More than 6300 proposals
- National Development Plan 2 (2007-2013) – NOT FINAL
 - Up to 20% investment subsidy (considering existing feed-in tariff support)
 - If >0.5 MW. only micro-hydro and biogas PPs are supported
 - Biomass. waste fractions (e.g. oil and animal fat). liquid manure and waste water treatment biogas. geothermal heat. heat pumps. solar. lifetime extension of existing hydros. autonomous wind projects
 - Total (support share): ~ 40-50 billion HUF (~160-200 million EUR)



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First commercial credit for RES

- For household applications
- Base currency: HUF, CHF, EUR
- Max 30 yrs
- Min 500.000 HUF (~2.000 EUR)
- Moving (relatively low) interest rate



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Biofuel

- 2233/2004. (IX. 22.) Govt Decree
2% up to 2010
- 63/2005. (VI. 28.) OGY (=Parliament) Communication
to Govt
4% up to 2010
- Exemption from excise tax until 2007
Differentiated taxation up to 2010
- Serious counterinterest from state budget point of
view (2% is still more probable)



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CO2 Emission Quotas (1)

- First phase 2005-2007:
Quota **14.95% more** than actual emission
(no previous emission information was available.
only from company self-reporting)
229 installations
30.2 M ton (actual: 25.7 M ton)

Lack of quota: 30 cases in the extent of 271.000
emission units (minimal).

CO2 Emission Quotas (2)

- 2nd allocation plan 2008-2012
Under public debate until 20 November
Proposal: 2008 – 27 Mt; 2012 – 32.33 Mt
Average: 30.845 Mt
of which 5% should be bought by auction

2013 targets (1)

- RES Strategy (Min of Econ and Transport)
Not yet approved
RES total (2013): 14%
RES-E (2013): 11.4%
 - Planned increase 2005-2010: 1000 GWh
2010-2013: 2400 GWh
- RES-E

• Solid biomass	3992 GWh
• Biogas	262 GWh
• Wind	710 GWh
• Other	436 GWh
• Total	5400 GWh



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2013 targets (2)

- RES total

	2003	2013
	PJ	PJ
Heat from RES-E prod	2.3	56.6
Biofuel	-	30
Heat from Solid biomass	31.5	50
Biogas	0.02	10
Solar collector	0.08	0.4
Other	3.7	18
Total	38.6	165



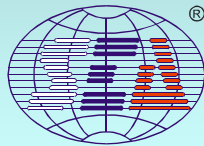
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Data Gathering on Renewable Energies for New Member States and Candidate Countries

3rd Workshop in Dubrovnik, 15.11. – 16.11. 2006

Latest Developments on RES Policy, its Implementation and Planning



Jan R o u s e k
Slovak Energy Agency, Bratislava
www.sea.gov.sk
jan.rousek@sea.gov.sk

Contents

- 1. Current economic and energy situation in Slovakia**
- 2. RES utilisation**
- 3. Potential of RES exploitation**
- 4. RES legislation in Slovakia**
- 5. Promotion of RES exploitation**

1. Current economic and energy situation

Selected macro-economic figures

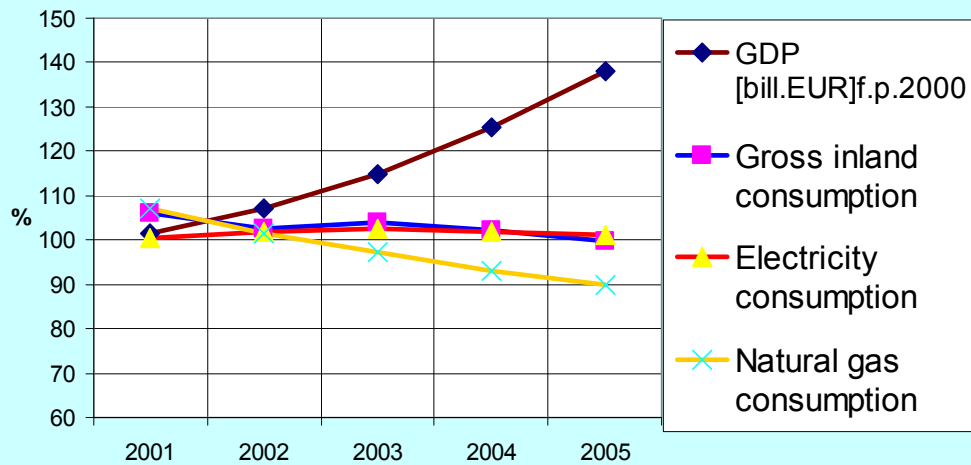
	2000	2001	2002	2003	2004	2005	2006
GDP growth rate [%]	2,0	3,2	4,1	4,2	5,4	6,1	6,5
Inflation [%]	12,0	7,1	3,3	8,5	7,5	2,7	4,6
Core inflation [%]	5,7	4,3	2,1	2,6	2,6	1,1	2,5
Unemployment - recorded [%]	18,2	18,2	17,8	15,2	14,3	11,4	10,2
Unemployment – statist. survey [%]	1 8 , 6	1 9 , 2	1 8 , 5	1 7 , 5	1 8 , 1	1 6 , 2	1 3 , 9

Macro – economic prediction

	2005	2006	2007	2008	2009
GDP growth rate [%]	6,1	6,6	7,1	5,5	5,1
Inflation [%]	2,7	4,5	2,5	2,0	2,4
Unemployment - recorded [%]	11,4	10,2	8,7	7,9	7,1
Unemployment – statist. survey [%]	16,2	14,5	13,8	13,5	13,1

Source: Ministry of Finance – Institute of Financial Policy [June 2006]

GDP and Energy Consumption Development (2000 = 100 %)



Actual data 2004 & 2005

		2004	2005
GDP _{f.p. 2000}	Mill. EUR	27 700	30 500
Gross inland consumption	TJ	784,2	767
Final consumption	TJ	386,3	358
Electricity consumption	GWh	28 682	28 572
Gas consumption	10⁶ m³	6 500	6 300

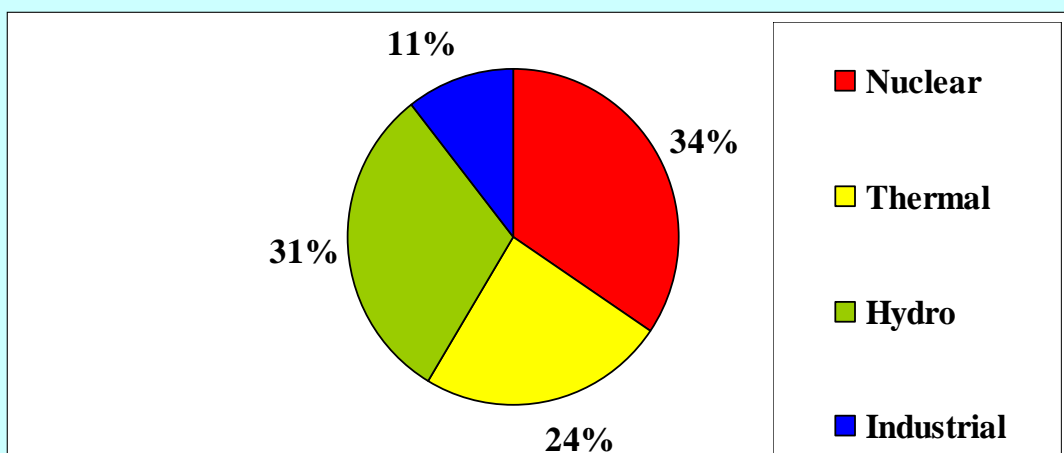
**Slovak Republic is strongly dependent
on the import of primary energy sources:**

One imports:

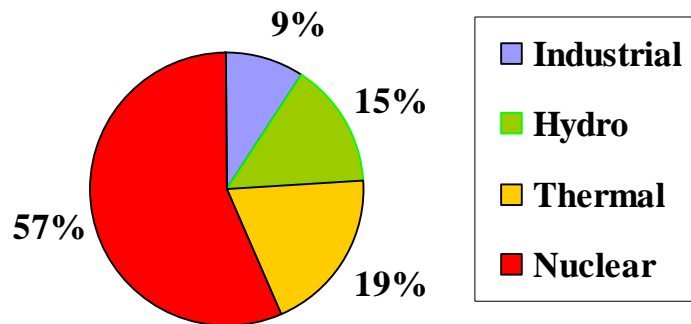
- 77 % of its gross domestic **coal** consumption
- 98 % of **gas** consumption
- 99 % of crude **oil** consumption
- 100 % of **nuclear fuel**

Renewable energy sources and rational use of energy are the important solution of country's energy problem

Installed power capacity in 2005



Electricity production structure in 2005



Slovak hydro power plants (system HPP)

	Installed capacity	Commissioned	Produced 2005 GWh
27 hydro power plants incl. 1 pumped storage and one accumulation plus pumped storage, hydropower plant Gabčíkovo	From 2x 2,32 MW up to 6x 122 MW	1936 - 1992	
Total:	1 652,7 MW +720,0 MW Gabčíkovo		4 483, 6

2. RES Exploitation in Slovakia

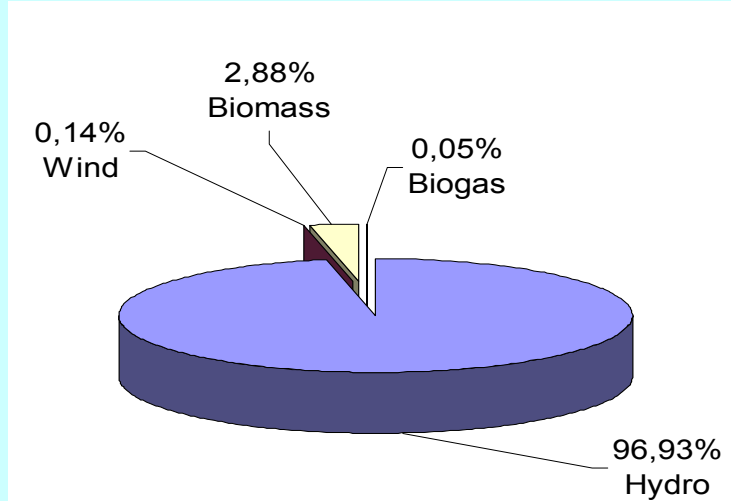
RES share in gross inland consumption

	2002	2003	2004
	[TJ]	[TJ]	[TJ]
Gross inland consumption	788 822	797897	784 214
Gross RES consumption	10 950	12 730	16 118
Primary electricity production in hydropower plants & wind farms	18 965	12 532	14 782
Total	29 915	25 262	30 900
RES share in energy consumption	3,8 %	3,2 %	3,9 %

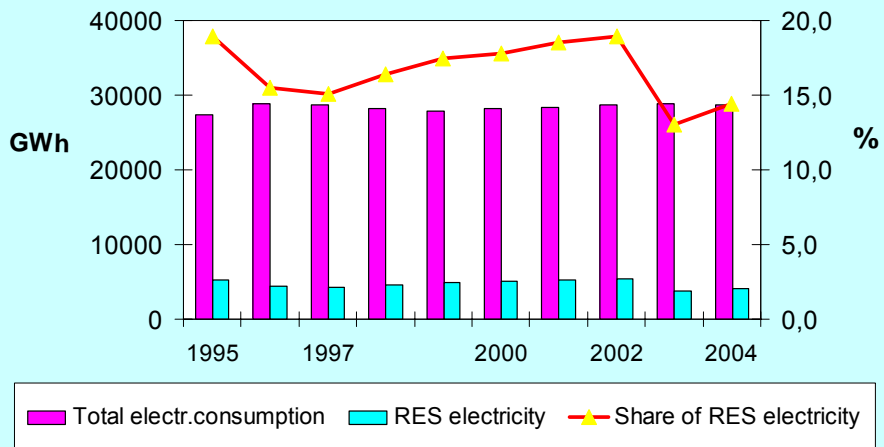
Recent electricity production in RES

Sources	2002	2003	2004
	[GWh]	[GWh]	[GWh]
Hydro power plants total	5 483	3 671	4 207
Hydro power plants (without pump storage)	5 268	3 479	4 100
Wind power plants	0	2	6
Biomass	159	84	33
Biogas	1	2	2
Total	5 428	3 567	4 141
Share in total electricity production	18,6 %	12,4 %	14,4 %

The share of individual RES in electricity production



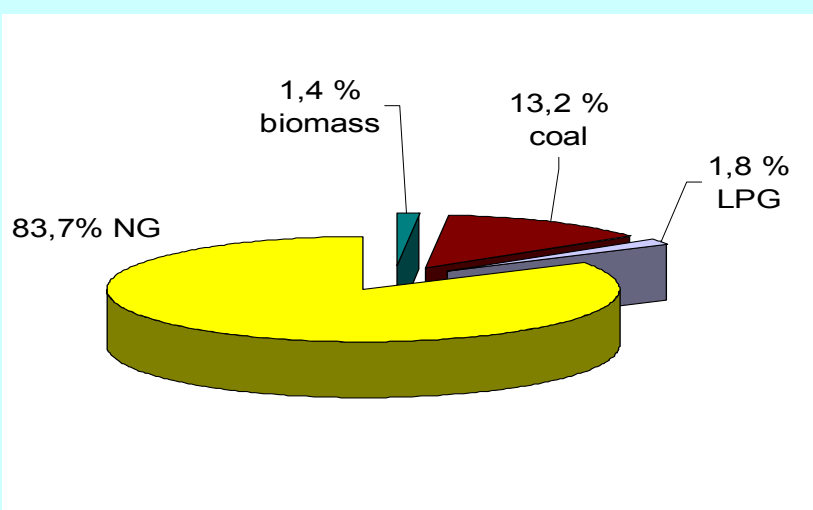
Development of total electricity consumption, RES electricity production, RES electricity share



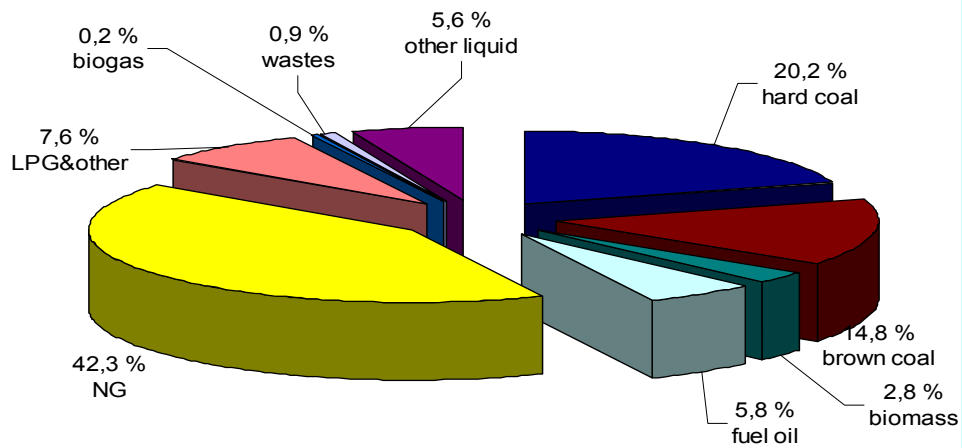
Recent heat production by RES

Sources	2002	2003	2004
	[TJ]	[TJ]	[TJ]
Biomass	474	643	1 354
Biogas	1	0	0
Geothermal energy	159	139	144
Solar energy	36	40	45
Total	670	822	1 543

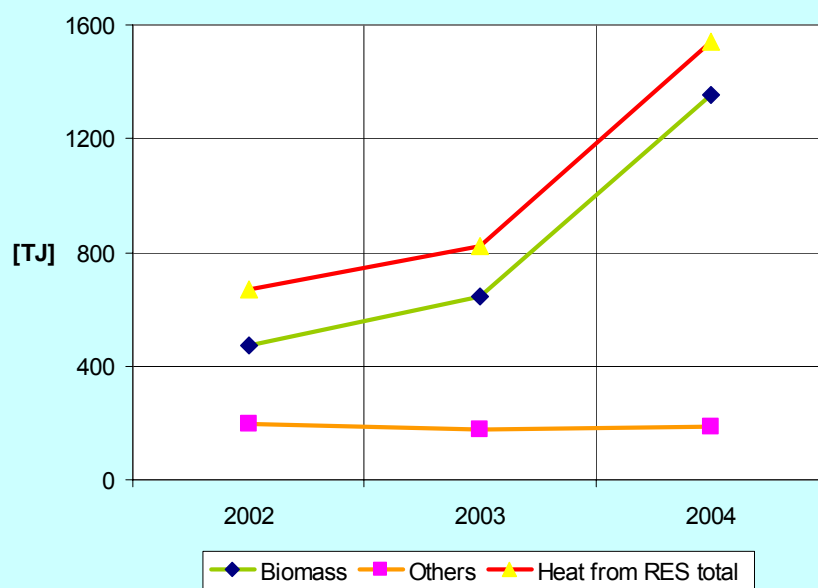
Share of individual primary energy sources in heat production (individual heating sources)



Share of individual primary energy sources in heat production (district heating)



Heat production from RES



3. Potential of RES exploitation in Slovakia

Exploitable potential for electricity production and production estimates

Source	Potential	2010	2020
	GWh	GWh	GWh
Hydro power over 10 MW	5 600	4950	5300
Hydropower under 10 MW	1 000	350	600
Biomass	1 300	350	1 300
Wind power	600	200	550
Geothermal plants	60	0	40
Biogas	500	50	500
Solar energy	1 540	0	10
Total	10600	5900	8300

Source: Energy Policy of the Slovak Republic {Ministry of Economy of SR, Jan.2006}

Exploitable potential for heat production and production estimates

Source	Potential	2010	2020
	TJ	TJ	TJ
Biomass	75 600	25 000	44 000
Of which: Dendromass	47 000	20 000	34 000
Agricultural biomass	28 600	5 000	10 000
Biogas	6 900	2 000	5 000
Geothermal energy	22 700	200 (1000)*	3 000
Solar energy	34 000	300	3 000
Total	139 200	27 500	55 000

* Assumption of geothermal heat delivery in Košice

Source: Energy Policy of the Slovak Republic {Ministry of Economy of SR, Jan.2006}

RES exploitation in transport and production estimates

In compliance with the Government Regulation No 246/2006 Coll. as of October 1st 2006 only bio Diesel is available at the petrol stations of country's dominant motor fuel producer and distributor, bio-petrol is on sale since the beginning of November.

Estimate of biofuel production

Source	2010	2020
	TJ	TJ
Biofuels	5 000	15 000

4. RES legislation in Slovakia

Act No 656/2004 Coll. on Energy (Energy Act)

- License is not necessary for the construction, start and operation of power plant producing RES electricity on the equipment under 5 MW installed capacity. No license is necessary for the production of biogas
- Ministry of Economy can, under the condition of general public interest set the obligation of preferential access to the system, preferential transmission and distribution of RES electricity and preferential supply of RES electricity on the relevant territory

Govt. Regulation No 124/2005 Coll. on the Rules governing the functioning of electricity market

- Distribution system operators are obliged to buy preferentially RES electricity to cover their losses

Decrees No 2/2005 and No 2/2006 of the Regulatory Office for Network Industries

- fixed feed-in prices for electricity produced by RES

Feed-in prices are set only for the years 2006 and 2007 – that is serious disadvantage – to reduce enterprising risk one should have at least 12 – 15 year certainty.

Regulatory Office for Network Industries set these feed-in prices on the assumption of maximum pay-back period of 12 years.

Selected examples of feed-in prices for the year 2006

Hydropower up to 5 MW	€cent/kWh
Installed before 2005	4,9
Installed after 2005	5,9
Solar power	20
Wind Power	
Installed before 2005	6,5
Installed after 2005	7,3
Combustion of Biomass	
purposely produced biomass	7,8
waste biomass equipment inst. before 2005	5,2
waste biomass equipment inst. after 2005	7,0
Combustion of Biogas	6,5

Act No 657/2004 Coll. on Heat Energy Management

- obligation of the licensee who operates heat distribution net to buy the heat supplied by the RES operator at feed-in price set by the Office for the Regulation of Network Industries
- regional support for RES heat is declared through the obligatory development plan of the region, district and municipality.

Govt. Regulation No 1149/2004 on the Concept of Exploitation of the Agricultural and Forest Biomass for Energy Purpose

- Annual production of agricultural & forest biomass suitable for energy exploitation and its energy potential
- Desirable items to be solved in the prepared RES Bill

Act No 555/2005 Coll. on Energy Efficiency of Buildings

- the obligation to evaluate the possibility of RES utilisation in new large buildings

Government Decree No1022/2005 of 21st December 2005 on the National Programme of Bio fuels Development

- Implementation of Directive 2003/30 EC on bio fuels promotion in transport and Directive 2003/96/EC on energy product taxation
- Bio fuels strategy in Slovakia up to 2010

Government Regulation No 246/2006 on the Minimum Amount of Motor Fuels Produced from RES (Valid as of May 1st 2006)

- bio component of the amount 2 % of energy content of motor fuels (Diesel oil, petrol) to be added – up to December 31st 2009
- Beginning January 1st 2010 bio component amount 5,75 %

5. Promotion of RES exploitation

- **National programmes** – Scheme supporting energy conservation and RES exploitation

- Environmental Fund

- **Structural Funds of the EU** – Agriculture and Countryside development (Investments into agricultural farms, Improvement of processing and marketability of agricultural products)

- Industry & Services operational programme item 1.4:

Support of energy conservation and RES exploitation

Support of energy conservation and RES exploitation

(item 1.4 of the operational programme Industry & Services):

Consists of 2 schemes:

“**de minimis**” support scheme for smaller projects (support from 2600 EUR to 100 000 EUR), and

“**State Support Scheme**” for bigger projects (from 50 000 EUR up to 5 000 000 EUR)

“de minimis” scheme (smaller projects): 17 projects in the implementation phase, of these 6 projects RES (1 small hydro power plant, 1 geothermal heating plant, 4 biomass utilisation),

“State Support” (bigger projects): 34 are implemented, 16 RES projects (small hydro power plants, geothermal heating plants, biomass utilisation).



*Data gathering on renewable energies for
New EU Member States and Candidate Countries*

Workshop organise by:

*EC Joint Research Centre- Institute for Environment and Sustainability & Energy Institute Hrvoye Pozar
Dubrovnik, Croatia, 15-16 November '2006*

Latest development on RES policy, implementation and planning in Poland

by

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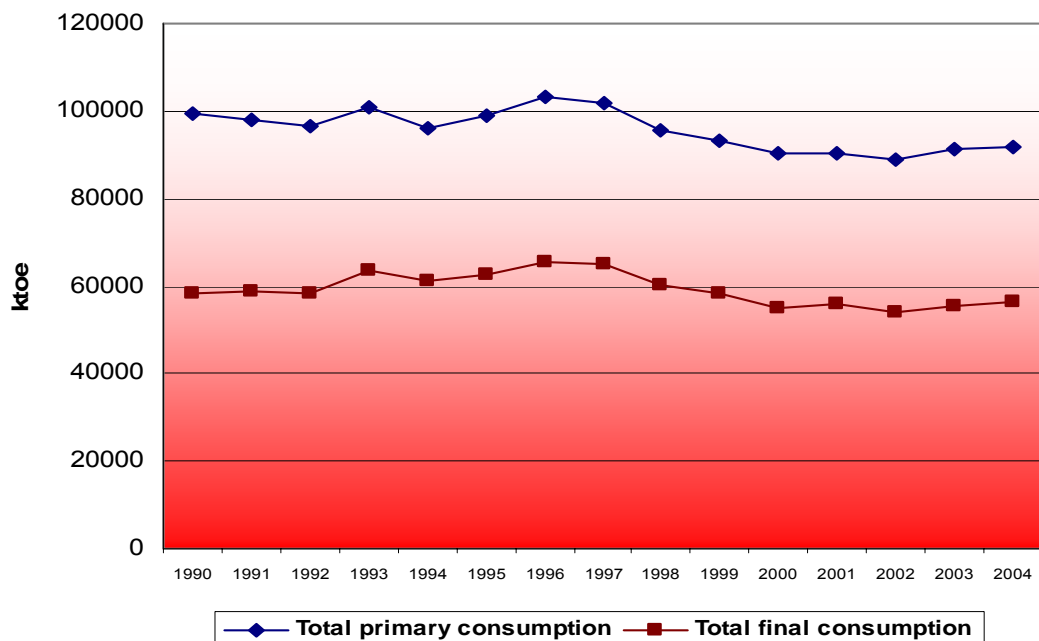
Outline of the presentation

- General energy and renewable energy statistical data and potentials for Poland
- Green electricity: legislation & statistics
- Biofuels: statistics & trends
- Green heat
- Financing
- Conclusions

Poland, basic data for '2004

Population	millions	38,191
Gross Domestic Product (GDP)	billions Euro (in constant Euros of 2000)	208,221
GDP per capita	thousands Euro (in constant Euros of 2000) per capita	5,45
GIC (Gross Inland Energy Consumption)	ktoe	91 951
TFC (Total Final Energy Consumption)	ktoe	56 456,2
Gross Energy Intensity (GIC/GDP)	toe per thousands Euro (in constant Euros of 2000)	0,4416
Final Energy Intensity (TFC/GDP)	toe per thousands Euro (in constant Euros of 2000)	0,2711
GIC per capita	toe per capita	2,408
Electricity generated	GWh	154 159
Electricity generated per capita	kWh per capita	4 037,6
Electricity consumption per capita	kWh per capita	3 816,4
Energy Dependency	%	15,2
CO₂ emissions (2003)	Mt	319,082
CO₂/GIC	t CO ₂ per toe	3,47

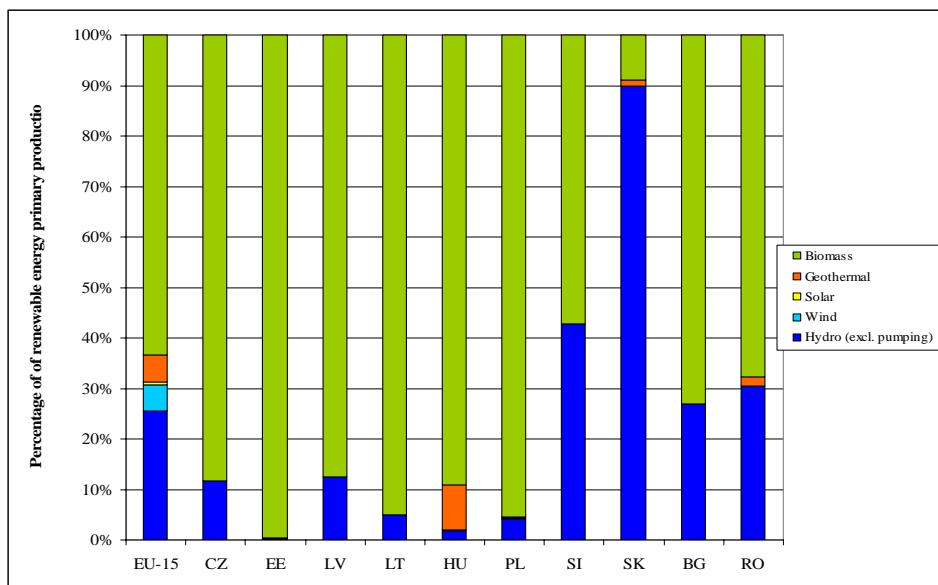
Trends in energy consumption in Poland



General economic and sustainability indicators for Poland'2004 as percentage of EU 25 '2003 or factor EU25/PL

	Poland	„EU 25”	% or factor
Population (mln)	38 231	451 864	8,46
GDP (bln €)	202	9 599	2,10
Employment (mln)	13 782	196 772	7,00
Expenditure on research (bln €)	1,2	169	0,70
Energy intensity, (kg of oe/1000€ GDP)/(factor EU25/PL)	650,1	209,9	<i>factor 3,10</i>
Share of green electricity cons. (%) / (factor EU25/PL)	2,0	12,7	<i>factor 6,35</i>
Expected production/share of biofuels '2005 (%) / (factor EU25/PL)	0,5	1,2	<i>factor 2,40</i>

Structure of renewable energy production in EU-15 and specific NMS/CEEC countries in '2004



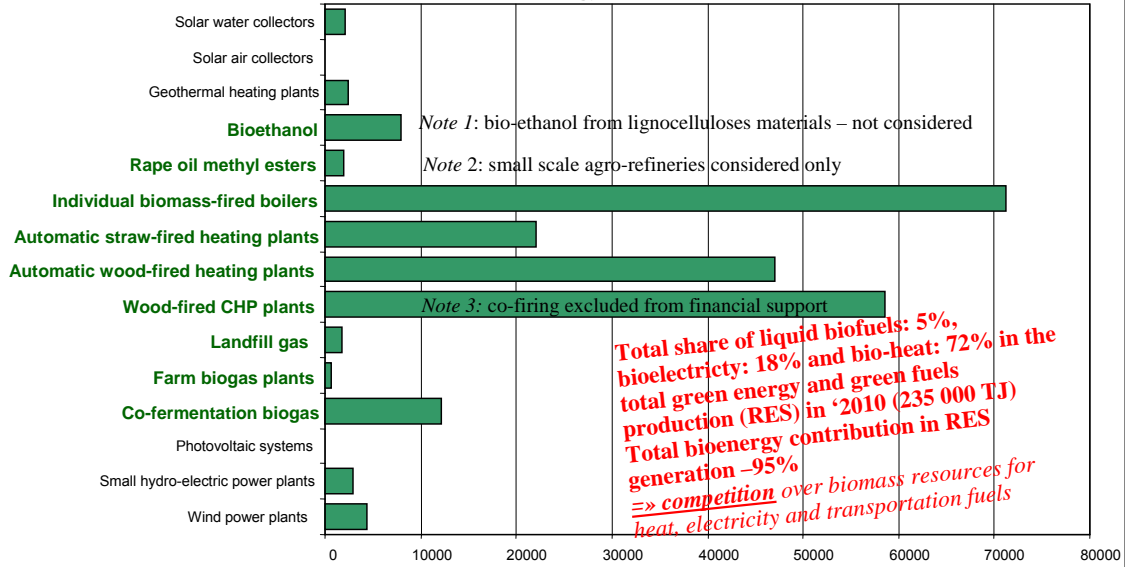
National Renewable Energy Strategy '2001

Overall target: 7,5% RES in TPE in 2010

general note 1: bioenergy technologies marked in green

general note 2: large scale hydro excluded from the balance & support

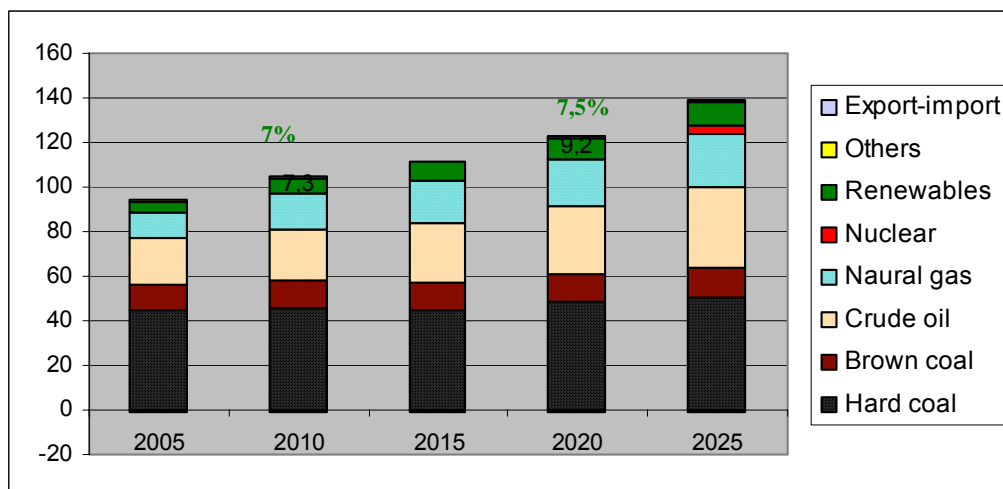
Total production of energy & fuels in 2010, in TJ



„National Energy Policy 2025”, approved '2005

Primary energy use in Poland till 2025 [Mtoe]

(reference – "coal" scenario)



Technical potential of RES in Poland

Update of potentials approved ('2001) „National renewable energy strategy”,
EC BRE C '2004 (for RCSS)

Resources	Technical potential [PJ/rok]	Share [%]
Biomass	755	43,1
Hydro	49	2,8
Geothermal	220	12,6
Wind	281	16,1
Solar	445	25,4
Total	1750	100,0

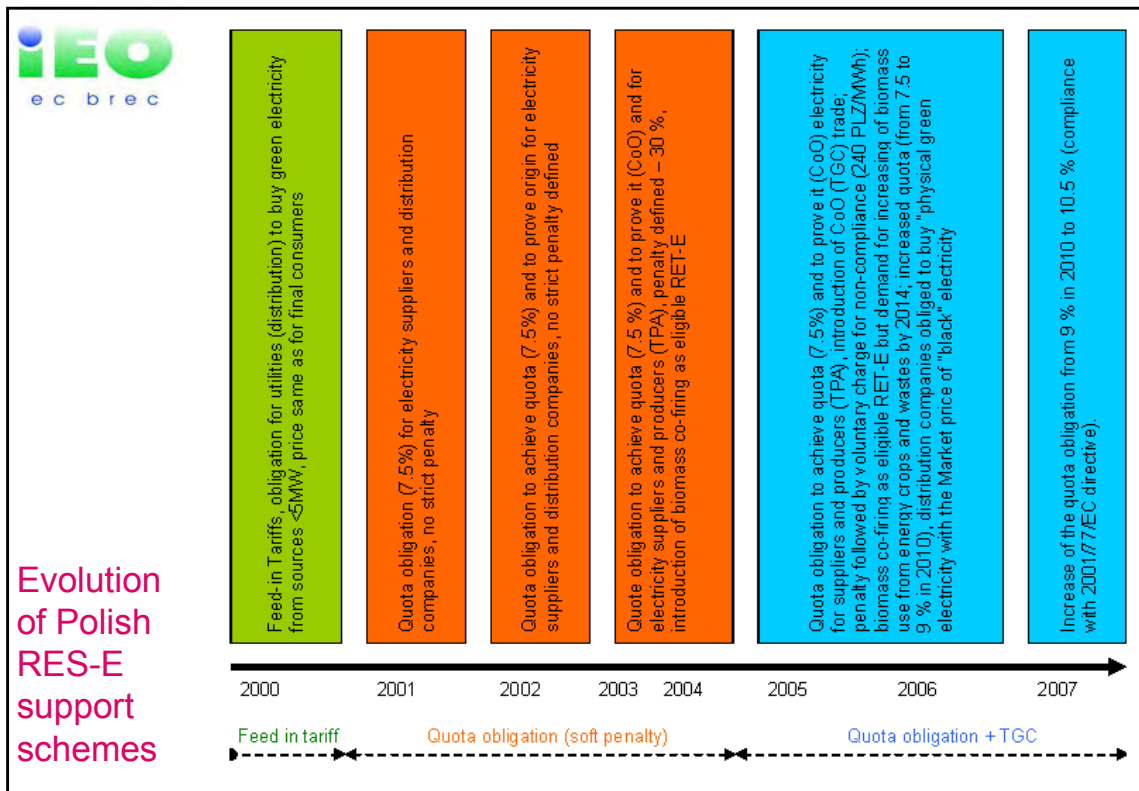
Utilisation '2003 (in PJ) and utilisation of technical potential of RES (in%) in Poland

<i>Resources</i>	Use of energy from RES	
	<i>PJ</i>	<i>% of potential</i>
Biomass	164	21
Small Hydro	8	16
Geothermal	0,5	0,2
Wind	0,02	0,08
Solar	0,03	0,06
TOTAL	173	10
Current RES contribution to the primarily energy balance		4,0

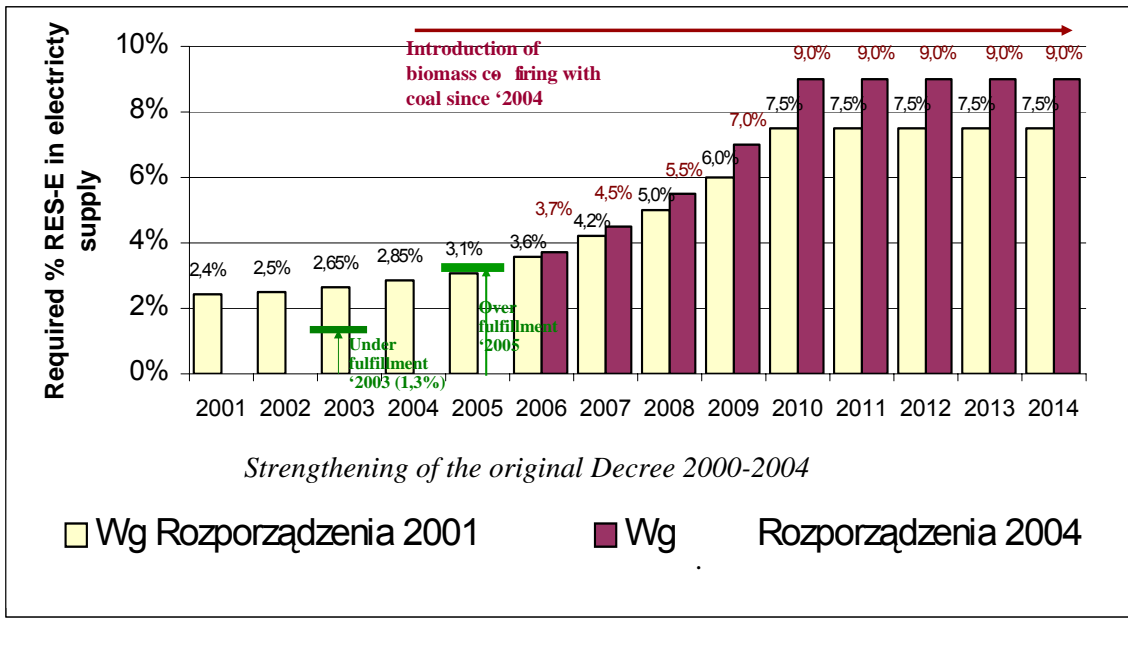
Remark: Poland is rich with renewable resources

The characteristics of Polish system of support for green electricity production after '2000

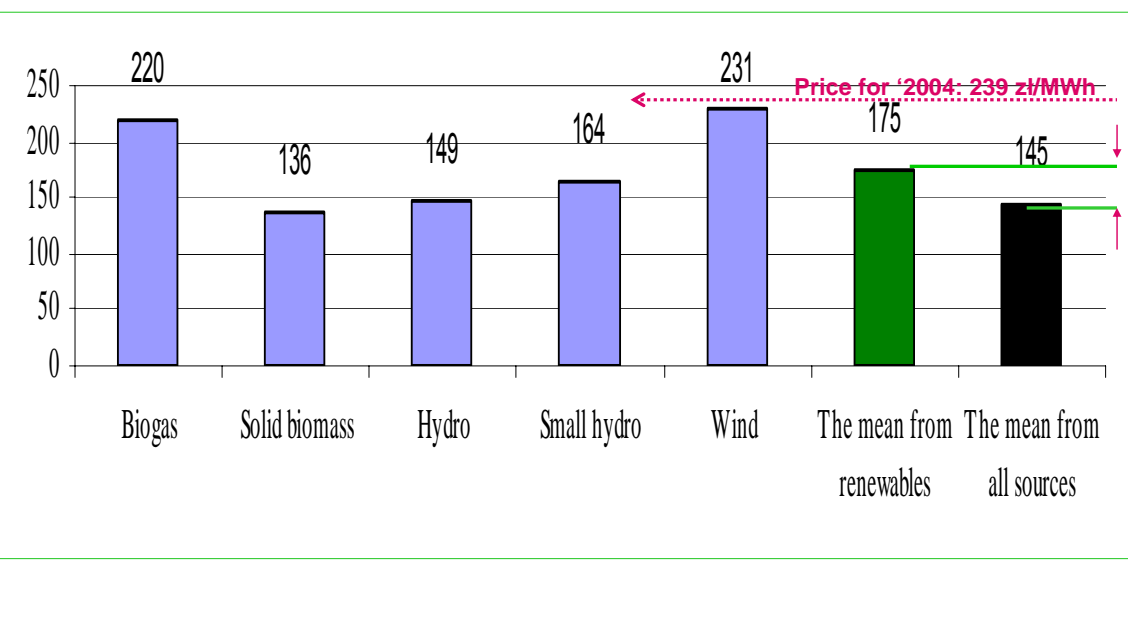
- The mixed system: investment support and quota system (before '2000 – feed-in-tariff)
- The support for the investment from national ecological funds (grants or preferential credits) and EU programmes
- Energy law and decree of Ministry of Economy on obligation of purchase of energy from renewable energy sources: quota mechanism- 10,5% in the total electricity supply to final consumers in '2010 (*equivalent of 7,5% in the gross electricity consumption according to indicative target set up for Poland in 2001/77/EC directive*)



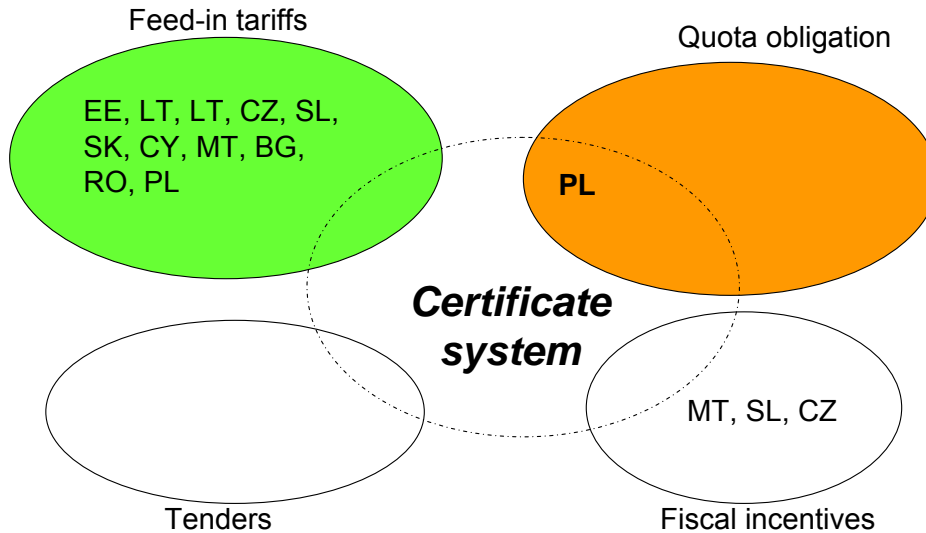
Development of decree (Rozporządzenie) of the Ministry of Economy 2001-2004 on obligation of purchase of energy from RES up to 2014



The price for green electricity '2003 [PLZ/MWh] in PL under „quota obligation” system, before introduction (2004) co-firing, higher quota and 30% penalty

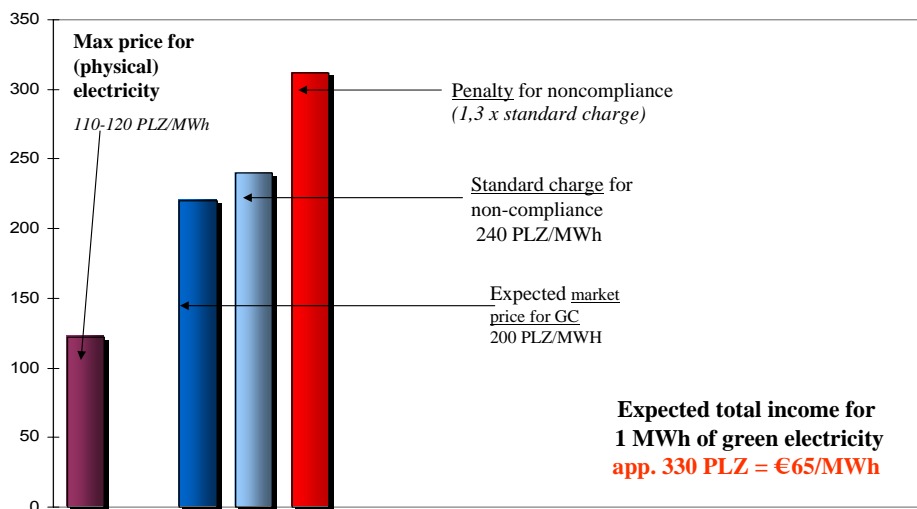


Status of RES-E support schemes in Poland (comparing to the NMS&CC)



Total income for 1 MWh of green electricity generated/sold together with certificate of origin (after Energy law amendment '2005)

PLZ/MWh

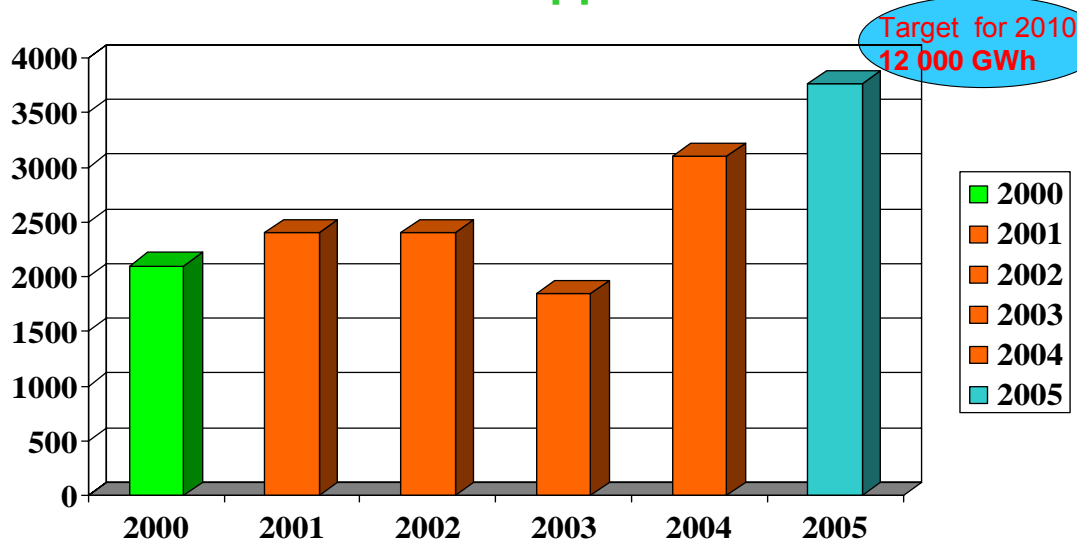


Note: Higher prices of green certificates for biomass co-firing and hydro (produced by traditional utilities)

Economics of green electricity production in '2005 (source: EP)

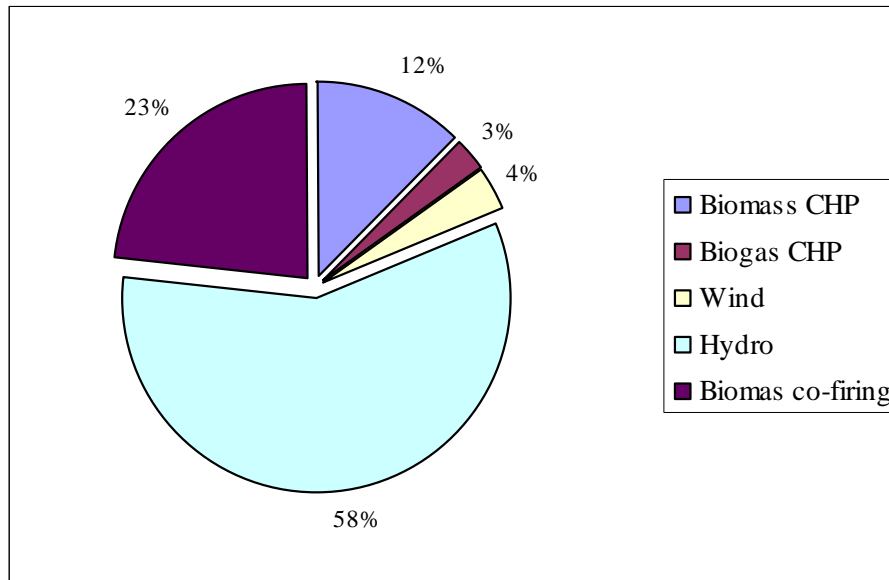
Type of RES-E technology	2004			2005			
	Price zł/MWh	Mean price zł/MWh	Difference zł/MWh	Price of electricity zł/MWh	Price of TGC. zł/MWh	Total income zł/MWh	Extras, 2004-2005 zł/MWh
SHP < 5MW	300	239	-39	118	200	318	18
Wind (30MW)	292	239	-53	118	200	318	26
Large hydro (100MW)	237	239	2	118	200	318	81
Biomass CHP (10MW)	214	239	25	118	200	318	104
Biomass co-firing (2000 MW)	133	239	106	118	200	318	185

Green electricity production 2000-2005 [GWh/year], according to changes in the support schemes



Growing role of biomass co-firing in the renewable electricity mix '2005

(total supply 3,76 TWh; ie. 3,5% of total electricity supply)



Biomass resources, are they sufficient for biomass co-firing?

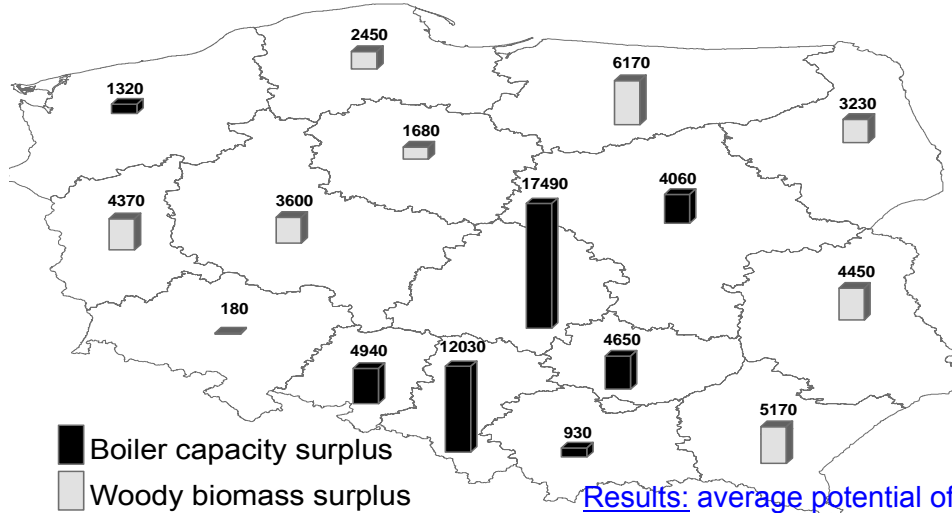
4% RES-E from biomass co-firing with coal=
69 PJ of energy conten in biomass =
9-10 m³ of fire wood per year to obtain =
app. of 1-2 mln m³ from forestry



...plus **7-9 mln m³** wood from energy plantations =
ok. 300 tys. ha of energy crops plantations



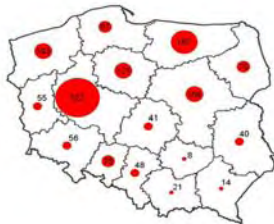
Example of optimistic biomass co-firing international study, results in [TJ/y@ region] (maximum biomass potentials, no transport between regions)



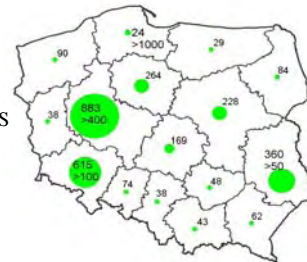
Results: average potential of electricity produced from biomass in co-firing in PL: **3,1%** (3,4 TWh) in 2010; cost less than €20 per MWh

Source: Johnsson, Berndes & Berggren '2006

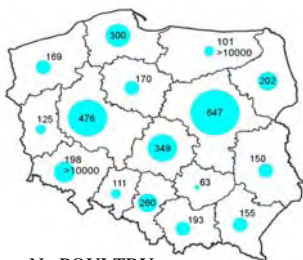
Biogas potential- missing potential of agriculture



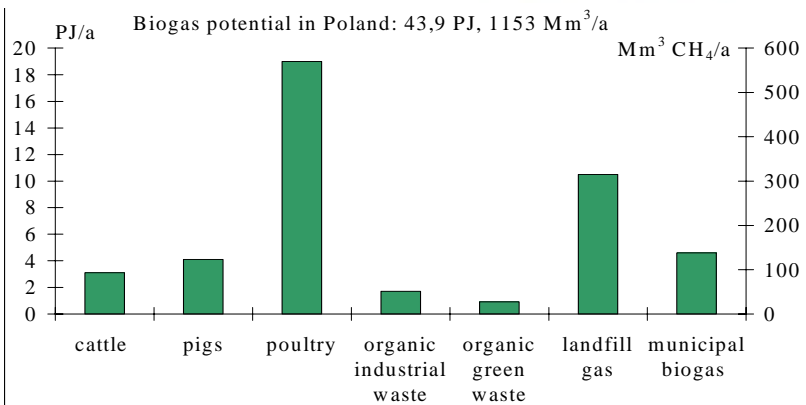
No of CATTLE FARMS >100



No of PIG FARMS > 500



No POULTRY FARMS > 5000



Current visions for RES-E in '2010

	MG '2005*	Updated vision of EC BRE C IEO '2006	
• Biomass	4,0%	2,5%	<i>Too slow development of energy plantations and to little time remaining to 2010</i>
• Hydro	1,2%	2,0%	
• Wind	2,3%	2,5%	
• Biogas	-	0,5%	
Total	7,5%	7,5%	

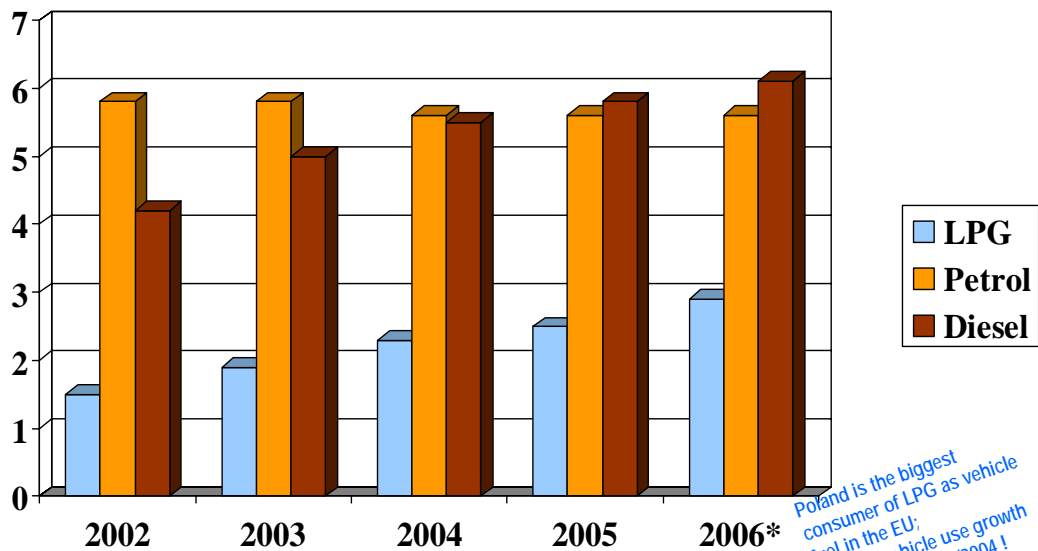
* Report of the Ministry of Economy MGiP to the European Commission, 31.08.2005

Liquid fuels sector in Poland

Key figures for '2004

- **Oil refineries:** 7 refineries with the capacity 18 mln t of crude oil/year; domestic production of crude oil - 4% only
- **Concessions of the Energy Regulator (URE) in the oil sector:**
 - **78** for fuels production,
 - **122** for fuels storage,
 - **6488** for fuels distribution
- **Oil sector** (medium and large companies only) **gross income:** 21 bln PLZ (app. € 5 bln)/year
- **Major players;** two oil groups: PKN ORLEN (app. 55% of vehicle fuels market), LOTOS Group S.A. (app. 27% of vehicle fuels market) and others: refineries & importers

Final consumption of vehicle fuels in Poland in 2002-2004 & forecast for 2006 [bln. liters (10⁹l) /year]



Poland is the biggest consumer of LPG as vehicle fuel in the EU; LPG for vehicle use growth was 35% in '2003/2004 !

Biofuels development up to '2004 (drop in bioethanol use)

Year	Consumption of transportation fuels [10 ³ t]	Consumption of bioethanol [10 ³ t]	Share of biofuels (bioethanol) [%]
2000	7184	40,6	0,35
2001	7046	52,4	0,46
2002	7049	65,3	0,57
2003	7547	60,1	0,49
2004	7847	38,3	0,30

Note: no biodiesel on the market before '2005

Production & use of (clean) bio-components in Poland '2005

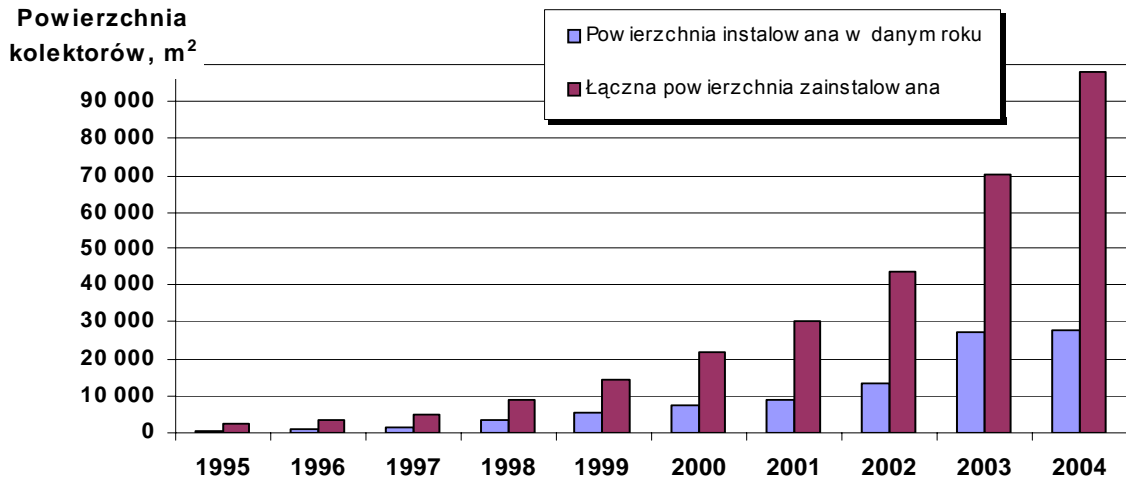
	Bioetanol		RME	
	tons	m ³	tons	m ³
Production	87 416	110 793	63 866	72 575
Distribution	90 913	115 226	50 721	57 637
- export abroad	31 099	39 416	48 599	55 226
- inland use	59 814	75 810	2 122	2 411

No regulation and quality standards
for 5% biodiesel in '2005 in PL => export (mainly to DE)

Forecast of the biofuels use up to 2010 (Ministry of Agriculture '2006)

Consumption	unit	2006	2007	2008	2009
Gasoline	mln t	4,040	3,980	3,920	3,860
Diesel	mln t	7,460	7,830	8,220	8,630
Share of biofuels	% energy	1,5	3,5	4,25	5,000
Ethanol	mln t	0,103	0,236	0,282	0,327
Biodiesel (RME)	mln t	0,123	0,301	0,384	0,475

Historical cumulative and yearly growth of solar thermal collectors in PL [m²]



Cumulative Solar thermal capacity in Poland '2005 [m²]

m ² solar collectors	Cumulated in 2004	Installed in 2005	Cumulated in 2005*
Glazed solar collectors	89 887	23 485	113 372
Unglazed solar collectors	1 430	120	1 550
Vacuum solar collectors	3 270	4 048	7 318
TOTAL	94 587	27 653	122 240


Yearly growth, app. 30%

Including '2005 in total:
Individual systems: 94 105
Collective systems: 28 135

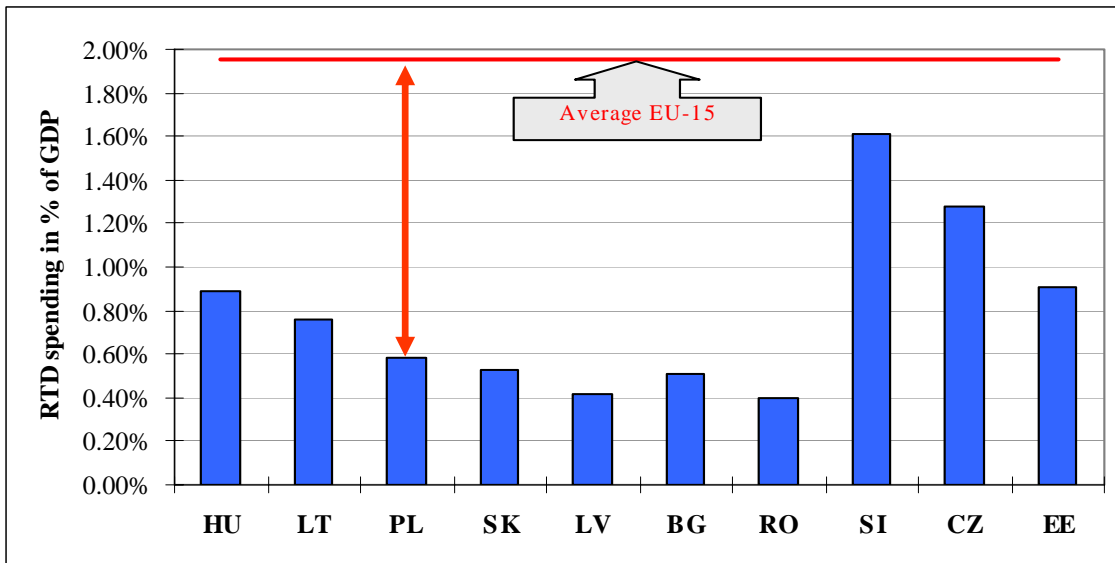
Development of units for biomass heat production 1999-2005 (EC BRE C data)

	1999		2000		2001		2002		2005	
	No	MW	No	MW	No	MW	No	MW	No	MW
Straw district heating >500 kW	10	12	25	35	34	50	65	92	120	185
Individual wood boilers <500 kW	-	-	-	-	-	-	110000	500	150000	730
Individual wood boilers .> 500 kW	-	-	-	-	-	-	175000	4375	250000	6500
Wood district heating systems	65	170	145	375	145	375	160	450	250	820
Small scale straw fired boilers <500 kW	-	-	-	-	-	-	150	23	250	48

EU financing: new EU budgeted 2007-2013 for Poland (including ERDF and Cohesion Found)

Operational programme title	RES related priorities/activities	Projects types (above Euro 5 mln) 	Available funds: EU/national/private contributions, [mln Euro]
"Infrastructure and environment"	Priority 10 "Energy infrastructure friendly to environment", action: 10.2 "Increased generation of energy from RES"	<ul style="list-style-type: none"> •biomass electricity (up to 10 MWe) •biomass and geothermal CHP •green heat production •biofuels (biodiesel) production •RETs (all type) equipment production facilities 	334,2/59/219
"Innovative economy"	Priority 4 "Investment in innovative technologies and products" (including especially those having positive impact on environment)	<ul style="list-style-type: none"> •RTD •Development and implementation of know-how. •Investment in modern (national scale at least) research and innovation •Investment support for industrial and private research and development centres 	2 838/425/0

RTD spendings in PL [% of GDP, 2004].....



Source: Eurostat

Conclusions

- Poland has **considerable bio-resources** availability (not fully exploited yet) at lower than in EU-15 cost (land and labour);
- Poland is on a good track in the implementation of 2001/77/EC directive but the **support scheme for green electricity is not optimised** and future bioelectricity prospect is unclear and **needs updated and comprehensive bioenergy/RES strategy up 2020 & clear objectives & efficiency criteria**
- **Biomass co-firing should be supported, but:** a) use lowest quality of biomass fuels (*organic waste and straw, e.g. through torrefaction*), b) strengthen production of energy crops, c) pay attention for sustainability, d) transition way for utilities towards 100% biomass CHP.
- Supporting scheme based on *quotas/TGC* needs active the use of **others policies and measures** (RTD policy, subsidies, tenders or *feed-in-tariffs for some RETs*) to support small scale (to compensate „TGC privilege” for large scale).



Latest Developments on RES policy, implementation and planning in Bulgaria



Sofia Energy Centre

“Data Gathering on RES for New Member States and Candidate Countries”

15 November 2006, Dubrovnik, Croatia



Sofia Energy Centre

“Data Gathering on RES for New Member States and Candidate Countries”

15 November 2006, Dubrovnik, Croatia



Main data of the country and the energy situation in general

Geographical location: Southeastern part of Europe on the Balkan Peninsula

Territory: 110912 km²

Population: 7761000 (31.12.2006)

Climate: temperate continental with clearly worked four seasons.

Temperature: the average annual temperature is 10.5 °C

Terrain: mostly mountains with lowlands in north and southeast

Gross Domestic Product: 24.1 Billion USD (2004)

GDP per capita: 3101 (2004)

Primary energy consumption: 21 030 ktoe (2005)

Final energy consumption: 10 127 ktoe (2005)



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Quantities of fuels and energies in primary energy consumption

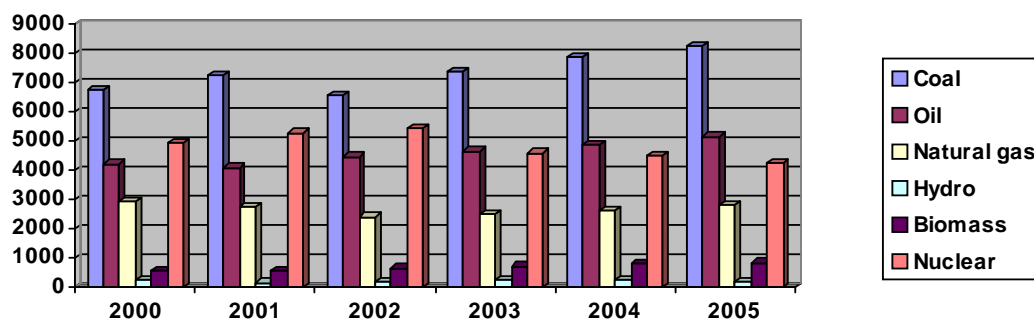
	year	2000	2001	2002	2003	2004	2005
Coal and other fuels	ktoe	6759	7266	6570	7365	7873	8267
Oil	ktoe	4220	4092	4473	4653	4899	5156
Natural gas	ktoe	2932	2738	2404	2500	2644	2814
Nuclear	ktoe	4925	5277	5463	4594	4475	4251
Hydro	ktoe	230	149	189	255	256	189
El. energy (export)	ktoe	-397	-595	-541	-472	-505	-480
Timber, etc	ktoe	558	543	647	709	801	834
PEC	ktoe	19227	19470	19205	19604	20441	21030



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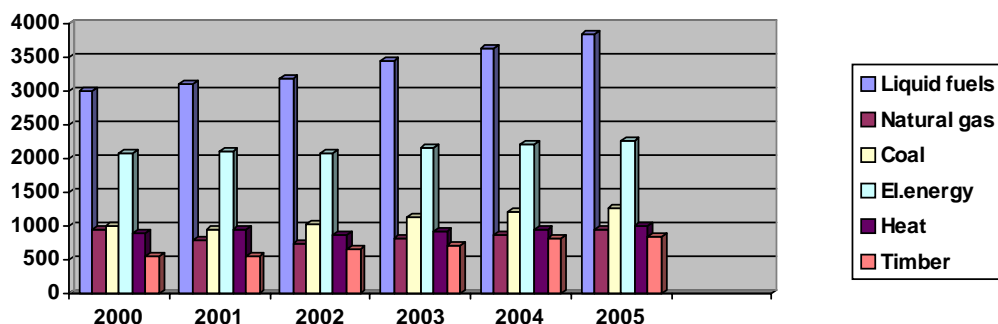


Fuel and energy in PEC for the period 2000 - 2005



Final energy consumption (FEC) in Bulgaria for the period 2000 – 2005 for energy needs

	Year	2000	2001	2002	2003	2004	2005
Liquid fuels	ktoe	3007	3114	3184	3468	3651	3843
Natural gas	ktoe	937	778	741	814	869	943
Coal	ktoe	986	936	1028	1127	1199	1252
El. energy	ktoe	2075	2110	2067	2153	2208	2270
Heat	ktoe	876	935	859	911	951	986
Timber	ktoe	555	541	642	706	801	834
Total	ktoe	8435	8414	8521	9179	9678	10127



Fuels and energy in FEC for the period 2000 – 2005



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15 16 November 2006, Dubrovnik, Croatia



Important laws dealing with RES

- Energy Law (published in State Gazette on 08.04.2006).
- Energy Efficiency Law (adopted 12.02.2004).
- The Environment Protection Act, which introduces the scheme for trading quotes for greenhouse gasses.
- The Water Act (published in State Gazette No. 67/27.07.1999), setting the building of small hydro plants and geothermal installations.
- The Waste Management Act (published in State Gazette No. 86/30.09.1999).
- The Clean Air Act (published in State Gazette No. 45/28.05.1999).



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15 16 November 2006, Dubrovnik, Croatia



Possibilities for financial support of RES

❖ The Kozloduy International Decommissioning Support Fund (KIDSF) administered by EBRD. The financial support under KIDSF could be also for utilization of RES (e.g. wind, hydro, biomass, solar). The support could be pure grant or partial financing in various co-financing structures with other loan applications.

Usually the owners of RES projects receive a 20% discount on the principal of the loan after, the completion of the project;

❖ The program between USAID and some banks (credit lines). Under this programme USAID will guarantee for up to 50% of the credit. Additionally a consultant helps the clients develop the respective projects. An example of this is the biomass project in the hospital in Svishtov;

❖ Introduction of solar collectors in the building sector is considered energy efficient and is supported by “Energy Efficiency Fund”;

❖ The production of biofuels in Bulgaria is in its infancy. The biodiesel is free of excise duty, which makes it able to compete with the traditional diesel;

❖ Adopting a new law on RES will broaden the corresponding financial incentives.



Sofia Energy Centre

“Data Gathering on RES for New Member States and Candidate Countries”

15 16 November 2006, Dubrovnik, Croatia



RES	Available potential in Bulgaria		
	-	-	ktoe
Water energy	26 540	GWh	2 282
Biomass	113 000	TJ	2 700
Solar energy	4 535	GWh	390
Wind energy	3 283	GWh	283
Geothermy	14 667	TJ	350
TOTAL	-	-	6 005



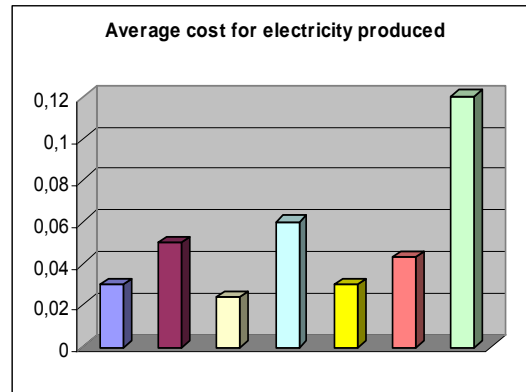
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“Data Gathering on RES for New Member States and Candidate Countries”

15 16 November 2006, Dubrovnik, Croatia



RES	Lv/kWh
Small HPP	0,030
Biomass (avg.)	0,050
Biogas	0,024
Biowaste	0,060
Geothermy	0,030
Wind	0,043
Solar	0,120



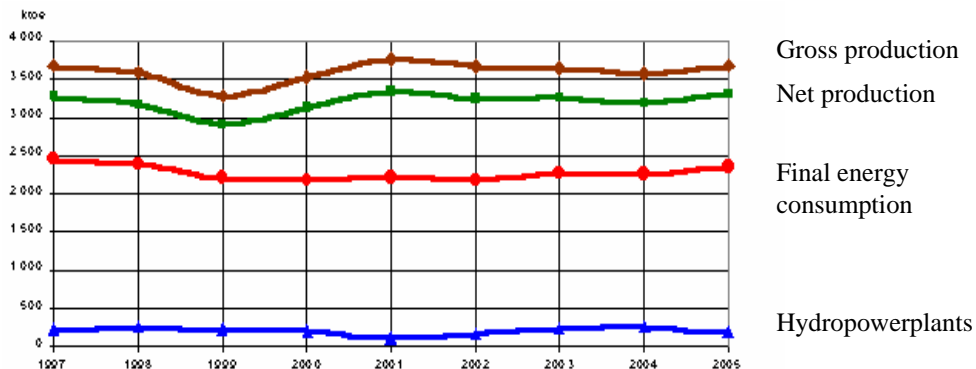
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Energy balance in the country for 1997-2005



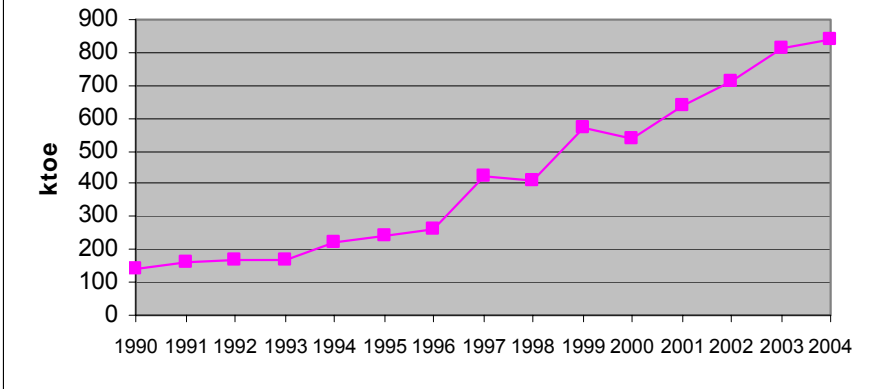
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Energy consumption of biomass for 1990-2004 in Bulgaria (ktoe)



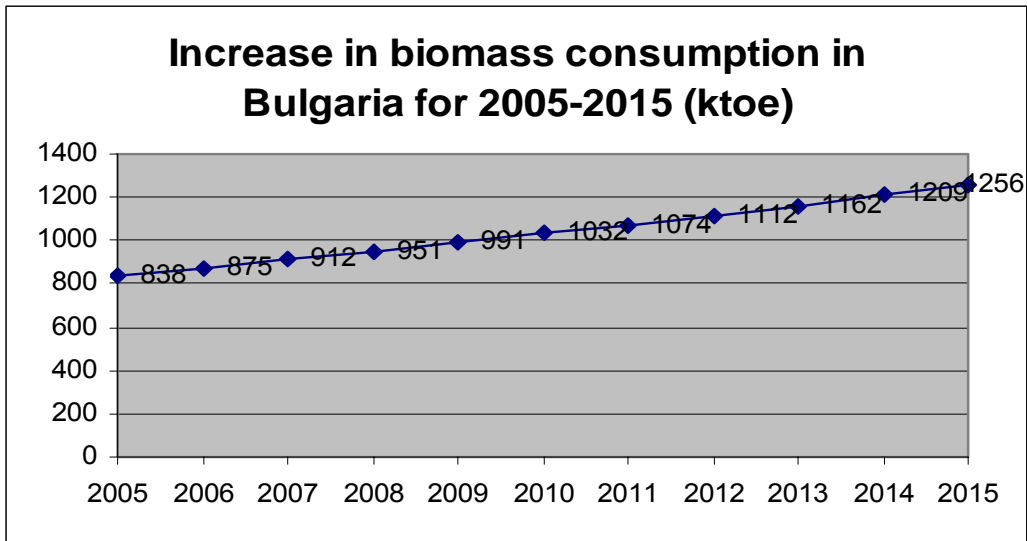
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Increase in biomass consumption in Bulgaria for 2005-2015 (ktoe)



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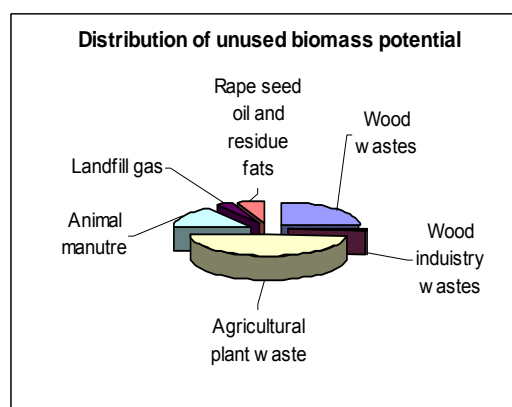
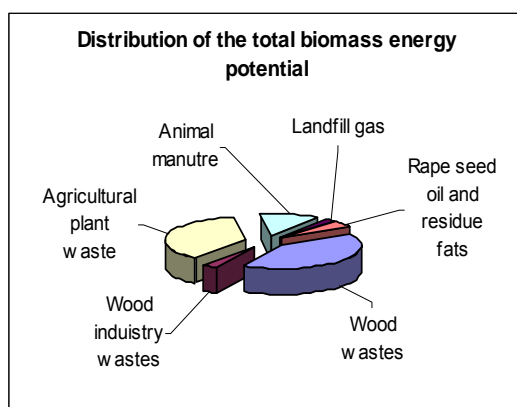
Type of waste	POTENTIAL		
	Total	Unused	
	ktoe	ktoe	%
Wood wastes	1 110	510	46
Industrial waste from wood industry	77	23	30
Agricultural plant waste	1 000	1 000	100
Animal manure	320	320	100
Landfill gas	68	68	100
Oil crops (Rape seed and sunflower)	117	117	100
Total	2 692	2 038	76



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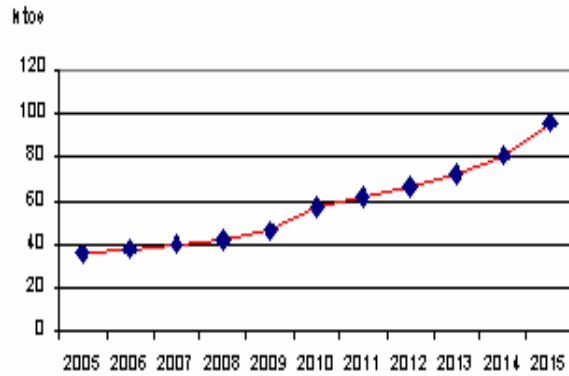
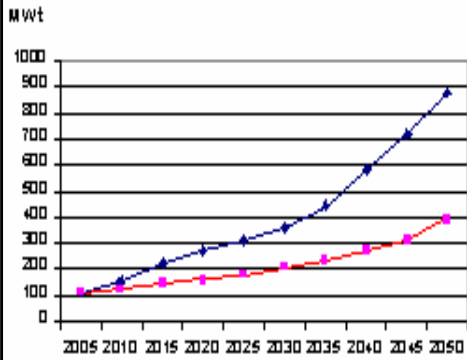
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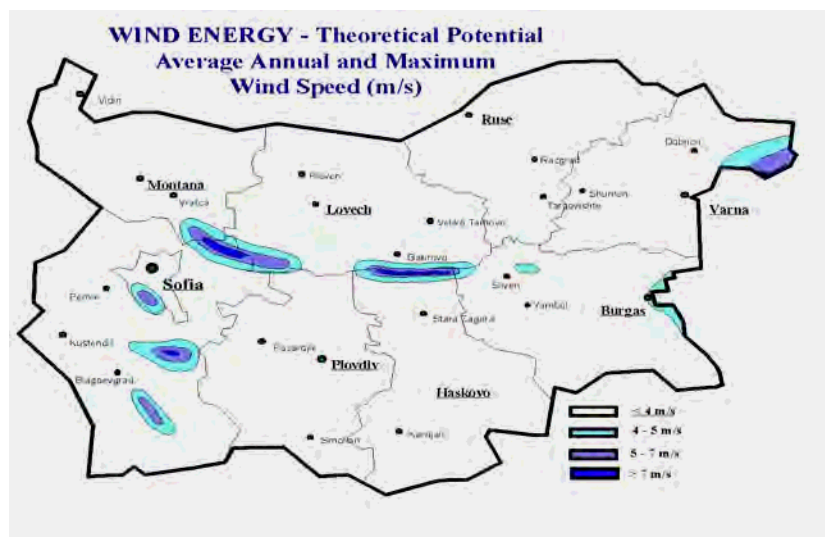
(On the left) Prognosis for installation of geothermal capacities – highly optimistic and realistic; (On the right) Prognosis for utilization of geothermal energy for 2005-2015



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“Data Gathering on RES for New Member States and Candidate Countries”

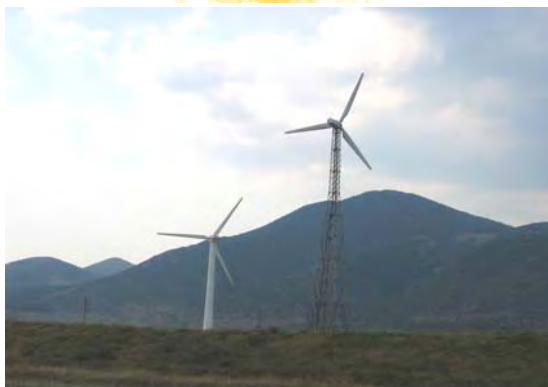
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Wind energy utilization in Bulgaria until 2015.

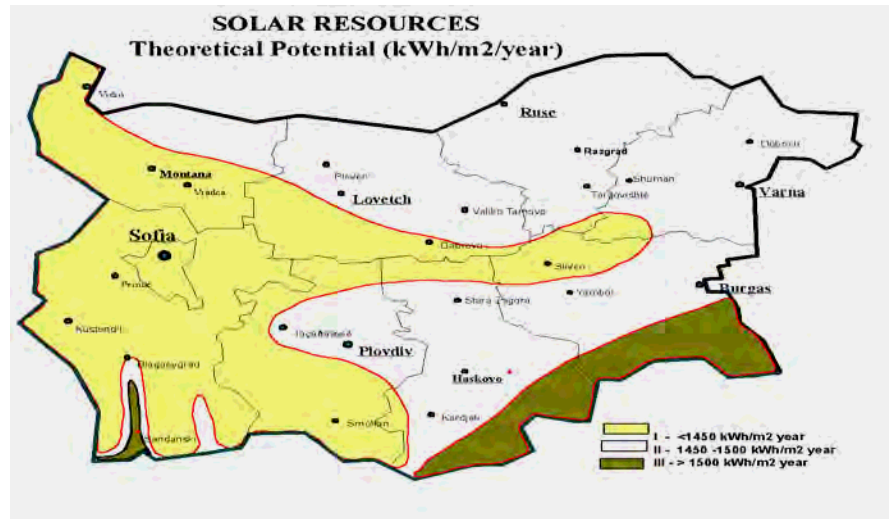
Year	-	2001	2002	2003	2004	2005	2010	2015
Electricity produced	GWh	0.03	0.047	0.063	0.126	0.252	8.0	258



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Solar Thermal Potential in Bulgaria

- The average solar radiation is 1517 kWh/m² (1410-1600 kWh/m²);
- The average annual period of sunshine is 2150 hours (2100-2500 hours);
- The total theoretical potential of the country is about 13×10^3 k.t.o.e.;
- The utilisable annual potential is about 390 k.t.o.e. (4535 GWh)



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Status and perspectives of utilisation of Solar Thermal Energy in Bulgaria

Development of solar thermal systems:

- ❖ During the period 1977-1990 there are about 50 000 m² installed;
- ❖ From 1990 to 2002 – many demonstration projects were implemented;
- ❖ During 2002-2005 the utilisation of solar collectors increases;
- ❖ At present there are solar thermal installations with total area of 56 000 m² in the country with total installed capacity of about 42 MW ;
- ❖ Solar thermal market at the moment is estimated to around 5000 m²/year;
- ❖ In the National Programme for encouragement of RES utilisation in the long-run (2005-2015) it is foreseen:
 - 260x10³ m² solar collectors in 2010;
 - 470x10³ m² solar collectors in 2015

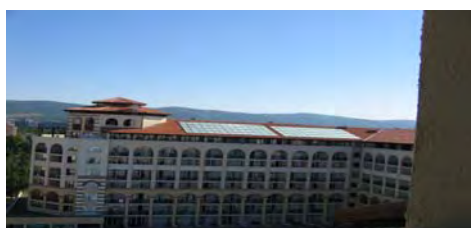


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15 16 November 2006, Dubrovnik, Croatia



Solar systems in hotels on Black Sea



“Data Gathering on RES for New Member States and Candidate Countries”

15 16 November 2006, Dubrovnik, Croatia



Type of RES	No. of implemented projects	Installed capacity, kW	Average annual production	
			Electrical power, MWh	Thermal power, MWh
Hydro-energy – small HPP	26	22 956	36 416	
Biomass	19	18 750		56 250
Geothermal energy	12	26 680		80 040
Wind power	6	1 075	4 300	
Total	63	93 117	40 716	136 290



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Conclusion:

- The available potential for all RES in the country is about 6000 ktoe. The greatest available potential of all RES has biomass (~2700 ktoe), followed by hydroenergy (~2280), solar energy (~350 ktoe) and wind energy (~280 ktoe). If the available RES potential is fully utilized its share in FEC in 2015 can reach 38%.
- Sustainable energy development in the conditions in our country, that includes optimal utilization of traditional fuels, can be achieved only with combining measures introducing RES with measures improving energy efficiency.
- In the following 10 years the biggest share in the electricity generation from RES will have hydroenergy and possibly biomass and in the heat generation – biomass, geothermal energy and solar thermal installations.
- A special peculiarity of RES is their economic advisability for the realization of small investment projects, due to the distribution of the potential, which asks for decentralization of the transforming/processing powers.



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Renewable Energy Sources (RES) in Romania

Dan I. Teodoreanu

1. Legal framework in the field of RES (1)

Primary legislation:

- **“The Electricity Law”**, No. 318/2003
- **GD (Government Decision) No.1535/2003 – “National strategy for RES (Renewable Energy Sources) Use”** (similar with EU White Paper for RES (1997))
- **GD No. 443/2004 – “Promotion of the electricity produced from RES”** (similar with EU Directive 177/2001)

<i>RES Type</i>	<i>Potential Annual</i>	<i>Energy</i>
Solar energy	1.433 thou tep (60x10 ⁶ GJ) 1200 Gwh	Thermal Electric
Wind energy	23.000 GWh	Electric
Hydro Total: P< 10MW	40.000 GWh 6.000 GWh	Electric Electric
Biomass	7.597 thou. Tep (318x10 ⁶ GJ)	Thermal Electric
Geothermal energy	167 thou tep (7x10 ⁶ GJ)	Thermal

Teoretic Potential of the RES in Romania (GD 1535/2003)

RES	2003- 2010		2011 – 2015	
	New Capacities	Investment (mil. Euro)	New Capacities	Investment (mil.Euro)
Solar-thermal	7,34 ktep	75	16 ktep	93
Solar- electric	1,5 MW	7,5	9,5 MW	48
Wind energy	120 MW	120	280,0 MW	280
Hydro <10MW)	120 MW	150	120 MW	120
Biomass-thermal	3249,8 ktep	240	3487,8 ktep	200
Biomass-electric	190 MW	280	379,5 MW	400
Geothermal	17,50 ktep	15	23,9 ktep	12
Total	-	887,5	-	1153,0

Proposal for new capacities and necessary funds (GD 1535/2003)

I. Legal framework in the field of RES (2)

Quota/green certificate :

- GD No.1429/2004: “Certification rules for the origin of power supply produced by RES”

- GD No.1892/2004 and No.958/2005: regarding the “System established to promote electricity generated from renewable energy sources”

I. Legal framework in the field of RES (3)

In 2010 the quota for RES should be 33% from the total energy consumption(including large hydro plants)

The other quotas (without big (>10MW) hydro) should be as in the table below.

2005	2006	2007	2008	2009	2010	2011	2012
0,7	2,22	3,74	5,26	6,78	8,3	8,3	8,3

I. Legal framework in the field of RES (4)

Total number of Green Certificates (GC) for 2006 = **20003**

Total number of GS sold in the first 11 months = **766**

After one year of operation of the system nothing significant was happened in the promotion of RES.

It is clear that the feed in tariff should be the system necessary to be applied for the promotion of all kind of RES in Romania (including solar, hydro, biomass, geothermal).

II. Research &Development Program(1)

Research & Development Programs funded by Romanian Government – Ministry of Education and Research:

National Program: “Research for Excellence”- based on “Collaborative research” and the EU Technology Platforms already established.

II. Research &Development Programs(2)

“Research of Excellence” Ongoing PV (Photovoltaic Solar Energy) projects (2005 – 2009):

- ✓Research activities for solar cells based on silicon thin films, crystalline silicon and polymers;
- ✓Building Integration and grid connected of PV Systems;
- ✓Complementarity of PV and solar thermal building integration for power supply and cooling.
- ✓Hybrid stand alone systems

II. Research &Development Programs(3)

Other research activities in the field of RES “Research of Excellence” :

- Biofuels
- Hydrogen and fuel cells
- Biomass (crops, wood,waste, s.o)
- Marine energy
- Wind technology for small and medium turbines
- Renewable heating
- 2005/2006 Competition: Total projects: more than 40
- The funding from budget is in the range of more than 2.5 millions of Euro/year and private other 30% of the total funds.

II. Research & Development Programs(4)

R&D Energy Sectorial Programs funded by Romanian Government – Ministry of Economy and Commerce:

Ongoing projects (2005 – 2008):

- ✓ Evaluation of RES potential in Romania;
- ✓ R&D projects based on RES for Rural Electrification
- ✓ Total funds: Budget: ~1 Mill.Euro

Private: ~30% from Total funds

III. Structural and cohesion funds (2006 – 2013)

Priority 2: R&DI Projects for investment in infrastructure, innovation and centers of excellence-platforms for research, demonstration and dissemination at EU level.

EU Funds (Program Draft): ~ 500 Mill.Euro; Local funds ~ 250 Mill.Euro

Priority 4: Projects based on RES applications/energy efficiency.
Co-financed by EU- European Regional Development Fund (max. 50% of the total eligible cost) and Romanian Government/Private Companies for the rest.

Total EU funds(Program Draft): ~600 Mil.Euro (RES ~ 120 Mill. Euro)

IV. NESL – ICPE-Center of Excellence for solar and wind energy

Before 1989, NESL – ICPE (founded in 1981) had the leading position in solar and wind energy in Romania, official partner in joint projects financed and organized at national and international level.

The most important aspect after 1989 was the great opening towards Europe, ICPE-NESL being involved in PECO, JOULE THERMIE, INCO-COPERNICUS, FP5 AND FP6 Projects that offered new opportunities to improve the overall activity.

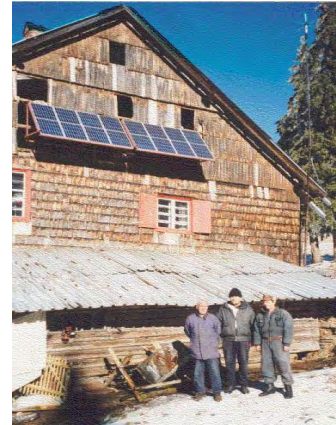
(14 projects).

Member of EU PV Technology Platform and “Smart Grid “ Networks of the Future Platform

NESL – ICPE-Center of Excellence for solar and wind energy(2)



IV. PV APPLICATIONS DEVELOPED BY NESL(3)



PV SYSTEMS FOR SOCIAL OBJECTIVES:

PV generators: 12 V or 24 V, 400 – 1000 W_p

Storage: Pb–acid, 12 V or 24 V, 500 – 1000 Ah

Inverters: 250VA / 12 V, 1300 – 2000 VA /24V

IV. PV APPLICATIONS DEVELOPED BY NESL(4)

Eco energy structure:

- Water heating with solar-thermal panels: 16 m²
- PV generator: 2.4 k W_p
- Grid connected inverters
- UPS: 2.4 kW



IV. PV APPLICATIONS DEVELOPED BY NESL(5)

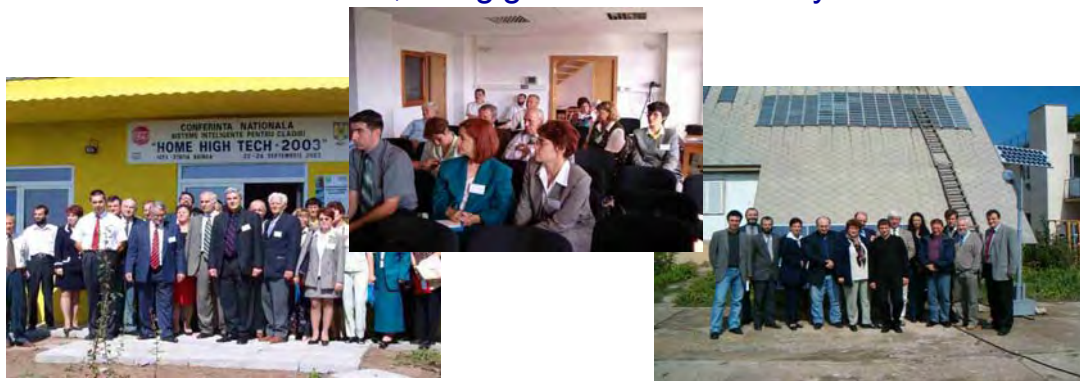
Hybrid system: PV - wind



Related Activities

Training in renewable energies

From 1993, ICPE-NESL (two times in collaboration with Romanian Agency for Energy Conservation), organised training courses, workshops, round tables and conferences for market actors and end-users of renewables, to Agigea Test Site Facility.



Tasks for Romanian RES Stake holders

1. Improvement of the legislation and instruments in the field of RES.
Promotion of the “Feed in tariff” at least for the next 15 years.
2. Education of the people regarding the Environment aspects of the RES development.
3. Promotion of the private-public partnership for at least Demo activities.
May be in the large scale industry for components (including technology transfer)
4. Active Participation in the European Platforms: “PV Platform”, “Hydrogen and Fuel Cells”, “Clean fuels”, “Smart Grid”.
5. Intensify the activities of Dissemination of the important R&D best applications for the potential customers and students.

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030138, Bucharest, Romania
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EUPV Technology Platform*

Renewables in Croatia: Latest Developments 2005-2006

Velimir Šegon, EIHP
Marija Šćulac Domac, CCE

Croatia - basics



Inhabitants: 4.554 million
Total area: 89,810 km²
(land: 56,610 km²,
sea: 33,200 km²)
Structure: 20 counties +
Zagreb
5835 km of coastline
1185 islands, islets and reefs

Croatia in 2005

GDP per capita : 12.400 US\$ (PPP, US\$ 2005)
(7 % agriculture; 30,8% industry; 62,2% service sector)

Total primary energy supply: 411,66 PJ
(8,0% coal; 3,6% fuelwood; 44,2% liquid fuels; 24,5% natural gas; 15,2% hydro; 4,5% electricity; 0,05% RES other than fuelwood)

Total electricity consumption: 17.571,8 GWh
(36,6% hydro; 20,6% thermal; 10,7% public cogen.; 2,9% industrial cogen.; 29,1% net import; 0,12% RES)

RES Latest Developments: 2005-2006

- 1) Legislation (Electricity, Heat, Biofuels)
- 2) RES Utilisation & Projects in Croatia
- 3) International Cooperation

RES Electricity: Legislative Framework Overview

June 2001: Energy Laws (package of five laws)

December 2004: Amendments to Energy Law and Electricity Market Law - five sublaws on RES electricity and cogeneration:

- Ordinance on RES&C utilisation
- Regulation on the minimum share of RES&C electricity
- Tariff system for RES&C electricity
- Regulation on compensation for RES&C electricity incentives
- Ordinance regarding eligible producer status

RES Electricity Legislation: Status (Past and Present)

Legislation still in preparation (since 2001!)

Malta, November 2004: 'By 2005 will be in place'

Cyprus, December 2005: 'By 2006 will be in place'

Cavtat, November 2006:...

RES electricity legislation, con't

...by end of 2006 will be in place

Main driver: EC screening for energy (Ministry insists on completion by 2006, in last two months over 15 meetings of working group)

Intensive lobbying from different interest groups (!)

RES electricity legislation: lobbying results

Tarriff system (proposal!), article 4 (part 3):

Share of domestic component

Correction factor for
feed-in tarriff

Above 70%	1,00
65%	0,98
60%	0,92
55%	0,88
50% and less	0,85

RES electricity legislation: feed-in tariffs (proposal)

Tariff system for RES&C electricity (feed-in), €c:

	<1 MW	>1 MW
Small hydro	9,20	6,20
Wind	7,97	7,70
Biomass	12,84	11,22
Geothermal	16,89	16,89
Biogas, liquid biofuels	11,89	10,95
Landfill gas	4,86	4,86
Wave, tidal	8,00	6,67
Solar pv (<30 kW, >30 kW)	45,95	39,86

RES Heat Legislation

April 2005: Law on production, distribution and supply of heat – two sublaws on RES heat:

- minimum share of RES heat
- financial incentives

Expected to be put in place by end of 2006 (Ministry wishes – not realistic)

Biofuels Legislation

Energy Act: biofuels recognised as RES, definition and classification

Regulation of quality standards for biofuels (November 2005):

- defines quality standards and requirements;
- defines national indicative target of 5,75% by end of 2010 (premature – expert consultation missing!)

Missing: - incentives (tax exemption) regulation

RES utilisation: Energy in Croatia 2005

	Th. capacity	Th. production	El. capacity	El. production
Solar	N/A	N/A	48,84 kW	50,14 MWh
Wind	0	0	5,95 MW	9,5 GWh
Biomass	512 MW*	14767 TJ **	2 MW	10,9 GWh
Small hydro	0	0	26,7 MW	108,3 GWh
Geothermal	114 MW	547 TJ	0	0

*Only industrial heating plants

**Total, Includes fuelwood for households heating

RES utilisation: Energy in Croatia 2005 con't

Pellets production: 2000 t/y (complete production exported)

Briquettes production: 8500 t/y (domestic consumption)

Charcoal production: 7200 t/y

Fuelwood production: 1.390.000 m³/y

Recent RES Projects in Croatia

Wind Power Plant Ravne 5,95 MW

Wind Power Plant Trtar-Krtolin 11,2 MW

Biomass district heating Gospic 3 MW

Biodiesel Production Plant in Ozalj
20 000 t/year

Jakuševac Landfill Gas Power Plant 2 MW

Equipment production – solar, biomass, wind...





CCE's Renewable Energy Sources Association

Established in 2003 (only 12 members); today 140 members within 7 groups:

- Biomass and biogas
- Liquid biofuels
- Wind energy
- Solar energy
- Small hydro PP
- Geothermal energy
- RES equipment manufacturers and suppliers

*CCE – Croatian Chamber of Economy

International cooperation – programmes and possibilities

Croatia fully eligible for FP6 projects

First time fully eligible for EIE projects in last call (deadline 31 October)

INTERREG (Inter-regional transboundary cooperation)

International cooperation: Highlights

Regional Energy Agency for North-western Croatia

- submitted under EIE programme (consortium of four partners – Spain, France, Hungary, Croatia)
- will cover 3 counties + city of Zagreb (app. 1.4 million inhabitants)
- first regional energy agency in Croatia (!)



Conclusions

- Legislation to be in place in 2007
- RES projects developed in 2006 even with missing legislation (!)
- RES field and players development progress (Fund for EP&EE, CCE, Regional Agency, Developers and equipment producers,...)
- 2007: RES year in Croatia!

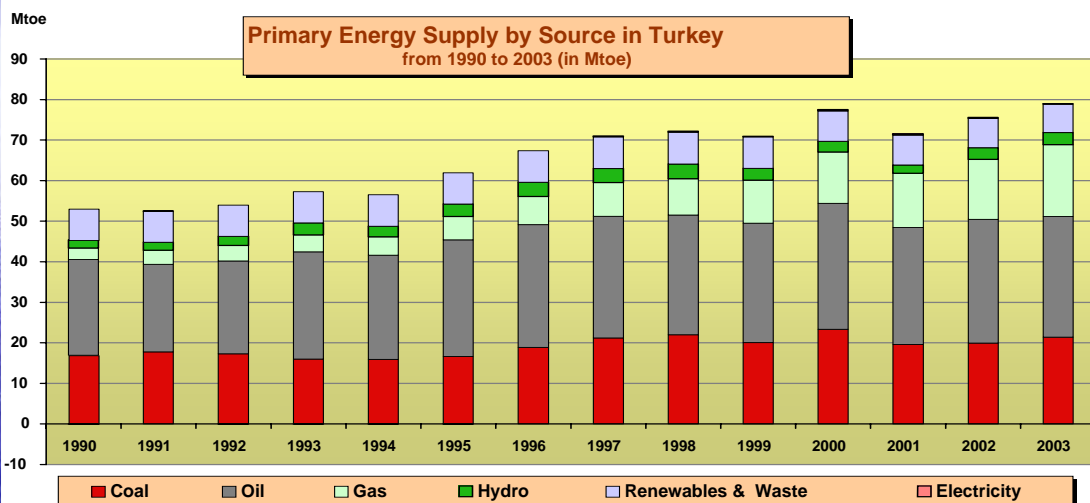
Energy Section
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Latest Developments on RES Policy, Implementation and Planning in Turkey

Associate Prof.Dr. Tanay Sıdkı Uyar
 Energy Section Marmara University Faculty of Engineering İstanbul Turkey

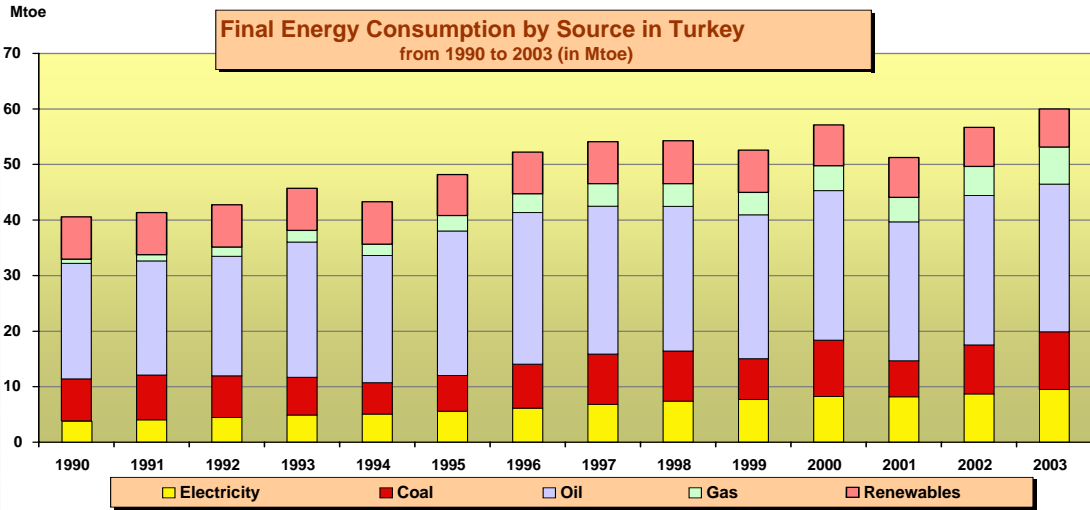
Workshop: "Data-Gathering for New Member States and
 Candidate Countries on Renewable Energies"
 Cavtat-Dubrovnik, Croatia, 15-16 November 2006

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Source: IEA - Energy Balances of OECD Countries, 2005

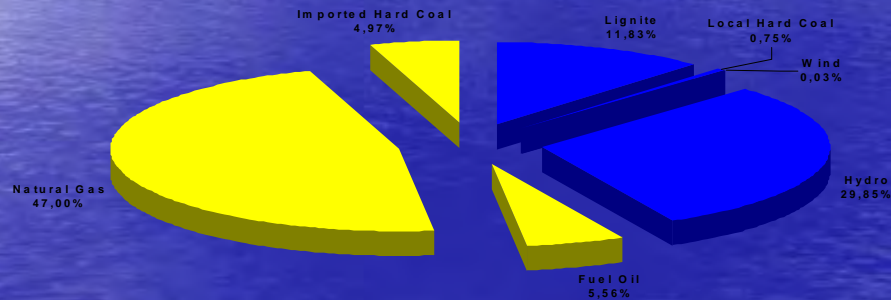
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Electricity Production in Turkey, 1999

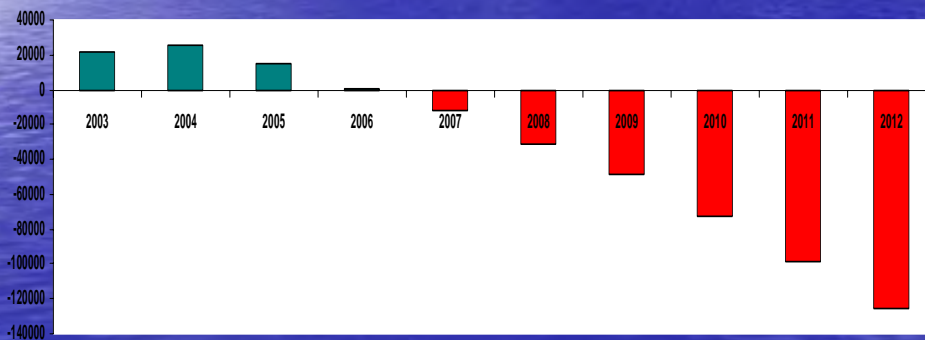


Challenges

- High dependency on imported fuels (>50%)
- 8% annual growth of economy vs. 2-5% growth in energy investments
- Currently projected energy investments lead to an electricity supply gap of 12.000 GWh in 2007 and of 125.000 GWh in 2012

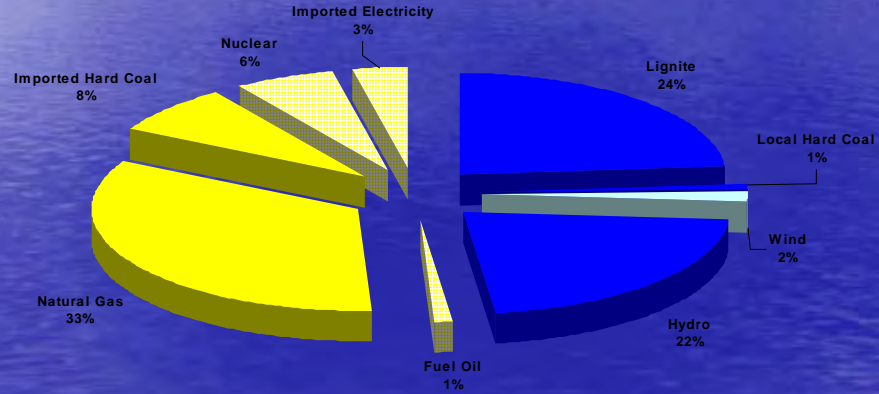
Surplus Deficit of Electricity Supply in Turkey

Surplus Deficit of Electricity Supply in Turkey



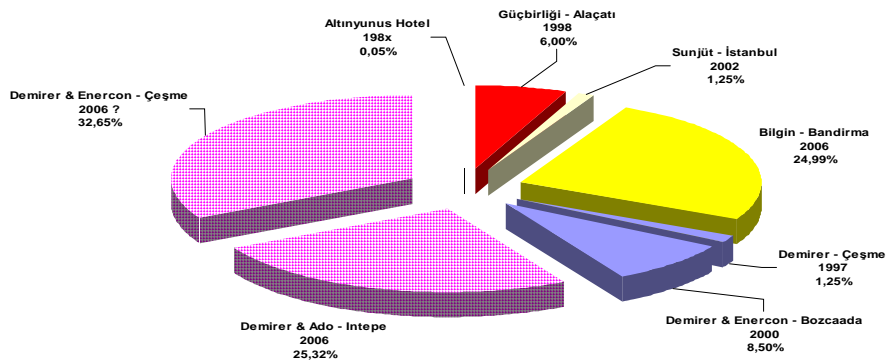
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Electricity Production in 2020 according to MENR (Ministry of Energy and Natural Resources)

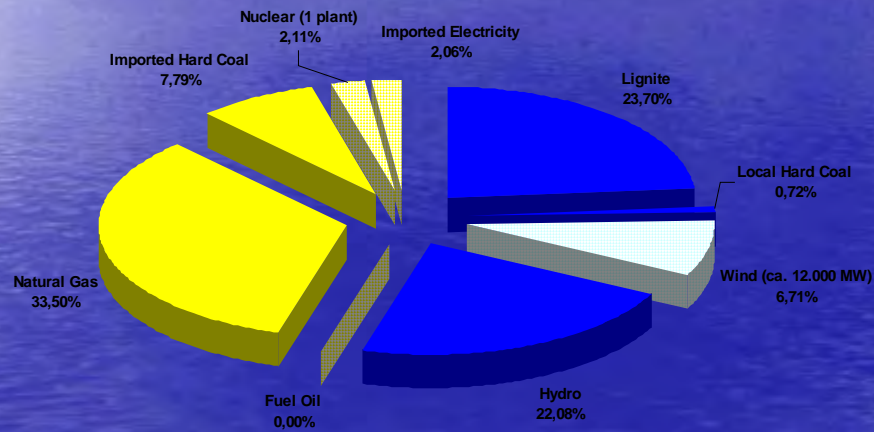


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Market Players Operating Wind Farms 120MW



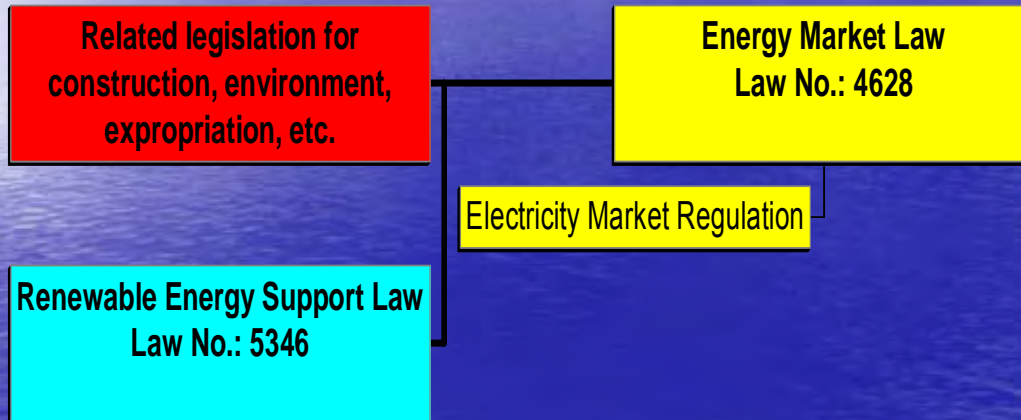
Electricity Production in 2020 in line with EU parliament resolution "2004/2153"



Solutions and Opportunities

- EU parliament's resolution "2004/2153 (INI)" demands 20% of renewables in 2020, leading to approximately 12.000 MW of wind power in Turkey
- Short-term: Wind power plants will play a major role in closing the electricity supply gap from 2007 to 2014, leading to investment opportunities of more than 6 billion €
- Medium-term: "20% of renewables in 2020" obligation by EU, leading to investment opportunities of more than 12 billion €

Legal Basis

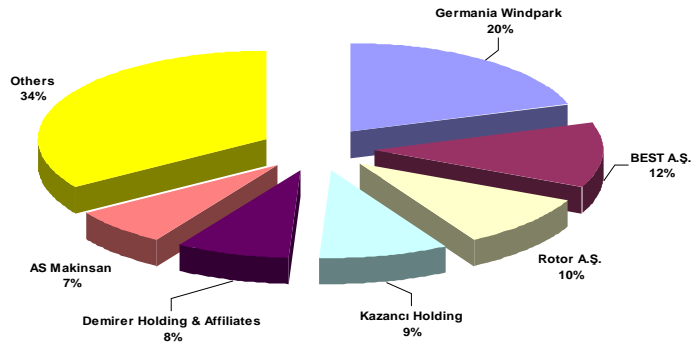


Investment Models

- 1. Generation**
According to Article 17 of the License Regulation, the generation licensees may engage in the activities of construction and commissioning of generation facilities, sale of the generated electricity to consumers.
- 2. Autoproduction**
According to Article 33 of the license regulation, autoproducer licensees may engage in the establishment of generation facilities in order to meet their own needs and, in cases of excess generation, the sale of up to 20% of the generated electricity to other licensees and eligible consumers

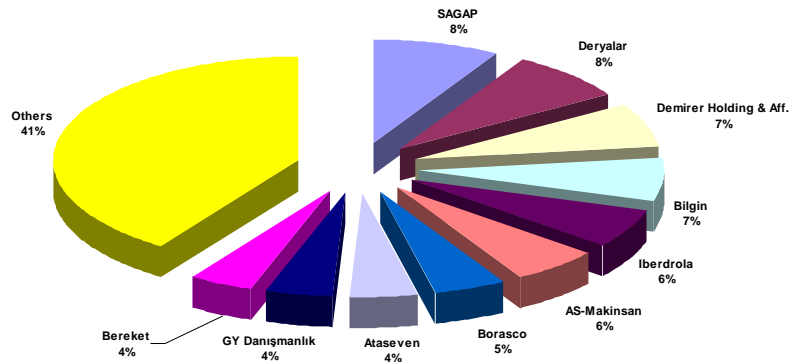
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Granted Licenses (1420 MW)



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License Applications (6700 MW)



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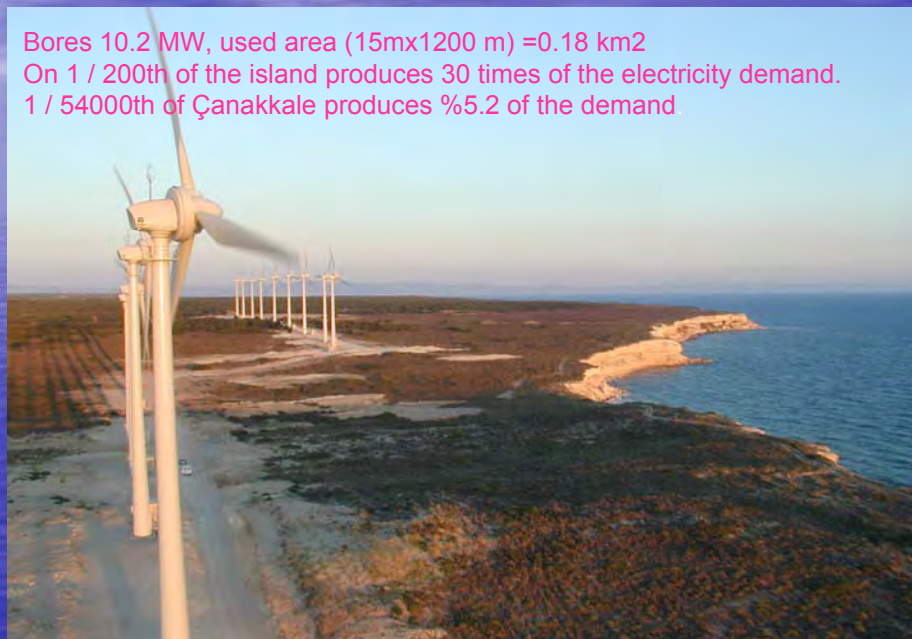
12 000 MW



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Bores 10.2 MW, used area (15mx1200 m) =0.18 km²
 On 1 / 200th of the island produces 30 times of the electricity demand.
 1 / 54000th of Çanakkale produces %5.2 of the demand

- TÜRKİYE
779,452
km²
- Çanakkale
9,737 km²
1/80th of
Turkey
- Bozcaada
36 km², 1
/270 of
Çanakkale

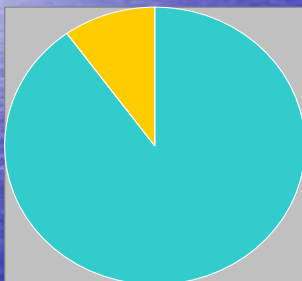


Electrical Network

- App. 5000MW wind farms can be integrated to the existing network
- Until efficient and economical energy storage system are developed

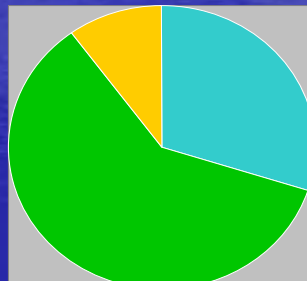
Cost break out

Wind



investment
fuel
operation

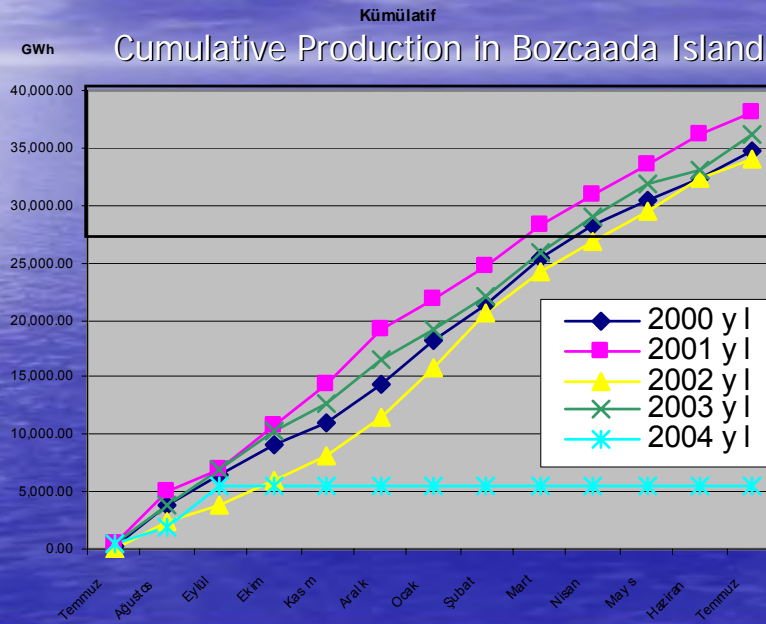
Natural Gas



investment
fuel
operation

Effects of High Investment and no fuel cost

- High employment
- Independent of oil price fluctuation
- Independent of foreign suppliers
- More dependent on investment environment and interest rates



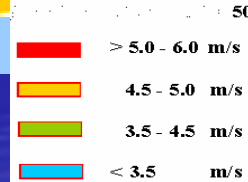


Wind Potential of Turkey The northwest Turkey, including the area around the Sea of Marmara and the western coast and southeastern Anatolia have been identified as most promising locations for wind power generation.



Technical Potential : 88.000 MW

Economic Potential : 10.000 MW



Electrical Energy Selling Prices

From State Electric Trade Company (TETAŞ)
 to the distribution companies ;

(Medium value included B.O.&B.O.T.)	2002	5,50 cent(USD)/kWh
	2004	6,00 cent(USD)/kWh
Industrial consumer price	2005	9,50 cent(USD)/kWh

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POWER PLANT TYPE	INSTALLED POWER MW	EÜAŞ MW	PRIVATE MW	CONT. PEAK LOAD %	PRODUCTION Mio kWh	SHARE IN PRODUCTION %
RIVER SMALL HYDRO	439	257	182	2,1	1980	1,5
WIND	19,2	-	19,2	-	44	0,0
GEOHERMAL	17,5	17,5	-	-	104	0,1
WASTE	10,0	-	10,0	-	24	0,0

Electricity Production in Turkey from the Renewable Energy Resources(2002)

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Wind Energy in Turkey total installed cap. 20MW

1	ALAÇATI,İZMİR	February 1998	1.7	DEMİRER HOLDİNG
2	ALAÇATI,İZMİR	November 1998	7.2	INTERWIND-GÜÇBİRLİĞİ
3	BOZCAADA ,ÇANAKKALE	June 2000	10.2	DEMİRER HOLDİNG
4	İSTANBUL ,HADIMKÖY	November 2003	1.2	DEMİRER HOLDİNG
	TOTAL		20	

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Renewable Energy Law of Turkey

- allows the wind produced electricity to be supplied to the grid
- Pays only the average market price of electricity purchase
- Provides conditions for implementation only in best wind potential sites
- Does not support PV Implementation and wind energy in less favourable sites
- Needs to be improved

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Renewable Energy Law, as passed by the Turkish Parliament on 10th May 2005

- Turkish Wind Energy Association (TÜREB)
www.ruzgarenerjibirliqi.org.tr
- The purpose of this law is to expand the utilization of renewable energy sources for generating electric energy, to benefit from these resources in a secure, economic and qualified manner, to increase the diversification of energy resources, to reduce greenhouse gas emissions, to assess waste products, to protect the environment and to develop the related manufacturing industries for realizing these objectives.

- c) Until the end of 2011, the applicable price for electricity to be purchased in pursuance with this Law is Turkey's average whole-selling price, as determined and published by EMRA for the year before.
- "The Average Wholesale Price of Electricity in Turkey" means the average of the wholesale prices of electricity, calculated by EMRA and applied annually in the country
- At the beginning of each year, the Council of Ministers is entitled to raise this price by 20%.

Hydro Power

Turkey is largely dependent on hydropower to meet its electricity needs and 40 percent of its total installed capacity is hydroelectric. The current total capacity of hydroelectric plants is 12.4 GW. This capacity is projected to rise to 13.9 GW in 2005 and to 18.8 GW in 2010.





Hydroelectric Potential of Turkey

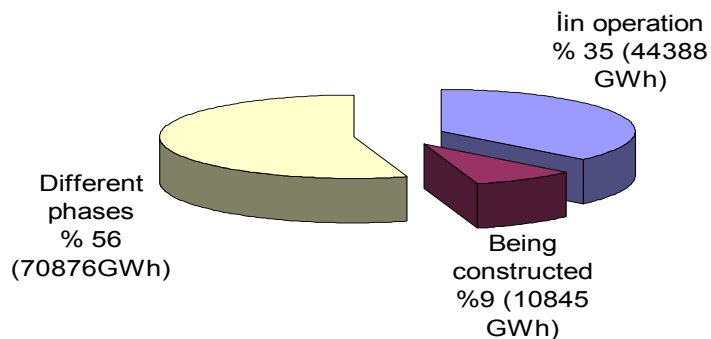
Gross potential : 433 billion kWh/year,

Technical potential : 216 billion kWh/year

Economic Potential : 126 billion kWh/year



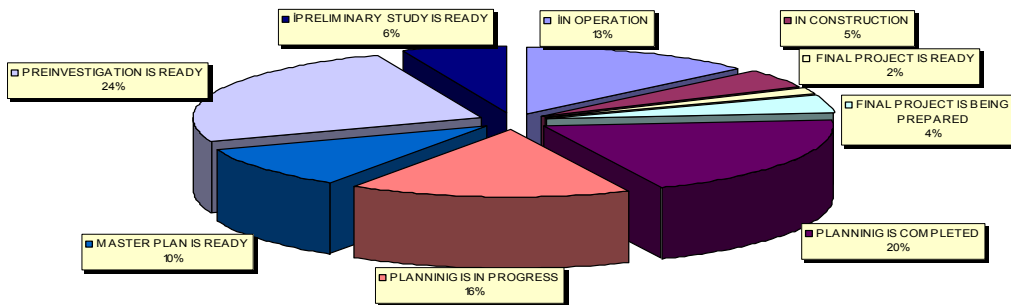
126 billion kWh/year economical hydroelectrical potential current phases



Share of Small Hydro is about 3 %



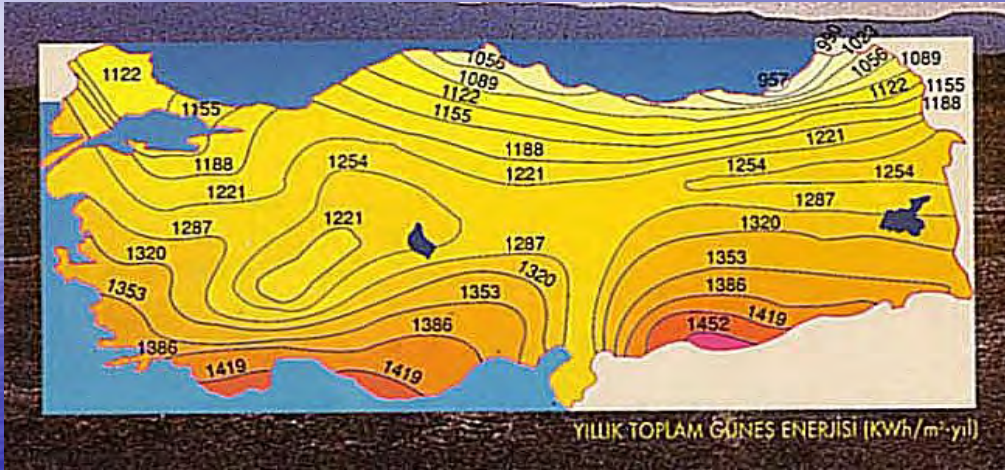
Hydroelectric Potential Distribution according to the current state of the projects (50 MW and smaller)



Solar Energy

- The energy produced in 2000 was 262 thousand toe. The energy produced with solar energy is less than 1 % of the national total energy production.
- Power generation by solar energy is not envisioned in the current Five-Year Development Plan because the government does not view it as cost-effective . In Turkey installed PV capacity is approximately 300 kW and used for powering communication stations, fire watch stations, lighthouses and motorway lighting.

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PV Applications in Turkey

- Off grid PV systems: When compared with diesel generators the PV systems pay back their first investment costs in 3 years.
- Grid connected applications requires support and encouragement
- Occupy an area of 8 m²/kWp

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Solar Thermal and solar PV Technical Potential in Turkey

Residences	Office and Service Buildings	Industrial Buildings	Total Building Surface
324 km ²	37 km ²	33 km ²	394 km ²

potential for PV Installed power is 25 625 MWp
 Annual energy production 32.671 GWh
 This shows that we can supply 26 % of the consumption of the year 2002 by PV systems

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Geothermal

The target for geothermal electricity generation by the year 2010 is 500 MWe. Turkey has an estimated 4,500 MW of geothermal power production potential. Current Turkish geothermal heating capacity is 820 MW. Some of the important geothermal fields of Turkey are Aydın-Germencik (200-232 °C), Denizli-Kizildere (200-242 °C), Çanakkale-Tuzla (173 °C), Aydın-Salavatlı (171 °C) and Kütahya-Simav (162 °C). It has been estimated that the Aydın-Germencik geothermal field would have 100 MWe power production capacity.



Türkiye'de neotektonik-volkanik etkililiğiyle jeotermal alanlar

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GEOHERMAL POTENTIAL MAP FOR TURKEY



Eris and Ozgur, 1994; Erisen et al., 1996; Mertoglu, 1998; Kocar and Eltez, 1998; Hepbasli and Ertoz, 1999 (Gunerhan, Kocar, Hepbasli, 2000)

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Geothermal Energy Use in Turkey

- Power: **18 MW** (Kizildere-Denizli, 1984). Projected to increase to 120 MW. Potential: **200 MW**
- Heating: **640 GWh/yr** for heating, greenhousing, etc.
- A **dry-ice plant** was built in 1986 near the geothermal plant. The plant has a capacity of 40,000 ton/year, using CO₂ from geothermal wells.
- Turkey has the **7th largest geothermal resources** in the world.
- **140 high-temperature geothermal resources** are identified by MTA. Most geothermal resources are **not utilized**.

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Geothermal Energy Use in Turkey: Current Use

- The **first space heating** system is a hotel in **Gonen** in 1964.
- The first **district heating system** was built again in **Gonen-Balikesir** in 1987 with a capacity of 16.2 MW_t (600 homes)
- The first geothermal **greenhouse** was a 4500 m² field in Denizli-Kizildere, completed in 1985.
- **52,000 homes** are heated by geothermal **Balcova-Izmir**: District heating system serves 7,500 residences
- **Gonen - Geothermal District Heating provides heat to 1600 residences, 109 businesses, and 54 washing facilities.**
- **Denizli, Aydin District Heating Systems are being planned.**
- After 1990, development of direct use increased steeply as **185%** during 1990-1995 and **173.4%** during 1995-1998.

Source: G. G. Gunerhan, G. Kocar, A. Hepbasli, 2000. "Geothermal Energy Utilisation In Turkey."

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Geothermal Energy Use in Turkey: Projected Use

- **140 suitable geothermal sites** in Western, Northwestern, and Central Turkey
- **30% of all heating** needs can be met by geothermal (up to 5 million residences)
- **31,500 MW_t** of geothermal heating potential (currently only 2% of potential is used).
- **4500 MW** of power potential (currently only 0.5% of potential is used).
- **500,000** residences by 2010
- **1,250,000** residences by 2020

(Source: Orhan Mertoglu, Geothermal Association of Turkey)

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Geothermal Electric Power Generation in Turkey

Plant Location	Year Built	Status	Type of Unit	Power Potential (MW _e)	Rated power (MW _e)	Annual Production (1998) (GWh/a)
Denizli-Kizildere	1984	Operates	SF, C	200	20	90
Aydin-Germencik	-	Planned	SF, B	100	25	-
Aydin -Salavatli	-	Planned	B or K	N/A	5	-

SF: Single flash; C: Condensing; B: Binary; UC: Under construction; K: Kalina; N/A: No data

Source: WEC-TNK, 1998; GRC Bulletin, 1998; Tufekcioglu, 1999 (Gunerhan, Kocar, Hepbasli, 2000)

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Current Situation of Geothermal District Heating Systems in Turkey:

Location	Number of residences Heated by Geothermal	Operation Date	Temperature of Geothermal Water (°C)	Investor
Dokuz Eylül Üniv. Campus+ Balçova +Narlı dere	16002	1983	137-60	Equal partnership of Governorship and Municipality Inc. (Dokuz Eylül University; Governorship+ Rectorate)
Gönen	3400	1987	80	Mainly Municipality INC.
Simav	5000	1991	137	Municipality
Kırşehir	1900	1994	57	Mainly Local Governorship+ Municipality INC.
Kızılcadamam	2500	1995	80	Mainly Municipality INC.
Afyon	4500	1996	95	Mainly Governorship + Municipality INC.
Kozaklı	1200	1996	90	Mainly Municipality INC.
Sarımsaklı	3200/5000	1998	70	Mainly Municipality INC.
Diyadin	400	1999	70	Mainly Governorship INC.
Salihli	4100/24000	2002	94	Municipality
Sarayköy	1500/5000	2002	140	Mainly Municipality INC.
Edremit	2000/7500	2003	60	Municipality + private sector INC.
Bigadiç	500/3000	2005	96	Municipality
Sarımsaklı	1600/2000/3000	2006	50,5	Governorship + Municipality+ (Mainly) Private Sector Inc.
Thermal Facility and nearly 1 million m ² Greenhouse Heating (Sarımsaklı, Dikili, Balçova, Simav etc.)				Governorship (Geothermal Field Inv.) + INC. (Greenhouse Inv.)



Comparison of Geothermal Utilization between 2000 and 2005 in Turkey;

Geothermal Utilization (Installed Capacity)		2000	2005	Increase (%)
Heating (Residences + Thermal Facilities)		392 MWt	635 MWt	62
Greenhouse Heating		101 MWt	192 MWt	90
Thermal Tourism		327 MWt	402 MWt	23
Total Non-Electrical Utilization		820 MWt	1229 MWt	50
Mineral recovery (Liquid CO₂ and dry ice)		120.000 t/y l	120.000 t/y l	-
Electricity Generation	Installed Capacity	20,4 MWe	20,4 MWe	-
	Production	90 GWh	94 GWh	4,4
Present springs and wells		3045 MWt	3524 MWt	16

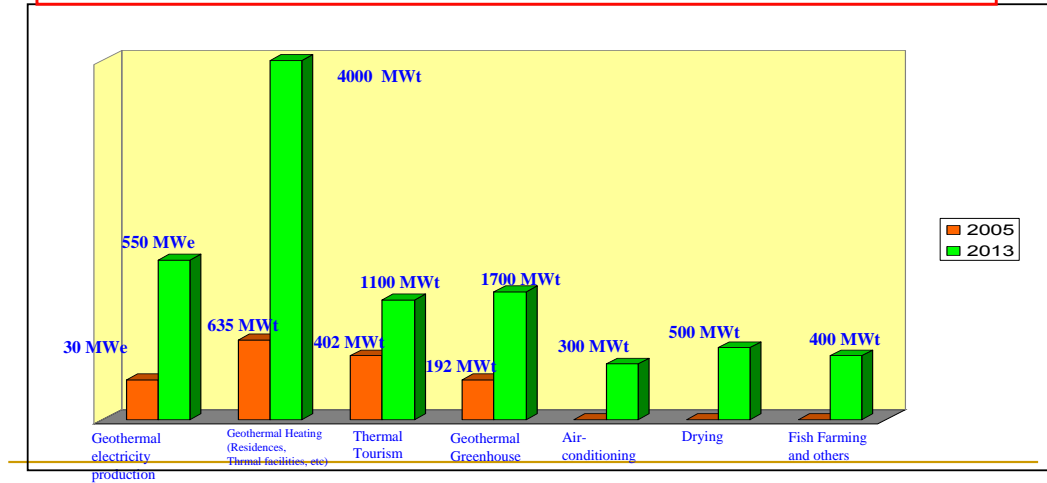
TOTAL GEOTHERMAL HEAT POTENTIAL OF TURKEY

31500 MWt* EQUALS TO

- = 5 Million residences heating or
- 150 Million m² greenhouse heating
- = More than 1 Million spas bed capacity
- = 9,3 Billion USD/year Fuel-Oil (30 Million tons/year)
- = 30 Billion m³/year natural gas

*State Planning Organisation, 8th 5 Year Development Plan, Geothermal Energy Report, 2001

**EXISTING GEOTHERMAL SITUATION IN TURKEY
 AND PROJECTIONS**



Energy Section Department of Mechanical Engineering Marmara University Faculty of Engineering					
Geothermal Application	2005	MW	2013 Projection	MW	
Electricity production		20MWe		550 MWe	4 bln. kWh/yr
District Heating	103.000 Res. Equiv.	635MWt	500.000 Res. Equiv.	4000 MWt	
Thermal Tourism (Balneology)	215 Thermal Fac.	402 MWt	400 Thermal Fac. Equiv.	1100 MWt	
Greenhouse heating	635.000 m2	192 MWt	5 mil. m2 (over.100.000 Tons product)	1700 MWt	
Cooling	-	-	50.000 Res.Equiv.	300 MWt	
Drying	-	-	500.000 tonnes/year	500 MWt	
Fish Farming + Other Applic.	-	-		400 MWt	
Total direct use		1229MWt		8000 MWt	35.040.000 MWth/yr
Total geothermal direct use (non-electric) 2013 projection fuel-oil Equivalence = 4 bln. USD/year					3,88 mil tons/yr
Avoided CO2 emission by total geothermal utilization in year 2013 (550 MWe + 8000 MWt)					10 mil. tons/yr

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	2005	2013
Geothermal CO2 production (brutto)	120.000 tons/year	200.000 tons/year

	2005	2013
Employment (Direct and Indirect)	40.000 persons	200.000 persons

	2005	2013
Export (greenhouse)	15 Million USD	250 Million USD

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The required investment amounts for fulfilling the Turkish Prime Ministry SPO 9th development plan (2007 – 2013) geothermal electricity production, heating (residences, thermal facilities etc.), greenhouse heating, drying, thermal tourism application targets

Geothermal application	2013 targets	Additional Investment required (USD) (until 2013)
Electricity production	550 MWe (4 Billion kWh)	1 billion USD
Heating (residences, thermal facilities etc.)	4000 MWt (500.000 res.Equiv.)	800 million USD
Greenhouse heating	1700 MWt (5 million m2)	350 million USD (wells incl.l)
Drying	500.000 tons/year	100 million USD
Thermal Tourism (Baln.)	400 thermal facility equiv.	800 million USD
Cooling	50.000 res. Equiv.	200 million USD
Total		3,25 billion USD

Biomass Energy

Wood, plant, and animal waste have been used for heating and cooking in Turkey. In recent years, Turkey's forestry sector has emphasized the use of wood from forests managed in a sustainable manner as an alternative to using fossil fuels. This approach seeks widespread utilization of forestry resources through forest development, by establishing plantations or silviculture projects and energy forests. The Ministry of Forestry's assessment studies show that, for only oak species, 4 million hectares (ha) of land are suitable for the development of energy forests.

Forests of Turkey	Total Forestland (ha)	Normal Forests (ha)	Degraded Forests (ha)	Normal Coppice-land (ha)	Degraded Coppice-land (ha)
State-owned	20,744,765.8	8,228,336.9	6,180,138.0	1,784,164.3	4,552,126.6
Private	18,481.9	9,416.1	448.8	5,650.9	2,966.1
Total	20,763,247.7	8,237,753.0	6,180,586.8	1,789,815.2	4,555,092.7

Source: Ministry of Forestry, Department of Statistics, 2002.

Wave Energy

- **Offshore Resource:** The total average wave energy resource in deep water was evaluated by integrating the wave power along the coastline around Turkey. Only one series of mainly from small scale converters can harness totally **10 TWh/year** with an annual wave power between 4 and 17 kW/m coming from a western direction.
- **Nearshore Resource:** The Turkish shore resource will be estimated much less economical one in similar manner than the deep-water resource. However, wave energy breakwaters are likely to be acceptable only at existing ports and partially generating electricity for local usage.
- **Shoreline Resource :** The shoreline resources are very site specific, with some areas being unsuitable for wave energy devices (e.g. shorelines of historic, scientific, ecological or visual importance). Again, the resource will be too low to invest for big scale converters but small-scale converters can be convenient for protecting some of the coastal structures and for meeting some portion of the local electricity need.

REFERENCES

1. Christian Johannes, General Manager Reconsult
2. Erol Demirer, General Manager Demirer Holding



Latest developments on RES policy, implementation and planning in **Estonia**

**Workshop “Data Gathering on Renewable Energies for New
Member States and Candidate Countries”**

jointly organised by DG JRC IES RE-Unit and the Energy Institute
Hrvoje Pozar, Cavtat-Dubrovnik, Croatia, 15-16 Nov 2006

Prof., Ph.D. Peeter Raesaar
Tallinn University of Technology
Department of Electrical Power Engineering

peeter.raesaar@ttu.ee



Estonia



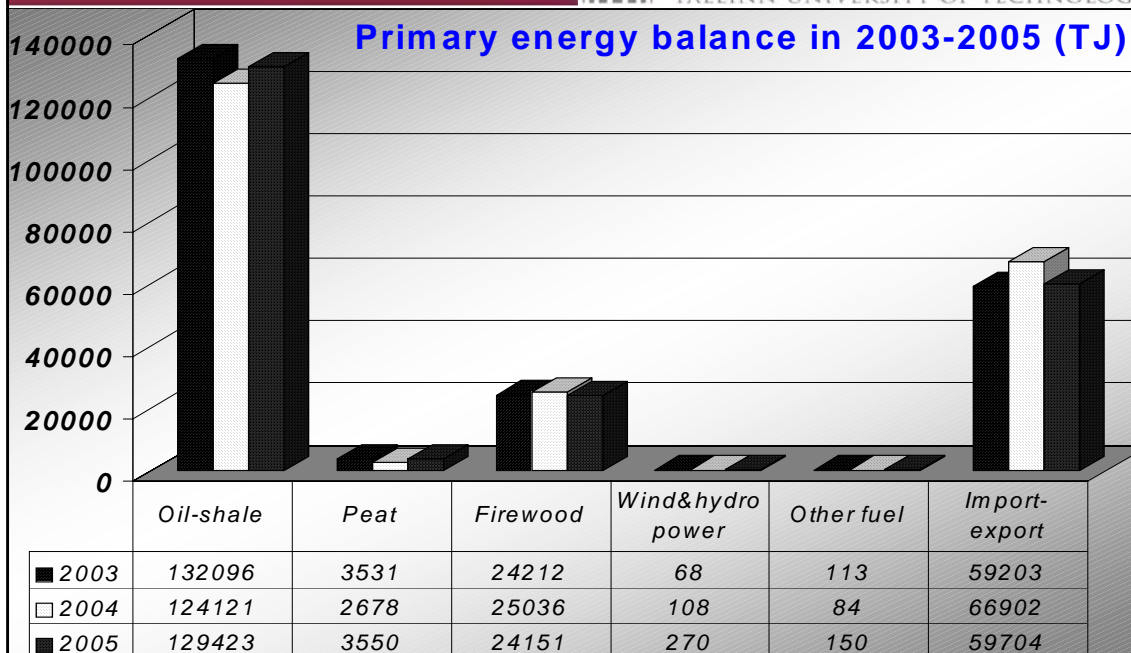
- ❑ Total area 45 227 km²
- ❑ 1 371 433 million inhabitants (01.01.2006)
- ❑ Capital: Tallinn – 400,4 thousand inhabitants
- ❑ Mean annual temperature 4.2-7.0 °C
- ❑ The main domestic fuels - oil shale, peat and wood

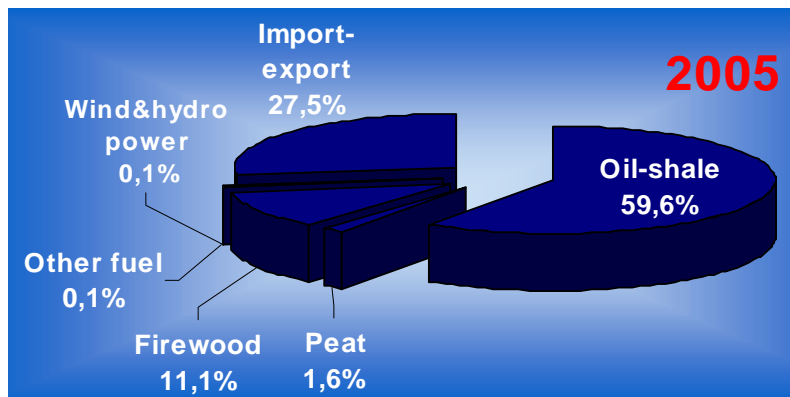
Some Key Facts

	2004	2005	Annual change
GDP*	8,21 billion €	9,07 billion €	+ 10,5 %
GDP per capita**	6948,4 €	7800,0 €	+ 12,3 %
Primary energy supply	216,9 PJ	212,1 PJ	- 2,21 %
Energy efficiency of economy	21,0 €/GJ	25,1 €/GJ	19,5 %
Electrification Rate	99,99%	99,99%	-
Final energy consumption	112460 TJ	113485 TJ	+ 0,91 %
Heat consumption	31921 TJ	32217 TJ	+ 0,93 %
Electricity consumption	6326 GWh	6403 GWh	+ 1,22 %

* at 2000 constant prices

** at current prices





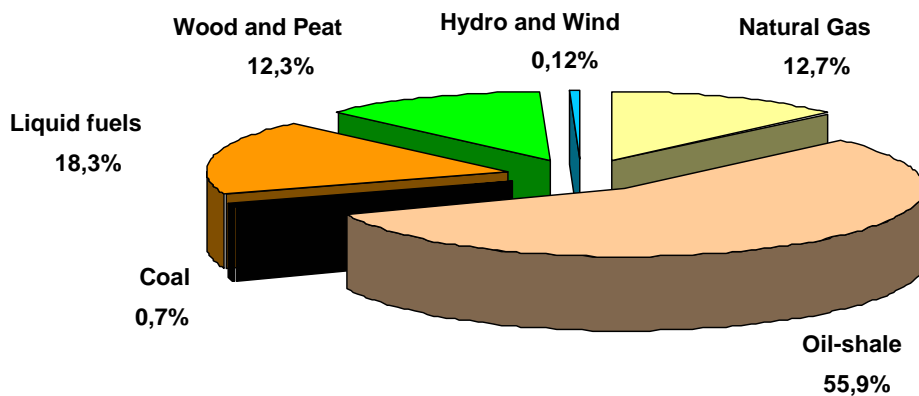
□ Share of domestic fuels has remained on the level of 65...70% during the last ten years



□ The main domestic fuel - oil shale

- covers about an half of the primary energy supply
- reserves 600 Mt
- mining about 13 Mt/a
- all consumed in Estonia

Primary Energy Balance in 2005



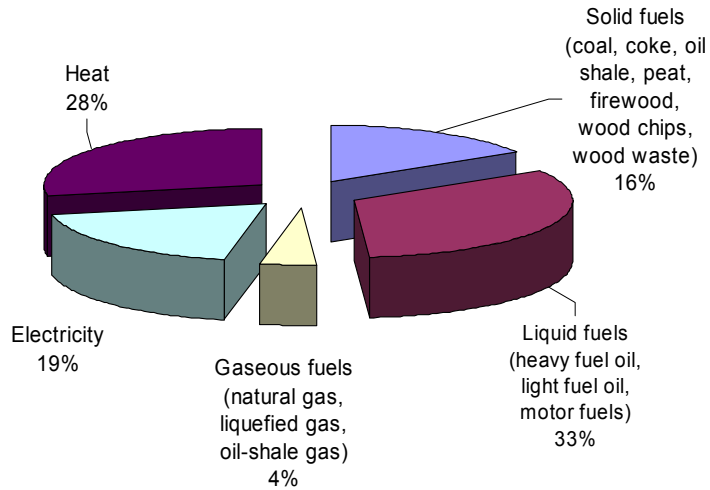
2005: TPES 212,1 PJ = 58,9 TWh = 5.07 Mtoe

Share of domestic resources: 68%

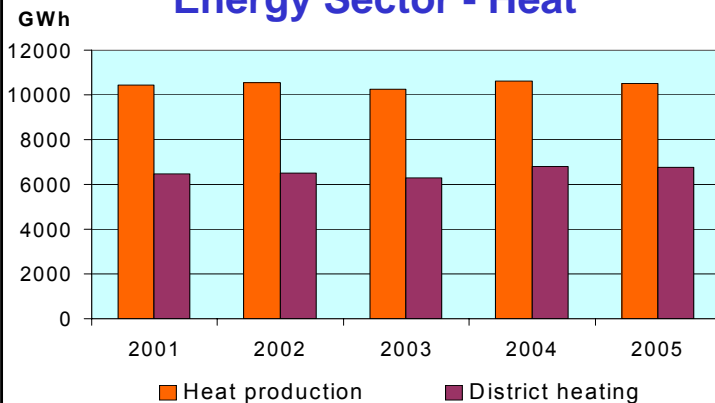
Share of RES: 10,9 %, the share of wood fuel still prevails

Final energy consumption in 2005

(excluding consumption of fuels for non-energy use, losses in transport, preservation and distribution)



Energy Sector - Heat



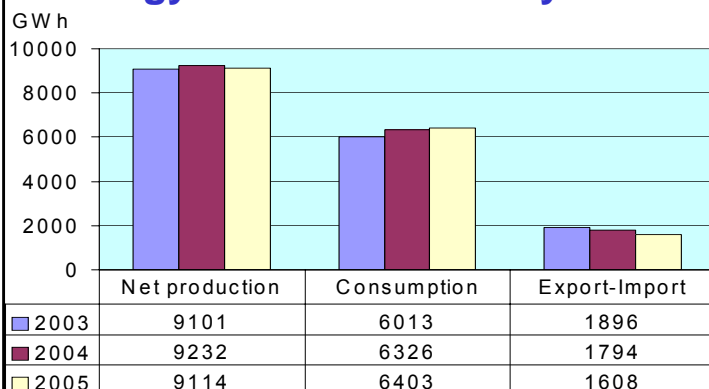
- production:
 - in 2004 - 10 617 GWh
 - in 2005 - 10 514 GWh
 - 65 % in boilerhouses
3 924 boilers
 - 35 % in CHP plants
37 turbines

□ District heating covers ca 70% of total heat need in buildings

□ From RES: 2157 GWh in 2004 → 2609 GWh in 2005

- wood - 1862 GWh in 2004 → 1922 GWh in 2005
- wood residues, biogas, black liquor – 295 GWh → 687 GWh

Energy Sector - Electricity



More than 90% - in two Narva Power Plants using domestic oil-shale



Installed capacities in 2005 →

	Capacity, MW	Fuel
Narva Power Plants	2142	Oil-shale
Iru Power plant	171	Natural gas
CHP plants, total	85	Natural gas, oil-shale, wood, wood residues
Plants on RES	35	Wind, hydro, biogas
TOTAL	2433	

Energy Sector - CHP

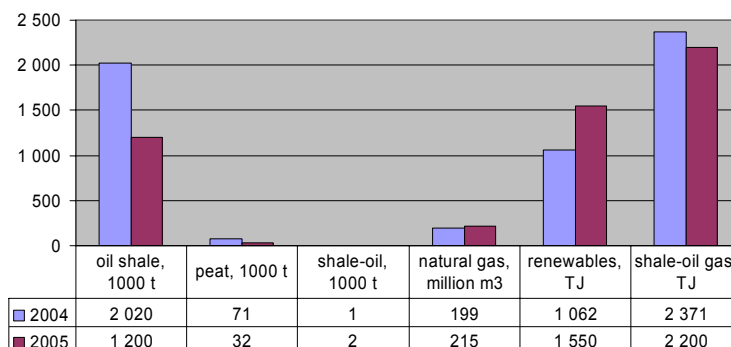
17 CHP plants with 37 units are in operation




in 2005:

- electricity generation – 1038 GWh → 11,4 % from the total generation
- heat production – 3182 GWh → 30,3 % from the total production

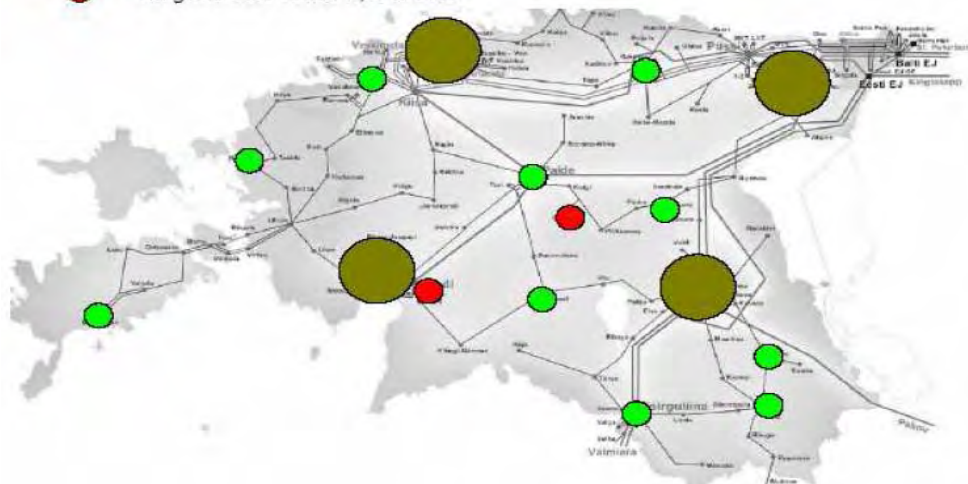


Renewables: wood chips, biogas, black liquor



-  - 20 MW / 600 GWh/a
-  - 3 MW / 90 GWh/a
-  - largest saw mills 1,5-3 MW

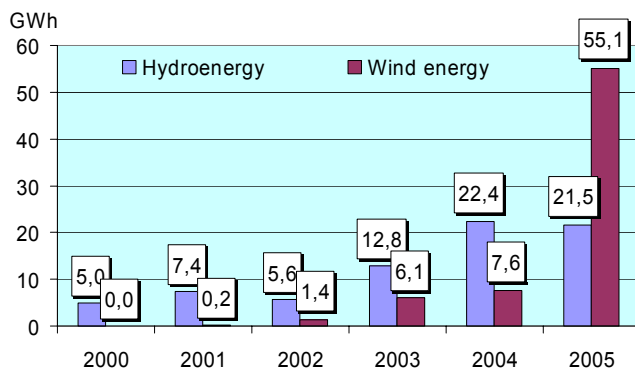
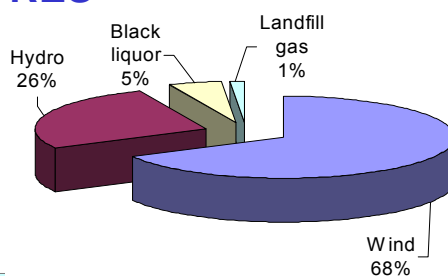
Possible new cogeneration plants



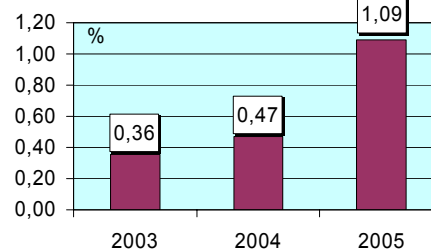
Energy Sector – Electricity from RES

□ In 2005 production from RES 81.8 GWh:

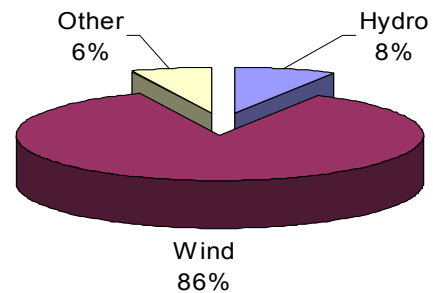
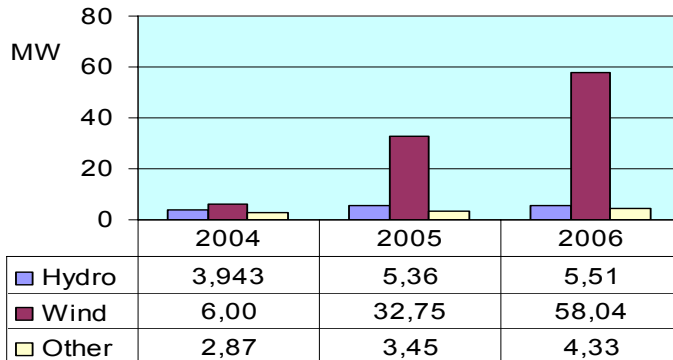
- wind – 55,1 GWh
- hydro – 21,5 GWh
- black liquor – 4,1 GWh
- landfill gas – 1,1 GWh



□ Share of electricity from RES:



Energy Sector – Capacities of plants on RES

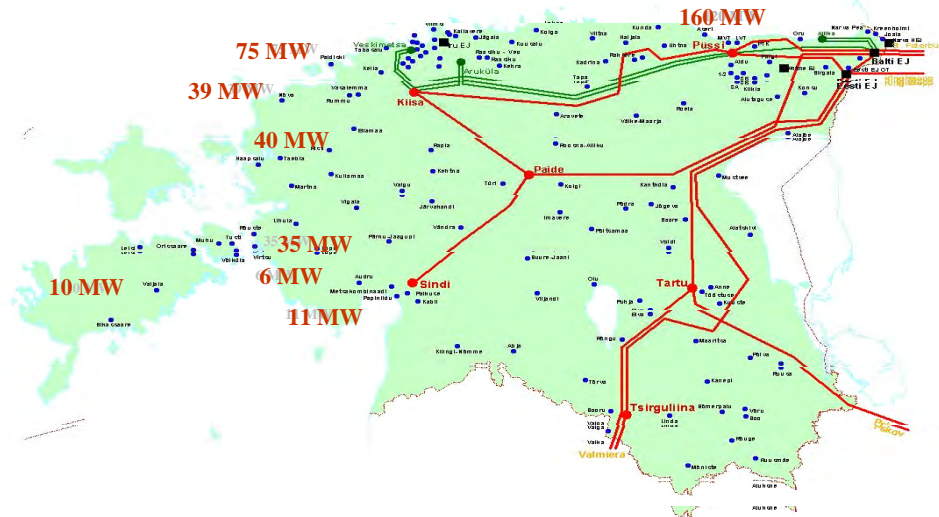


RES potentials: wind

- ❑ One of the most important RES – up to 3 TWh/a
- ❑ Most rapidly developing area:
 - ❑ 32,75 MW → 58,04 MW; 55,1 GWh → 135 GWh
- ❑ New windfarms: Pakri 18,75 MW, Rõuste 8 MW, Esivere 8 MW, Tüükri 24 MW
- ❑ Planned: Pakri II 50 MW, Türisalu 21 MW, etc.
- ❑ Applications – for 660 MW
- ❑ Currently under development: 13 projects 300-350 MW
- ❑ Technical restrictions:
 - Integrating capacity of the present grid – 400 MW
 - Lack of quickly starting-up generating units to compensate wind power fluctuations
 - Use of the off-shore resource is hampered by icing problems



Main new potential windfarms and the main grid



□ Integrating capacity of the grid ~ 400 MW (0,91 TWh/a)

RES potentials: Biomass



- The most prospective resource, particularly for heat production and local co-generation
- Biomass gave almost two thirds (65,4%) of renewables based energy
- Forests - about 50% of territory
 - Wood covers nearly 75% of total energy need in households
 - Heat production in 2005 - 2 TWh (~ 20%)
 - At the real cutting rate of 10,8 Mm³/a the firewood potential ~ 5,7 TWh/a
 - Logging waste resource ~1 TWh/a

□ Obstacle – high price due to high export demand of woodchips to Scandinavian countries

RES potentials: Biomass



- ❑ A prospective resource - cultivation of energy crops on fallow arable lands (400 000 ha)

- Rape – annual sown area up to 80 000 ha ~ 50 000 t biodiesel
- Alternatives – white mustard, oil flax
- Cereals – possible production 140-150 000 t/a of bioethanol
- Energy forest – osier, long leaved willow, grey alder
- Energy hay – reed grass, goat pea, etc.



Total annual potential ~ 10 TWh

RES potentials: Biomass

- ❑ Straw – at present 0,4 – 0,6 TWh/y, in future - 0,8–1,0 TWh/a
- ❑ Biogas
 - from manure - 0,4-0,5 TWh/a
in 2005 a new biogas plant – unexampled in East Europe
 - landfill gas - over 0,1 TWh/a
at present 2 plants in operation (about 30 GWh/a)
- ❑ Reed and bulrush - about 0,5 TWh/a
- ❑ Black liquor – 0,2 TWh/a

Total biomass resource – up to 18 TWh/a

- ❑ Peat fuels 8,3 TWh/a



RES potentials: Small hydro

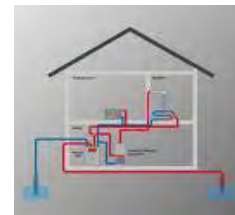
- ❑ Technical potential is moderate ~ 40 MW, ~ 0,3 TWh/a
- ❑ At present: 35 SHP plants (10...1100 kW), a number of micro plants (<10 kW)
- ❑ Total capacity 5.4 MW (21,5 GWh)
- ❑ In 2005 – restored Keila-Joa plant 365 kW
- ❑ In nearest future – 4 new plants: ~ 2 MW; ~ 10 GWh/a
- ❑ Forecast: about 8 MW (~ 50 GWh) by 2010
- ❑ Main restrictions – environmental aspects (fish protection, waterfalls)



RES potentials: other sources

❑ Geothermal energy

- Nearly 3500 heat pumps, total heat production ca 75 GWh
- Over 1300 heat pumps were installed in 2005



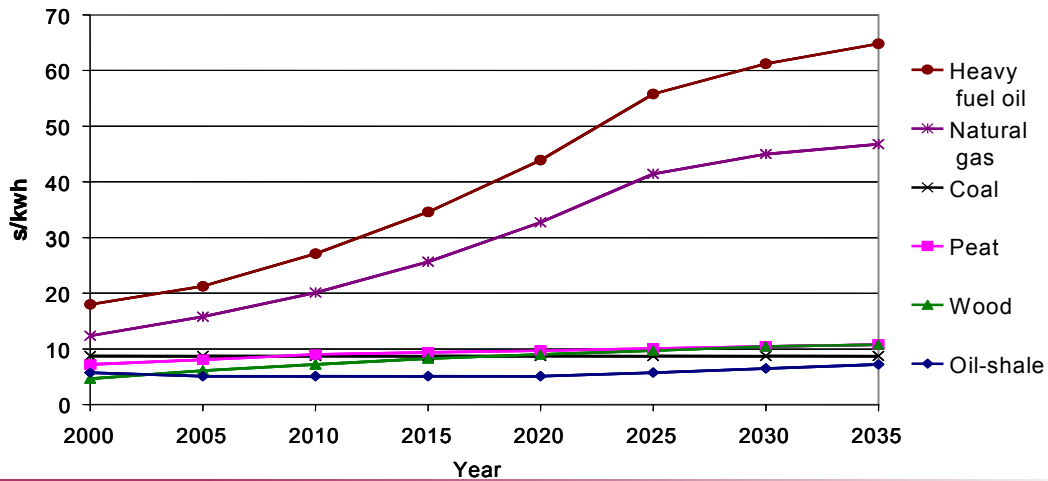
❑ Solar energy

- Annual technical resource – 150-600 GWh/a; 82% from April to September
- 36 small PV installations for lighthouses supply
- Two schools are equipped with solar batteries



Fuel prices

- In 2000–2005 prices of almost all fuels have grown
- In 2005 from the domestic fuels the prices of oil shale, firewood and peat briquette grew most



National strategic targets

- **Increase in the use of renewables** - indicative targets:

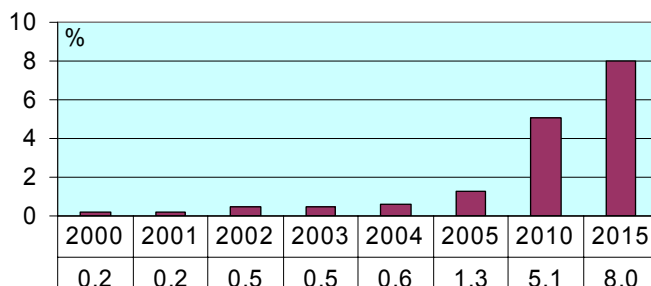
- 12 % of gross national energy consumption by 2010

The target is already achieved due to high share of wood and wood waste for heat production

- 5,1% of gross national electricity consumption by 2010 and 8 % by 2015

Share of renewable energy to total electricity consumption →

- Main emphasise on the biofuels based CHP generation and windpower



National strategic targets

- Increase in the use of CHP-s**
 - Indicative objective 20% of electricity from CHP plants by 2020 (at present 12-13%)
- Efficiency Improvements:**
 - Primary Energy Consumption shall not exceed until 2010 the level of 2003
- Self-sufficiency** - ability to cover domestic electricity needs any time by producers located in Estonia

Promotion of use of RES

- Purchasing obligation - feed-in tariff 5.2 €cents/kWh
- Promotion of wider application of CHP technologies
- Excise tax exemption for biofuels
- CO₂ taxation
- Support to energy projects linked with the use of RES
- Participation in EU energy-related programmes and projects
- A number of non-profit organizations for RES promotion



LATEST DEVELOPMENTS ON RES POLICY, IMPLEMENTATION AND PLANNING IN LITHUANIA

Vladislovas Katinas
Renewable Energy Unit
Lithuanian Energy Institute, Lithuania



Status of RES Policy in LITHUANIA

The National Energy Strategy of Lithuania.

**The Ignalina nuclear plant (INP) of capacity 2600 MW must be closed
(It is requirement of EU).**

Already the first unit (capacity 1300MW) of INP is closed (in 2005).

The second unit (capacity 1300 MW) will be closed in 2009.

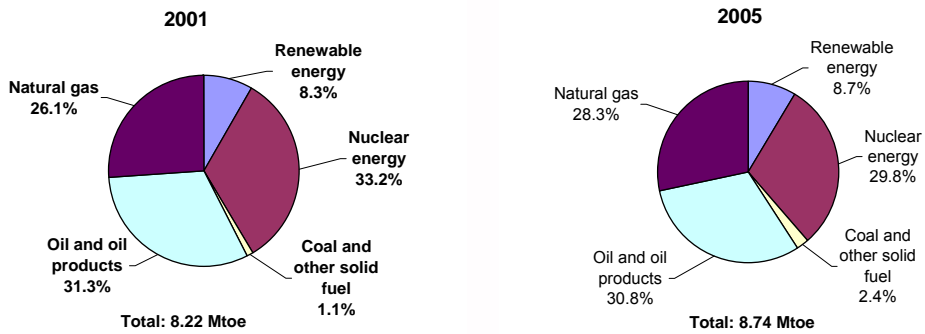
**After that, the Lithuanian Thermal Power Plant (capacity 1800 MW) will become the major
source of electricity.**

For this reason there will be increased the use of RES in Lithuania



Status of RES Policy in LITHUANIA

Energy gross inland consumption structure in Lithuania



Status of RES Policy in LITHUANIA

In Lithuania there are used such kinds of RE, which are traditional for our country such as

- firewood;
- wood waste;
- straw;
- hydro energy.

Biofuels

Two years ago in Lithuania the biofuel was begun to produce and use

(The requirement of the EU Directive 2003/30/EC on promotion of the use biofuels for transport)

The policy of Lithuania in the area of biofuels is:

Up to 2010 biofuels should comprise not less than 5.75% of fuel existing in the market.

In Lithuania there were erected some plants for production of biofuels as well as

- Bioethanol and
- Biodiesel.



Status of RES Policy in LITHUANIA

Other kinds of RES

There are erected pilot projects of

- wind energy;
- biogas;
- geothermal energy;
- solar energy and other ones.

In Lithuania there are most popular such projects as well as:

- hydro energy,
- plants of combustion biomass, and
- in last time wind energy.

In Lithuania RE is used for production heat and electricity.



SUPPORT MEASURES FOR RES USE IN LITHUANIA

According to legislation requirement the companies of electricity supply network must:

1. Purchase the electricity produced from RES in Lithuania.
(It is possible to realize not exceeding of the established government quota).

1.1. There is fix purchase process according to quata up to 2010 years or sometimes for longer time. There is such price for:

- Wind energy - 22 ct LTL/kWh (6.37 ctEuro/kWh);
- Hydro energy – 20 ct LTL/kWh (Capacity of hydro power plants is less as 10 MW);
- Bioenergy – 20 ct LTL/kWh (5.79 ctEuro/kWh).

1.2. Without quota for wind turbine capacity less as 250 kW
Later than 2010 year there will be market conditions.
(1ct = 0.01 LTL, 1EURO = 3.45 LTL)

Wind Turbines

Only in 2004 the first wind turbine capacity 600 kW was erected in Lithuania.

In 2006 the first wind park of 8 turbines capacity 2 MW each was erected and connected to electricity network.

According to government resolution till 2010 in Lithuania there will be erected 200 MW total capacity of wind turbines.



SUPPORT MEASURES OF RES IN LITHUANIA

Hydro energy

In Lithuania there are large and small hydro power plants (HPP)

Large HPP (capacity more as 10MW):

Kaunas HPP

Total capacity 105 MW;

Production in 2005 384.6 GWh.

Small HPP (capacity less as 10MW)

In 2005

Number: 77

Capacity 24.8 MW

Production 66.1 GWh

Biogas

In Lithuania there are some biogas pilot cogeneration units for the production heat and electricity. They are:

Company "Vycia" in Kaunas

1 unit capacity 185 kWel./300 kWheat

Waste Water Treatment Plant in Utena

1 unit capacity 275 kWel./440 kWheat

In JSC "Rokiskio suris" in Rokiskis.

2 units 165 kWel./264 kWheat



SUPPORT MEASURES OF RES IN LITHUANIA

The National Energy Strategy establishes a strategic

(It approved by Seimas of the Republic of Lithuania).

According to this Strategy the use of RES in Lithuania would increase up 12 % in the primary energy balance by 2010.

With regard to the requirements of the European Parliament and Council Directive 2001/77/EC "Regarding promotion of electricity production from RES"

In Lithuania there is the national target to produce 7% of electricity from RES by 2010.

In 1992 Lithuania together with 154 other countries has signed

The United Nations (UN) Framework Convention on Climate Change (FCCC) in Rio de Janeiro and

Others documents compliant with EU environment policy.

Lithuanian Parliament ratified the Convention in 1995 and

The Lithuanian Government approved FCCC National Programme in 1996. The major goals of Lithuanian government are:

- to reduce the import of energy resources,
- to reduce the climate change impact,
- to cut the CO₂ emissions as well as address other environmental issues.



SUPPORT MEASURES OF RES IN LITHUANIA

National Energy Efficiency Programme,

This is Special Programme as financing instrument for implementation of actions related to energy saving and utilisation of local and renewable energy sources.

There are such main goals of the programme:

1. Developing, revising and updating studies and programmes for utilization of local, renewable and waste energy resources and organizing their implementation.
2. Analyzing and assessing the implemented projects on utilization of local and renewable energy resources.
3. Implementing demonstrational solar and wind energy projects and continuing implementation of other projects on utilization of RES
4. Developing methods and schemes for collecting wood residue and straw for fuel, evaluating and implementing the methods and schemes.
5. Producing equipment that uses local and renewable energy resources while providing necessary assistance to the companies producing the equipment

A comprehensive policy on alternative energy was formulated during ten years (1990 – 2000).

A strategy to promote the use of alternative energy sources like biomass, small hydropower, biogas, wind energy, etc have been adopted.

The National Energy Strategy is renewed every five year.



LEGISLATION BASE

The major legal acts relevant to local and renewable energy sources (RES) have been selected and revised. These acts include:

- National Energy Strategy,
- Law on Energy,
- Law on Electricity,
- Law on Biofuel, Biofuels for Transport and Bio-oils
- Law on Heat, and
- others.

Large cluster of environmental acts.

1. The 21 January 1992 Law No. I-2223 (1996, 1997, 2000, 2001) of the Republic of Lithuania "On Environmental Protection";
2. The 4 November 1999 Law No. VIII-1392 of the Republic of Lithuania "On Protection of Air";
3. The 16 August 1996 Law No. I-1495 (amended in 2000) of the Republic of Lithuania "On Environmental Impact Assessment of Planned Economic Activities";
4. Ministry's of Environment Order No 387 on Setting Rules on Natural Resources Usage, Permitting and Setting Standards for the Pollutants of 30 11 1999 (LAND 32 - 99;
5. The 22 November 1994 Law No I-671(amended in 2001) of the Republic of Lithuania "On Forests";
6. The 13 May 1999 Law No. VIII-1183 (amended in 200, 2002) of the Republic of Lithuania "On Taxes for Pollution of the Environment";

and other ones.



SUPPORT MEASURES OF RES IN LITHUANIA

Table 1. Overview of Lithuanian renewable energy policy

NAME OF POLICY	POLICY TYPE	RENEWABLE ENERGY	DATE	LEVEL OF ACTION
Law on Energy	Promotion	All renewables	May 2002	National
Law on Electricity	Promotion	All renewables	July 2000	National
Law on Heat	Promotion	All renewables	May 2003	National
Law on Biofuels and Biooils	Promotion	Biomass	May 2000	National
National Energy Strategy	Targets, opportunities, actions	All renewables	Effective from October, 2002	National
National Energy Efficiency Programme	Implementation demonstration	All renewables	Effective from 2001 to 2005	National
Law on Monitoring of State Aid to Undertakings	Environmental; grants	All renewables	Effective From May, 2000	National, regional
Eco-Plants Feed-In Tariffs	Feed-in	small hydro, biomass, wind	Effective From February 2002	National
Public Service obligations	Purchase (heat, electricity); competition (heat)	All renewables	Effective from 2002 (electricity); from 2003 (heat)	National
Renewable Energy Targets	Support of connection-to-grid cost	wind, small hydro, biomass, solar photovoltaic, waste	Effective January 2004	National



RENEWABLE ENERGY RESOURCES

Referring to studies made by local and foreign specialists, the feasible potential of RES and local energy sources was established. Prospects for utilization of these resources for energy production was evaluated.

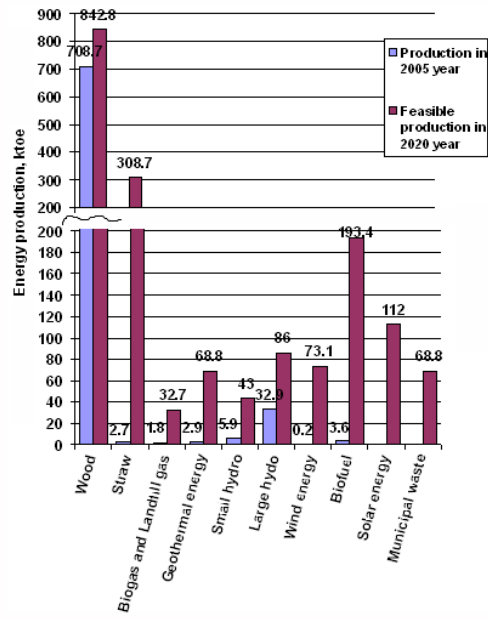
Table 1. Energy gross inland consumption and prospects of utilization using of RES

Sort of RE sources	Gross consumption Thous. t of oil equivalent					Prospects of utilization Thous.t. of oil equivalent	
	2001	2002	2003	2004	2005	2010	2020
Firewood and wood waste	654.4	659.3	672.3	694.7	708.7	817	842.8
Agriculture waste (straw)	-	2.9	3.8	3.9	2.7	43	308.7
Bioethanol (used to mix with gasoline)	-	-	-	0.1	0.8	20.5	71
Biodiesel (methyl-ester)	-	-	-	0.7	2.8	35.2	122.4
Biogas	-	1.5	1.8	1.6	1.8	12	24.1
Landfill gas	-	-	-	-	-	-	8.6
Wind energy	-	-	-	0.1	0.2	23.9	73.1
Geothermal energy	-	9.5	3.0	2.9	2.9	9.5	68.8
Small HPP	3.5	3.1	3.5	5.3	5.9	11.5	43
Large HPP	24.5	27.3	24.5	30.9	32.9	28	86
Solar energy*	-	-	-	-	-	-	112
Municipal waste	-	-	-	-	-	-	68.8
Total	682.4	703.6	708.9	740.2	758.7	1000.6	1829.2
Gross inland consumption of total primary energy	8222.1	8783.2	9164.7	9284.0	8737.6	9200	9400

* There are pilot equipments
HPP id Hydro Power Plant



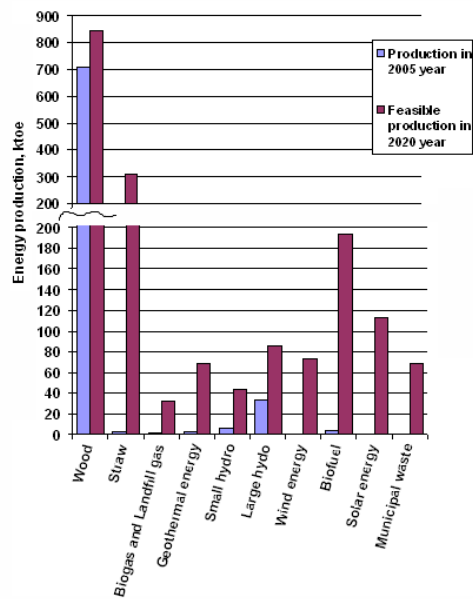
RENEWABLE ENERGY RESOURCES



Renewable energy production breakdown by source and feasible production using total potential RES for future utilization in 2020.



RENEWABLE ENERGY RESOURCES



Renewable energy production breakdown by source and feasible production using total potential RES for future utilization in 2020.



RENEWABLE ENERGY RESOURCES

Table 2. Wood resources for production of energy in Lithuania.

Short description of country		
1.1 population	[mill]	3.5
1.2 area	[ha]	6,530,000
1.2 forested area	[ha]	2,045,300
1.4 energy plantation area	[ha]	About 300
2. Wood fuel for energy production potential		
2.1 wood	[m ³ /y]	Total potential of wood felling (2020) – 7.4 million m ³ solid volume; Total potential of wood for energy (2010) – 5.15 million m ³ solid volume.
2.2 energy plants	[m ³ /y]	no data
3. Estimated installed capacity		
3.1 boilers of capacity 10 – 20	[kW]	No data (initial stage)a
3.2 boilers of capacity 20 –1000	[kW]	13,380 kW installed in 23 boiler-houses up 2003, wood waste only
3.3 boilers of capacity > 1000	[kW]	237,720 kW installed in 44 boiler-houses up 2003, wood waste only
4. Annual wood production		
4.1 wood chips	[t/y]	525,000 (20 % content of moisture) equivalent to 1.0 million m ³ solid volume
4.2 wooden logs	[t/y]	2,900,000 (40 % content of moisture) equivalent to 4.2 million m ³ solid volume
4.3 energy plant chips	[t/y]	No data
4.4 industrial wood waste	[t/y]	813,000 (20 % content of moisture) equivalent to 1.55 million m ³ solid volume
5. Share of wood energy in country energy balance in 2005	[%]	8.1



STATUS OF THE IMPLEMENTATION OF THE RES TECHNOLOGIES

Market problems:

The market for wood chips and other wood residues is growing.
The same is characteristic to straw.

The price of wood waste is expected to rise.

The probable import of cheaper wood chips from Belarus is deemed as stop the growth of price.

The investment to wood waste burning technologies is rather large and makes even the greater impact on utilisation of wood waste as price of fuel;

In Lithuania there is no good conditions for development wind energy, there are big environment restrictions for construction wind parks, also there must be used big funding for the reconstruction of the electricity network. The threshold is 200 MW capacities of erected wind turbines up to 2010 year and 500 MW up to 2020.

The real potential of hydro energy is reduced according to the environment requirements. In this moment the construction of the large HPP on big rivers is forbidden and the best small rivers for hydro energy are included into the protected environment zones.



CONCLUSIONS

The most efforts in Lithuania were aimed at developing biomass (wood, chips, wood waste, straw, biogas) and small hydro projects and their subsequent implementation. In 2005 the total capacity of installed wood-chip-fuelled boilers reached above 450 MW. No serious obstacles can be seen for extension of wood fuel usage. Prices of fuel market depend on local conditions as well as of the number fuel consumers, capacity of installed of the wood burning boilers, etc. There is created local industry for production biomass combustion equipment.

Electricity production from local and RE sources is based on hydro energy. Lithuania has one large (105 MW) and a lot of small capacity (less as 10 MW) hydro plants. Installed total capacity of small hydro plants is above 24.8 MW.

There is only initial stage for production electricity in cogeneration utilize from biomass, biogas and in wind parks.

In this moment according to Lithuanian government decision is done big progress for the installation of wind turbine. Till 2010 installed capacity of wind parks will encompass 200 MW.

The structural analysis of usage biomass shows that it is used mainly for heating energy production. At last time the biomass is begun to use into CHP for production of heat and electricity. In 2006 the reconstruction of Vilnius CHP-2 will be finished. There will be erected capacities
 $12 \text{ MW}_{\text{el}} / 36 \text{ MW}_{\text{heat}}$

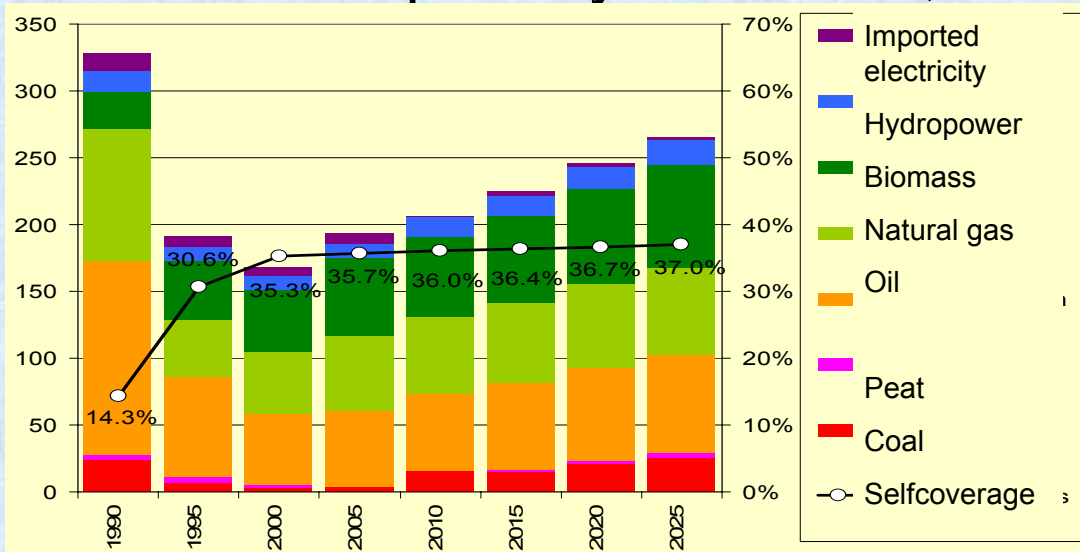
Latest Developments on RES Policy, Implementation and Planning in Latvia

**Dr. *Dagnija Blumberga*, professor
Director of Institute of Energy Systems and
Environment
Riga Technical University**

Actors involved

- **Ministries**
 - Ministry of Economy
 - Ministry of Environment
 - Ministry of Regional Development and self-governments
- **Agencies**
 - Latvian Investment and Development Agency
 - Latvian Environmental Investment Fund
 - Latvian Environmental Protection Fund
- **NGOs**

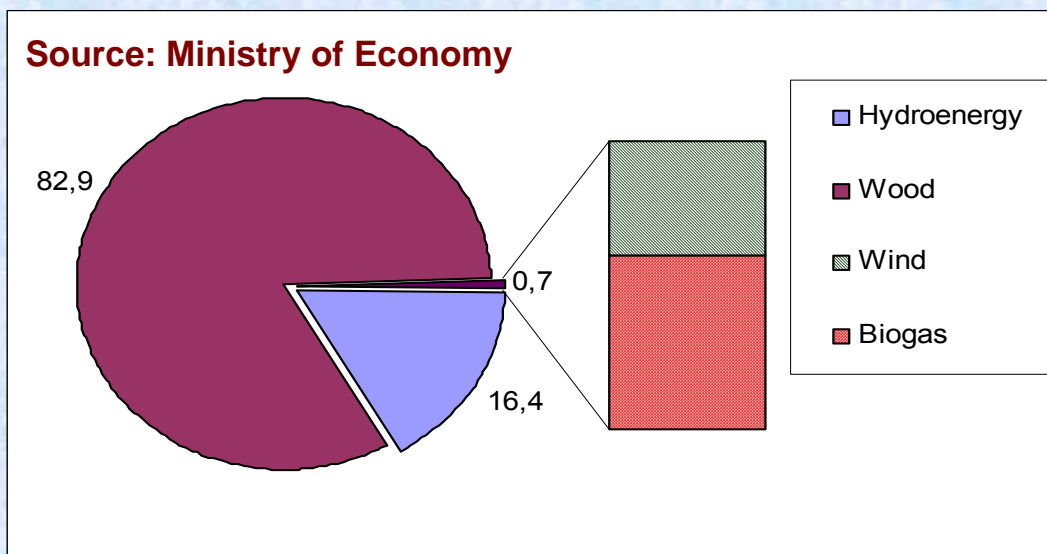
Structure of primary resources, PJ



Source: Climate policy.2005 -2010

RES in Latvia. 2005

Source: Ministry of Economy



Potential of RES in Latvia. Wood - 44,5 – 82,5 PJ

Wood logs	12 - 16 PJ
Forest residues	12 - 18 PJ
bushes	2 - 5 PJ
stumps	0,7 – 3 PJ
Wood waste (from industry)	14 – 37 PJ

Source: Ministry of Economy

Potential of RES in Latvia. Other Bioenergy

Straw	2,2 – 8,2 PJ
Biogas	2 PJ
Biodiesel	43000 t
Bioethanol	32000 t

Source: Ministry of Economy

Potential of RES in Latvia

Hydroenergy	~ 100 MW
Wind energy	0,8 – 4,5 PJ

Source: Ministry of Economy

RES and electricity production

- Permission issued in 2005
 - Wind power plant 12 MW
 - Cogeneration. Biomass 5 MW
 - Cogeneration. Biomass 4,5 MW
- Proposal received in 2006
 - Wind power plants 100MW
 - Solar power plant

RES Policy development = Implementation of EU Directives

- Renewable Directive
- Cogeneration Directive
- Emission Trading Directive
- Linking Directive
- EPB Directive
- Energy Service Directive
- Etc.

RES Policies

- National Development Plan. 2006 - 2017.
(Cabinet of Ministers July 4, 2006. Regulation)
- Basic statements of energy development. 2007 – 2016. (Cabinet of Ministers, August 1, 2006. Direction)
- Basic statements for use of RES in Latvia. 2006 – 2013. (Cabinet of Ministers, October 31, 2006. Direction)
- Electricity generation in cogeneration technologies (Cabinet of Ministers, November 7, 2006. Regulation)

Financial sources

- European Structural Funds
- Latvian Environmental Investment Funds
- CEEF programme
- Energy Efficiency Fund
- Commercial Banks
- State budget: subsidies to bio fuel production

Financial support. Subsidies to biofuel production

Financially supported quotas for biodiesel and bioethanol in 2006

- 16 455 696 litres bioethanol
- 18 181 818 litres biodiesel.

Amount of support:

230 Euro for 1000 litres biodiesel

185 Euro for 1000 litres bioethanol.

Feed in tariffs

Corrections in Energy Law in 2005 : no subsidies to RES electricity.

However:

HPP < 2MW built before 2003 double tariff during 8 years

Wind – licence received before 2001 double tariff

CHP < 4 MW licence received before 2001 double tariff

Electricity tariff for cogeneration. January 1st 2007

- **$C = T_g * k * n / 9,2$**
- **k** - load coefficient
 - 1,11 - till 0,08 MW;
 - 1,05 - 0,08 – 0,8 MW;
 - 1 - 0,8 – 4 MW
- **T_g** – tariff of natural gas, Ls/1000 m³;
- **n** – fuel coefficient
 - 3,8 - for fossil fuels;
 - 4,5 - for RES

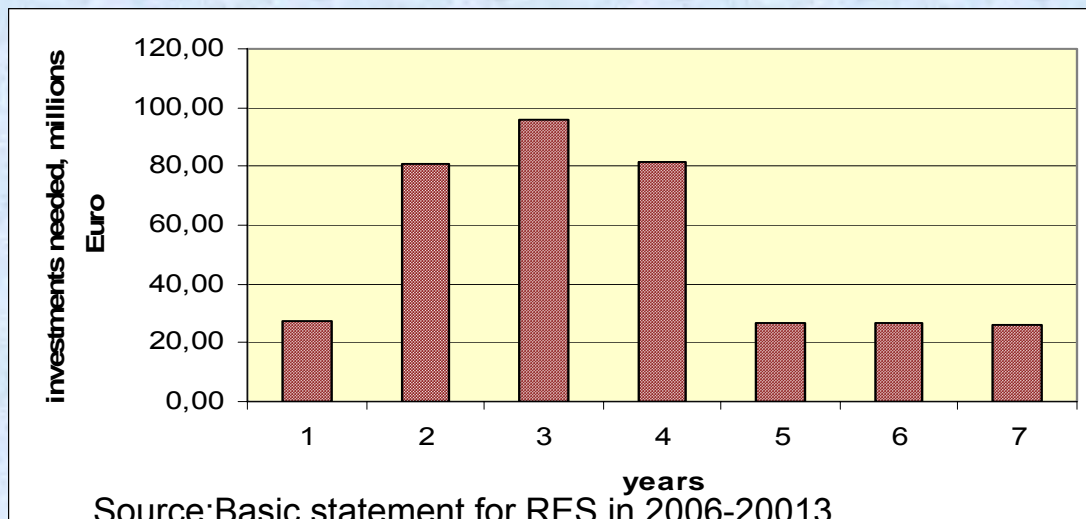
Programmes promoting RES

- EIE projects
 - Energy 4 Cohesion
 - GreenLabel Purchasing
 - InoFln
 - etc
- Nordic Energy Research
 - Solar thermal energy use (REBUS)
 - Biohydrogen (BioH₂)
- Green investment Scheme (GIS)

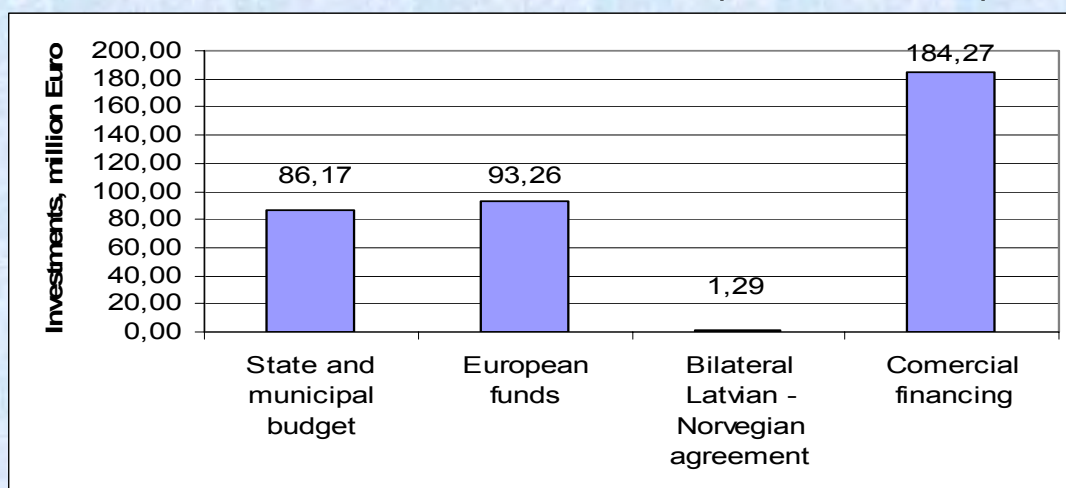
Programmes promoting RES. **GIS**

- World Bank marketing study about GIS projects
- 10 types of projects, including RES
 - Solar thermal energy use
 - Biogas use
 - Biomass use
 - Wind energy
 - Hydro energy

Development and Planning for RES. Finances needed (2007-2013)



Development and Planning for RES. Potential financial sources(2007-2013)



Other Potential financing

- Green investments
- Joint implementation
- Emission trading
- Future - taxes from wood chips export???

Conclusions

- Latvia becomes more and more open for use of RES

Latest developments on RES policy, implementation and planning in Bosnia and Herzegovina

Semra Fejzibegović, B.Sc. In Mech. Eng.
Hydro-Engineering Institute Sarajevo
Bosnia and Herzegovina

3rd Data Gathering Workshop for New Member States and Candidate
Countries for the Scientific Technical Reference System for Renewable
Energies and Energy End Use Efficiency
Cavtat Croatia 15-16 November 2006

General data on B&H



- Area: 51,129 km²
- Borders length (km): 1,538
- Land / River / Sea: 774/751/13
- Population: (1991) 4.37 millions
- GDP per capita: 1,582 USD

Situation in B&H

- **Complicated political and organizational structure in B&H.**
- **Administratively divided in two entities:**
 - **Federation B&H and**
 - **Republic of Srpska**
 - **and Brčko District**

Institutional aspect of energy sector

- **Ministry of Foreign Trade and Economic Relations is responsible for energy on state level**
- **Energy Department within this Ministry is currently organized in three branches**
 - **Strategy planning and policy development**
 - **Electricity**
 - **Gas**
- **Does not work with full capacity**

Institutional aspect of energy sector cont'd

- Entity level Ministries of Energy and Mining own and oversee three electric power companies, oil refineries, natural gas transmission and distribution utilities, and coal mines.
- District heating facilities fall under the responsibility of
 - municipal (RS) and
 - cantonal governments (Federation).

Situation in energy sector

- National Energy Strategy does not exist
- Short-term priority of SAA
- Energy sector reform has started, but is not finished
- Statistics and laws within energy sector do not exist

International obligations in the energy sector

- ECSEE Treaty
- Energy Charter Treaty (ECT) and Protocol on Energy Efficiency and Related Environmental Aspects (PEPEREA)
- Stabilization and Association Agreement (SAA)

Acquis communautaire

- After ratification process of ECSEE-Treaty, B&H will have to prepare plan for implementation of EC Directives on energy, environment and renewables
- For renewables:
- EC Directive on promotion of RES electricity and
- EC Directive on promotion on biofuels

Assistance in preparation of energy strategy of B&H

- Ongoing preparation of detailed energy study analysis in B&H by WB (started 1 July 2006)
- Forseen completion 30 June 2007

National energy strategy

- EU EuropeAid/CARDS project for B&H “Technical Assistance to Support the Energy Department of MoFTER in B&H”
- Project started 6 February 2006 and is going to be finished 5 February 2008
- Objective to prepare the energy strategy of B&H
- Within this document, the strategy for RES sector will be prepared

Recent progress

- **Actions plans for restructuring of electricity sectors in Entities are adopted**
- **State Electricity Regulatory Commission established**
- **Separation of transmission function from 3 power utility companies is under way - TRANSCO is formed**
- **transformation of JPCC into ISO**

Legislation on state level

- **Law on electricity transmission, system regulator and operator in B&H (Of. Gazette B&H, No 7/02, 13/03)**
- **Law on establishment of electricity transmission company in B&H (Of. Gazette B&H No 35/04)**

Legislation on Entity level

- Law on electricity in FB&H (Of. Gazette FB&H 41/02,24/05,38/05)
- Law on electricity in RS (Of. Gazette RS 66/02, 29/03, 86/03,111/04)
- Law on electricity in Brčko District (Of. Gazette BD, br.36/04)
- One of the objectives of these laws is RES use

Legislation on Entity level cont'd

- Decision on methodology of determination of level of purchase prices of electric power from RES with installed power up to 5 MW (Of. Gazette FB&H 32/2002, Of. Gazette RS 71/2003)
- Two power utility companies in FB&H and one in RS are obliged to take over the electricity produced from RES

Tariff systems for RES electricity

According to decisions:

- For small HPP 3.96 €cents/kWh
- Power plants on landfill biogas and biomass 3.81 €cents/kWh
- Wind power plants and geothermal power plants 4.95 €cents/kWh
- Solar power plants 5.44 €cents/kWh

International projects

FP 6 projects in B&H:

- RECOVER (Renewable Energy Co-ordinated Development in Western Balkan Region)
- VBPC-RES (Virtual Balkan Power center for advance of RES in Western Balkans)
- RISE- Renewables for Isolated System-Energy Supply and Waste Water Treatment

International projects cont'd

- **ADEG (Advanced Decentralized Energy Generation Systems in Western Balkans) task to find potentials of RES**
- **ACCENT (Acceleration of Cost-Competitive Biomass Use for Energy Purposes in the Western Balkan Countries) task to find solutions for biofuels production and to find biomass potential**
- **FLEXHEAT (Flexible Premixed Burners for Low-cost Domestic Heating Systems)**

RES in use

- **Two major renewable energy sources:**
 - **Hydropower for electricity production**
 - **Biomass for heat production**

Small HPP

- Estimated potential is 2,500 GWh/year
- Estimated number of about 140 from 1 to 5 MW
- Austrian government initiative to invest 350 millions € in five HPP with intention to use them to achieve one of aims for reduction of CO₂ according to Kyoto protocol

Wind potential

- Several locations with favourable wind conditions
- Preliminary study by GTZ, Germany shows the estimated economic potential of approx. 600 MW that could be developed by 2010, if appropriate incentive system to build wind power installations is set up
- The first systematic one-year wind measurement project in the region of Mostar was planned in 2002 in 10 locations, but was canceled due to a lack of funding

Solar energy

- Solar radiation in B&H among the highest in Europe
- From 1,240 kWh/m² in the north of B&H and up to 1,600 kWh/m² in the south
- Theoretical potential of 74.65 PWh/year and technical potential of 685 PJ.

Geothermal energy

- Research studies show the potential for home heating and similar low-temperature purposes of 33 MW_{th}
- Sources in Bosanski Šamac, Kakanj and Sarajevo are lower temperature type and only for thermal exploitation
- Private companies are currently investigating a possible commercial use in Sarajevo region (higher temperature for electricity production)
- Current activities limited to exploitation of thermal use

Biomass energy

- Significant potential in forestry sector (about 50 % of land in B&H in forest) and agricultural sector
- Innotech HT GmbH, Berlin Study of 2003 calculated the unexplored potential of approx. 1 million m³/year of forest waste and wood waste for heating of 130,000 residences or 300,000 inhabitants

RES technologies

- Thermal exploitation of solar energy with flat-plate collectors is practiced to only a limited extent
- One of the first photovoltaic installations built-in on roof of orphanage building in Trebinje (GTZ assistance)
- One example of biomass use for electricity production in state-owned factory Krivaja, Zavidovići manufacturing furniture and timber-houses having plan for heating of local area, but financial sources do not exist

RES technologies cont'd

- Production of domestic ecological heat boilers (two-stage combustion of wood waste)
- Successful use of these boilers in:
 - Zenica /residential building/ heating area 2,100m²
 - Sanski most / residential building / heating area 6,000m²
 - Aleksandrovac /elementary school and sport gym / heating area 3,500 m²
 - Hotel Maršal, Bjelašnica
 - Meat processing company Lijanovići, Široki Brijeg

Conclusion

- Decentralized, inadequately coordinated attempts related to use of RES
- B&H do not have organized approach in relation with RES development and research

Main barriers

➤ **Inexistence of:**

- **strategy and legislation in the field of RES**
- **financial and institutional framework of support
(financial incentives, fiscal policy, subsidies, RES funds)**

MACEDONIA - COUNTRY UPDATE ON RES POLICY, IMPLE- MENTATION AND PLANNING

Prof. Kiril Popovski

Macedonian Geothermal Association
MAGA - Skopje

REPUBLIC OF MACEDONIA



ENERGY BALANCE OF MACEDONIA

SUMMARY ENERGY BALANCES AND INDICATORS OF THE REPUBLIC OF MACEDONIA
Table 1 (According to the EC Questionnaire 2004)
in 000 toe

	Statistics			Forecasts			
	1995	2000	2002	2005	2010	2020	2030
Primary Production	1671	1595	1577	1704	2012	2167	2128
Solids	1414	1273	1356	1405	1697	1750	1584
Oil	0	0	0	0	0	0	0
Natural gas	0	0	0	0	0	0	0
Nuclear	0	0	0	0	0	0	0
Renewable energy sources	258	322	221	298	316	417	543
- Hydro	69	101	65	132	153	261	390
- Biomass	174	206	143	155	149	138	128
- Waste	0	0	0	0	0	0	0
- Wind	0	0	0	0	0	0	0
- Solar and others	0	0	0	0	0	0	0
- Geothermal	15	16	13	12	13	17	25
Net imports	1104	1104	1486	1549	1775	2969	3976
Solids	101	93	70	153	164	179	192
Oil	993	940	1272	1316	1278	1673	2253
- Crude oil and Feedstocks	160	811	560	1068	1221	1628	2238
- Oil products	833	129	712	248	57	45	15
Natural gas	0	53	74	80	334	1084	1100
Electricity	10	10	68	0	0	33	431

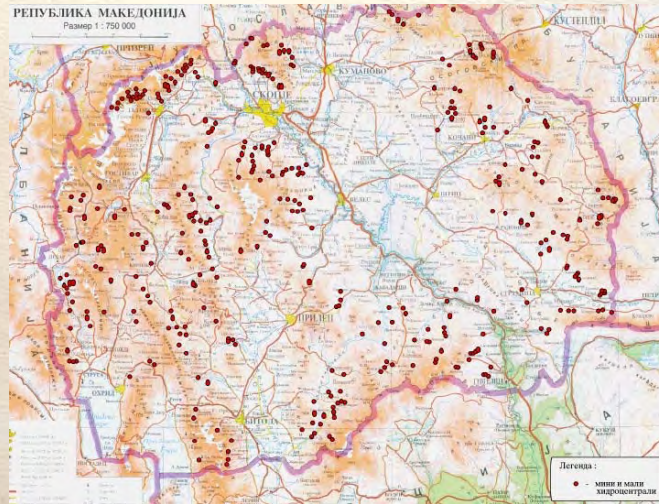


Hydro potential



- According to the water economy register of Macedonia, the gross hydro energetic potential of the water flows in Macedonia is estimated to 11,500 GWh, netto one to 9,000 GWh and technically usable to 6,200 GWh per year. Presently, production of the existing bigger hydro power plants is about 1,600 GWh/yr and of the small ones about 160 GWh/yr. That means that the available technical potential is about 27% in use. According to the same source of data, development of the power production with small and micro power plants can reach about 1,088 GWh/yr.

Location of potential mini hydro-power plants



Geothermal energy

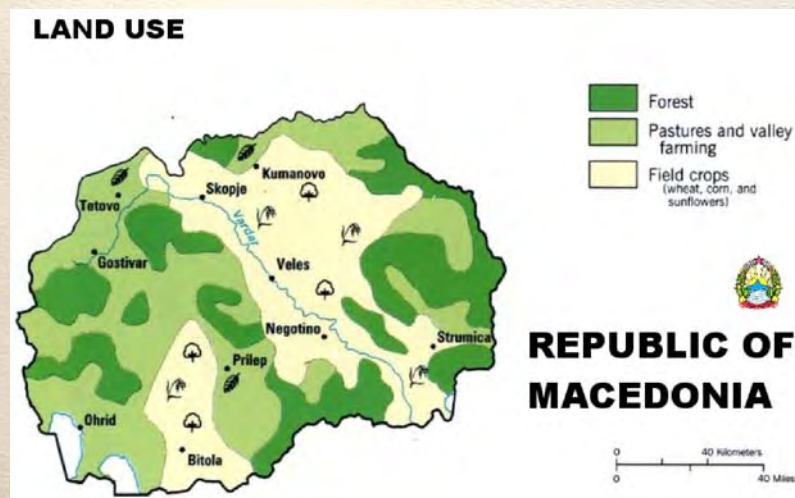


- Presently available flow from thermal springs and wells is about 1,000 l/s with temperatures varying from 20 to 79 °C. Based on temperature of 15°C of the effluent water, heat power on disposal is 173 MWt, and based on 20°C, it is 154 MWt. In the existing projects, average temperature of the effluent water is in the range of 30°C, which makes the heat power on disposal of 116 MWt. According to the data and information on disposal for the existing geothermal fields, their economical development can result with an available heat power of 350 MWt. Development of the existing energy resource with deeper wells and putting in use also other geothermal fields should result with an energy resource of about 1,000 MWt, with temperatures up to 120 °C.

Location of main geothermal fields in Macedonia



Disposition of characteristic bio cultures in Macedonia



Bioenergy resource

Technical energy potential of the biomass in Macedonia participates in the energy balance of the country with the production of heat with 12.7%. Biggest is the participation of forest woods with 10.52%. Eventual transformation of all this energy source for electricity production would result with the change of participation to 3.2%, which presently is not economically liable. However, the real potential is much bigger. Type and regional disposition of the biomass energy source depend on the natural characteristics of the region in question. It is most dense in agricultural and forest parts of the country.

It is necessary to underline that values represent the present situation. Organization of production of wood for energy purposes and oil cultures production for biodiesel production can multiply several times all of them.

ENERGY VALUE OF BIOMASS IN MACEDONIA

BIOMASS ENERGY RESOURCE IN MACEDONIA

Energy resource	Theoretical potential	Participation in the state energy balance	Technical potential of heat energy	Participation in the state energy balance	Technical potential for electricity production	Participation in the state energy balance	Economically liable potential for the next decade
	GWh	%	GWh	%	GWh	%	GWh
FORESTS	8.000	21,6	4.000	10,8	1.000	2,7	0
Biomass of agricultural production	2.000	5,4	287	0,9725	72	0,19	0
URBAN WASTE	830	2,24	415	1,12	121	0,327	0
TOTAL	10.830	29,24	4.702	12,695	1.193	3,217	0

ENERGY VALUE OF WOOD RESIDUES

FORESTS							
		Thin branches	Branches	Bark	Logs	Blackhead	Total
Annual waste wood mass production	m ³ /yr	16356	40886	9810	2459	12265	81776
Hardwood	m ³ /yr	15574	38547	8770	2198	11483	76572
Evergreen	m ³ /yr	782	2339	1040	261	782	5204
Energy potential	GWh/yr	48,7	121,74	29,21	7,32	36,52	243,49
Technical feasible for en. production	m ³ /yr	14020	36700	8810	2200	11010	72740
Technical feasible energy potential	GWh/yr	41,75	109,3	26,23	6,55	32,8	216,63



Quite interesting, presently not used
Energy resource!



ENERGY VALUE OF LIVESTOCK WASTE

WASTE FROM LIVESTOCK						
		Boyne cattle	Horses	Pigs	Poultry	Total
Number	x1000 heads	244,3	39,9	180,1	2934,0	
Annual production of biogas	x1000 m ³ /yr	72675,7	10398	11110	11244	105427,7
Energy potential	GWh/yr	474,4	65,0	71,0	78,1	688,5
Technical feasible biogas for energy production	x1000 m ³ /yr	69042	6760	10555	10680	97037,0
Technical feasible energy potential	GWh/yr	450,7	42,25	67,44	74,17	634,56



Disorganised production doesn't
allow organization of serious
projects!

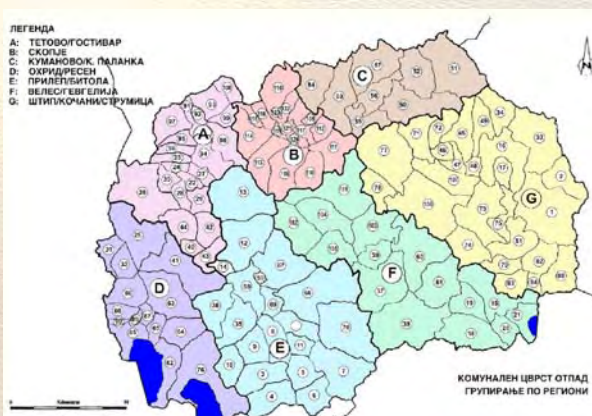


Urban waste energy resource

Urban waste is a “new” energy resource for Macedonia. Up to now, only studies for determination of the energetic value of it have been realised, together with the process of determination of the regional division of the country for collection of it



Grouped regions for collection of solid waste in Macedonia



ENERGY POTENTIAL OF URBAN WASTE

URBAN WASTE REGION/TYPE OF WASTE		ANNUAL QUANTITY OF URBAN WASTE (t/yr)				
		Households	Hospitals	Civil engineering	Industry	Total
A- Northwest	Tetovo	71453,1	265	8122,158	2350	82190,258
B- Noth	Skopje	167129,4	395	19432,6	16320	203277,00
C-Northeast	Kumano	64291,45	145	4857,9	5835	75129,35
D-Southwest	Ohrid	44071	165	5147,908	4065	53448,908
E-Southern Pelagonija	Bitola	64538,85	250	7142,325	11440	83371,175
F-Southern Central	Veles	63464,5	110	5611,7	12240	81426,20
G-Eastern	Stip	83705,55	155	9856,7	12470	106187,25
Total		558653,85	1485	60171,291	64720	685030,14
URBAN WASTE		Households	Hospitals	Civil engineering	Industry	Total
Annual quantity of urban waste	t/yr	558.653,85	1.485	60.171,291	64.720	685.030,14
Energy potential	GWh/yr	1141,50	6,66	42,9	79,72	1270,78
Technical feas. biogas for energy production	t/yr	475.797,87	1.284,32	40.885,62	54.084,88	572.052,69
Technical feas. energy potential	GWh/yr	927,20	5,76	29,15	66,62	1028,73

Solar energy

According to the radiation measurements performed by the National Institute of Hydro-meteorology, the average daily solar radiation varies between 3.4 kWh/m² in the Northern part of Macedonia (Skopje) and 4.2 kWh/m² in the South Western part (Bitola). Under the conditions of the geographic belt where the meteorological stations are located, the total annual solar radiation varies from a minimum of 1,250 kWh/m² in Northern part of Macedonia to a maximum of 1,530 kWh/m² in the South Western part, which leads to an average annual solar radiation of 1,385 kWh/m².



Constraints for RES development



- Possibilities for development of RES in Macedonia are quite limited due to the present un-favourable treatment. RES development is officially accepted as a high priority for the country but this is only a poor declaration without concrete actions for a strategic and active approach, supported by necessary measures and instruments for implementation. There is no particular financial support for RES development at all in Macedonia. All the present activities are mostly initiated and financed by EC funds, USAID, World Bank and other international programmes, which makes them rather limited and, thus, with small influence on the general situation in the country.



Main constraints for development



- Absence of treatment of RES as energy resources with potential to seriously influence the national or regional or local energy balance;
- Absence of consistent development strategies;
- Absence of the necessary legal background;
- Absence of defined convenient system of funding the development;
- Absence of defined convenient economy environment for investing in RES development;
- Absence of developed system for information dissemination;
- Absence or very low level of education on RES investigation, development and exploitation.

Existing legislative supporting RES development

There is no particular law related to RES development or use in The Republic of Macedonia. The Law on Concession Rights partially covers the geothermal and water resources use rights, but in a very unsuccessful way. There is an obligation for confirmation of the tariff of geothermal heat sold to third parties, but it is still not applied in practice. The small hydro power plants are in a similar situation.



Discussion



For Macedonia it can be summarized that:

- Partial engagements for definition of concrete strategies for development are present. However, the country still doesn't have a concrete strategy for RES development that is officially accepted and supported by measures that would enable its implementation;
- Country has not a satisfactory legal back-ground allowing easy permissions, concessions, funds etc. enabling application of RES;
- Country has not defined programs and solutions for particular measures for supporting development of concrete RES;
- Country has not allocated financial resources for supporting the development of RES.



The best options



- The identification of the best options for wide introduction of RES can be mainly localized in:
- Biomass heat plants, geothermal energy and solar thermal collectors for heat production;
- Small hydro power plants and biomass cogeneration for electricity generation;
- Liquid biofuels for transport.
- Other RES technologies, like solar PV for electric energy generation and geothermal cogeneration can also be valuable, but conditions on disposal are limited, at least in the short- and middle-time term .



Conclusions 1



Present state-of-the-art of renewable energies use in Macedonia is mainly a consequence of the process of political and economic changes in flow. The economy collapse of the country, unsolved problems with the privatization of production capacities, a list of legal constraints, absence of a strategy for development, absence of the state support for the necessary explorations and investigations and very hard conditions for financing necessary reconstructions and new investments in the sector resulted with a complete stagnation for the period of last 15 years.



Conclusions 2

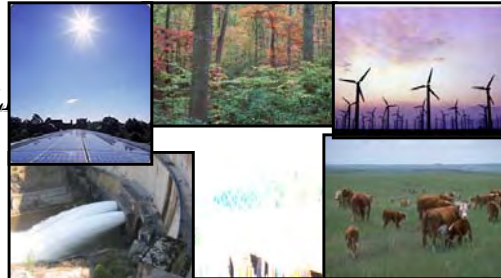


- **Real change of the situation cannot be expected before resolving the problem of listed constraints. Therefore, even the process of elimination of them is already in flow (new laws for energy, for mineral and water resources, and for concessions, etc.), it is not possible to expect serious changes during the period of next 5 years, particularly if not getting organizational, technological and financial support from foreign, and particularly EU resources. Present bad economy situation in the country doesn't allow to the local policy and decision makers to understand the importance of locally on disposal renewable energies use in the import orientated country, unable to pay the increasing energy costs of imported fossil fuels and electricity.**



Republic of Montenegro
Ministry of Economy

POTENTIALS OF RENEWABLE ENERGY RESOURCES IN MONTENEGRO



Cavtat, November 15-16, 2006

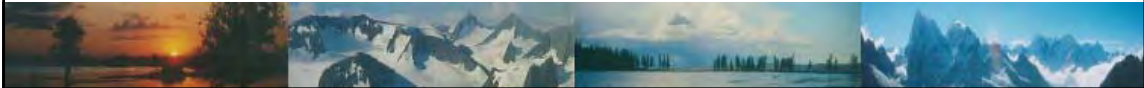
Reform of energy sector

- Energy Law was adopted in 2003.
- Energy Regulatory Agency was established in January 2004.
- Energy Policy was adopted in February 2005.
- Electric Power Company of Montenegro (EPCG) has been functionally unbundled
- Energy Efficiency Strategy was adopted in October 2005.
- Montenegro signed Energy Community Treaty in October 2005
- Strategy for Small Hydro Power Plants Development in Montenegro was adopted in April 2006.
- Design of Energy Development Strategy until 2025 is underway
- The study on renewables (wind, sun and biomass) is in preparation



Energy Policy

- **The goals and objectives of Energy Policy, among others, are:**
 - ❑ secure, qualitative, reliable and diversified energy supply
 - ❑ reduction of import energy dependence
 - ❑ creation of conditions for higher utilisation of renewable energy resources, combined production of electric and heat energy and utilisation of fossil fuels through clean technologies
 - ❑ provision of institutional and financial incentives for energy efficiency improvement and energy intensity reduction in all sectors
 - ❑ sustainable production and utilisation of energy in relation to environmental protection, and international cooperation in this field, particularly in reduction of GHG emissions



Renewables

- **The most important renewable resources in Montenegro are:**
 - hydro potentials of water flows
 - biomass
 - solar energy
 - wind
- **There is a realistic need for intensified researches on possible utilization of renewable resources, as well as the need for creation of conditions for their commercial utilization**



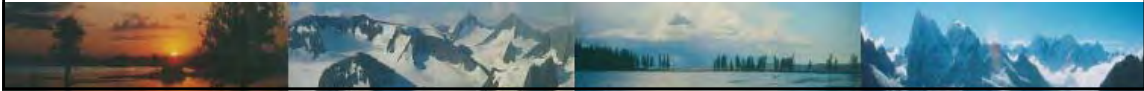
Hydro-potential

➤ Montenegro has hydropower potential of:

- ~10 billion kWh/year in main water flows
- ~0.8 – 1.0 billion kWh/year in small water flows
- ~17% of overall hydropower potential has been utilized

➤ Small hydro power plants-SHPP:

- The share of the existing SHPP in the power of production units amounts to only 1.1%
- The share of SHPP production in total average annual production is 0.83%
- Locations of SHPP in Montenegro are characterized by relatively small flows and high slopes



Projected SHPP

➤ The explored hydro-energetic potential of small water flows at the level of studies, except:

- HPP »Otilovići« (Scheme project and Tender documentation - 2001)
- HPP »Buča« and HPP »Vukovo Vrelo«(Scheme project-1984)
- HPP »Šavnik-2« (Scheme solution - 1992)
- HPP »Krupac« and HPP »Slano« (General Project-2002)

➤ In total, 70 small hydro power plants are projected:

- Total installed power 232 MW
- Electricity production 644 GWh per year



Biomass

- The key biomass in Montenegro:
 - forest wood for heating (150.000 – 200.000 m³ per year)
 - wood scraps from wood processing industry - for technological steam generation
- The data about energetic potential of biomass are not available
- Total area of woods amounts to 620.872 ha.
- Initiatives in wood processing industry to substitute a certain quantity of electricity by technological wood scraps as a fuel
- Study on the possible utilization of biomass for production of heat and electricity (during 2006)



Biomass Power Plant

- Outline scheme has been prepared for BPP
- It is necessary to design prefeasibility and feasibility studies

⇓ Biomass collecting from 3 municipalities:

- Berane, Rožaje and Andrijevica
(max. distance - 35 km)

⇓ Transportation and storage:
(Berane Municipality)

⇓ Biomass power plant:

- Installed power: 2 (4) MW
- Annual production: 14 (28) GWh



Solar Energy

- Utilisation of Solar energy in Montenegro:
 - heating,
 - preparation of hot water and
 - other low temperature processes
- It has been found out that Podgorica and Montenegrin Coast are the areas with good parameters for substantial utilisation of solar energy
- It is necessary to design detailed analysis of all crucial parameters which define available solar energy
- Agenda of the Government of the Republic of Montenegro for 2006 predicted the elaboration of a study on possible utilisation of solar energy in Montenegro



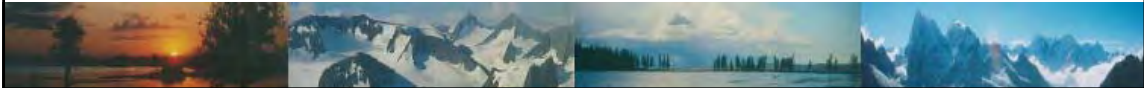
Wind Energy

- Results of previous researches are still insufficient for any substantial utilisation of wind energy for the purpose of electricity production
 - Data from RHMI are not sufficient, but they can be used for identifying the best locations for construction of wind generators
- Potential areas that could have “good” wind power are located in the vicinity of Nikšić, then in south western region of Montenegro, in the mountains over the sea, and in Coastal region
 - there is necessity for detailed researches
 - some detailed measurements were undertaken at the locations Ilino Brdo and Vucje
 - the first realized project – wind generator was constructed on Ilino Brdo (500 kW and 1,25 – 1,80 GWh/year)
- The Agenda of the Government of Montenegro for 2006 predicted elaboration of a study on possible utilisation of wind energy in Montenegro



Geothermal resources and solid waste

- In Montenegro so far:
 - no substantial geothermal water resources have been discovered
 - solid waste has not been used as an energy fuel
- It is predicted under Strategic Master Plan for Waste Management to deposit waste onto several regional sanitary deposits
- It is calculated that 200.000 – 250.000 tons of solid communal waste is formed yearly in Montenegro
- It is necessary to consider in details the possibility for construction of an industrial plant to burn out waste and produce heat and electricity
 - potential locations - in the vicinity of big cities (Podgorica and Nikšić)



Latest developments on RES policy, implementation and planning in Serbia

Prof. Dr. Milan Martinov, mmartog@uns.ns.ac.yu and
Prof. Dr. Milos Tesic, Faculty of Technical Sciences, Novi Sad
Dr. Mladen Ilic, Energy Saving Group, Belgrade

M. Martinov, M. Tesic, Faculty of Technical Sciences, Novi Sad, M. Ilic, Energy Saving Group, Belgrade
DG JRC, EC Meeting, Cavtat, Croatia, November 2006

ENERGY POTENTIAL OF RES IN SERBIA

Biomass - 2.7 million toe

Small Hydro (<10 MW) - 1 600. GWh or 400 000 toe

Geothermal energy - 185 000. toe

Solar energy (-)

Wind energy (-)

Coal – total production in Serbia: 6.7 miliona toe

Consumption of primary energy: 12.4 miliona toe

Consumption of fuel oil in industry: 400 000 toe

***) 1 toe – ton of oil equivalent = 41 860 MJ**

M. Martinov, M. Tesic, Faculty of Technical Sciences, Novi Sad, M. Ilic, Energy Saving Group, Belgrade
DG JRC, EC Meeting, Cavtat, Croatia, November 2006

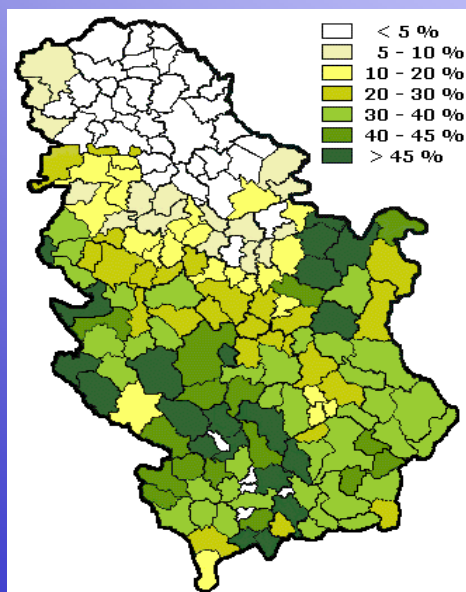
BIOMASS AS ENERGY SOURCE

- ❑ **Agricultural biomass wastes:**
 - wastes of crop farming
 - wastes of fruit growing and viticulture
 - biomass wastes of livestock breeding - manure
- ❑ **Forest biomass**
 - fuel wood
 - wastes of forestry
 - wastes of primary processing of wood
 - wastes of pulp, paper and furniture industry
- ❑ **Energy crops**

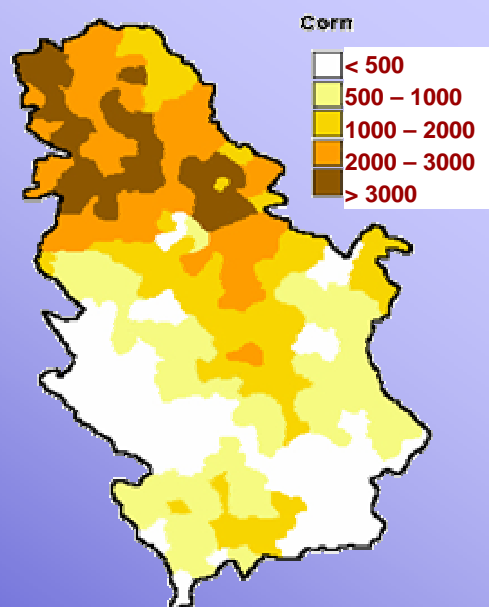
45 000 km² arable land in Serbia (57%)
 24 000 km² land covered with forests (30%)

M. Martinov, M. Tesic, Faculty of Technical Sciences, Novi Sad, M. Ilic, Energy Saving Group, Belgrade
 DG JRC, EC Meeting, Cavtat, Croatia, November 2006

Share of forest in municipality area



Production of corn (kg/ha)



45 000 km² arable land in Serbia (57%)
 24 000 km² land covered with forests (30%)

M. Martinov, M. Tesic, Faculty of Technical Sciences, Novi Sad, M. Ilic, Energy Saving Group, Belgrade
 DG JRC, EC Meeting, Cavtat, Croatia, November 2006

ENERGY POTENTIAL OF AGRICULTURAL WASTES (crop residues, fruit and vineyard pruning, livestock residues)

1 million toe /year – energy potential of crop residues
 3 million tons of wastes (wheat 45%, corn 35%)

0.36 million toe /year - energy potential of pruning biomass
 530 000 tons of wastes of fruit pruning (plum 55%, apple 20%)
 345 000 tons of wastes of vineyards pruning

0.042 million toe /year - energy potential of livestock manure
 - environmental effects of energy using of manure

1.4 million toe /year – total energy potential in agriculture
 (available wastes for energy purpose only)

*) 1 toe = 41 860 MJ

M. Martinov, M. Tesic, Faculty of Technical Sciences, Novi Sad, M. Ilic, Energy Saving Group, Belgrade
 DG JRC, EC Meeting, Cavtat, Croatia, November 2006

ENERGY POTENTIAL OF FOREST BIOMASS

Forests cover about 30% of the territory of Serbia
 (beech 27%, oak 24%).

6 millions m³/year – biological increase of wood-stock in forests

5 millions m³/year - potential of cutting in forests

~ 4 millions m³/year - estimated real cutting in forests

2.9 millions m³/year – registered cutting in forests

	toe / year
- forestry residues	550 000.
- residues in primary wood processing (registered)	70 000.
- consumption of fuel wood	300 000.
- unregistered cutting (heat & processing)	160 000.
- 30% of forests which are not presently utilised	300 000.

1.3 million toe /year - energy potential of forest biomass

*) 1 toe = 41 860 MJ

M. Martinov, M. Tesic, Faculty of Technical Sciences, Novi Sad, M. Ilic, Energy Saving Group, Belgrade
 DG JRC, EC Meeting, Cavtat, Croatia, November 2006

POSSIBILITIES OF INCREASE OF BIOMASS ENERGY POTENTIAL IN SERBIA

- Area used for crop farming (15% less than in 1990.)
- Number of fruit trees (10 to 15% less than in 1990.)
- Number of grapevine plants (20% less than in 1990.)

- Forestry (about 30 % of forests are out of utilisation,
cutting in forests 55% → 70%)
- Maintenance of forests
- Plan to increase area covered with forest:
27% → 31.5% (in 2010.) → 41.4% (till 2050.)

- Possibilities for energy crops –SRC, first of all poplar

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ENERGY BALANCE IN SERBIA

2.7 million toe /year – total energy potential of biomass

1.4 million toe /year – wood, forest biomass

1.3 million toe /year - agricultural waste biomass

11.8 million toe /year – consumption of fossil fuels in Serbia

(57 % coal, 26 % liquid fuel, 17 % gas)

Consumption of liquid fuel in public centralised heating systems
during a winter season and available biomass energy

	Fuel oil	Necessary area	Actual status
3 municipalities in agricultural flat area	8 830. tons	6 000 ha – crop farming	133 000 ha - wheat & corn
2 municipalities in forest area (45%)	5600. tons	15 100 ha forest - 19 600 tons	160 000 m3 regist. cutting

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REAL STATUS

- No one gasification facility
- No one biogas plant (except for municipal sewage)
- Biodiesel – test in public transport
 - monopoly
 - new plant for 100.000 t/a under planning for construction
- Stoves and boilers
 - old and inefficient equipment
 - manufacturers
 - public sector
 - agricultural farms
 - wood processing companies

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POLICY

1. “Memorandum of Understanding on the Regional Energy Market in South East Europe and its Integration into the European Community Internal Energy Market”

Signed, December 2003 and December 2005

2. Kyoto Protocol

Not signed

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LEGISLATION CONCERNING BIOMASS ENERGY USE

- ❖ Energy Law (enacted on 2004, under change)
- ❖ Article on Energy Permission for construction of energy plants (necessary for plants over 1 MWe)
- ❖ Rules on Energy License for energy production, transmission and distribution (electricity, heat, gas, oil)

- ❖ Energy Strategy (2004)

- ❖ Program for Energy Strategy Implementation (in preparation)

- ❖ Rule on privileged producers of electricity (in preparation)

- ❖ Ratification of Kyoto Protocol => obligations regarding emission

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PROGRAMS

- ❖ National Energy Efficiency Program (including RES)
financed by Ministry of Science and Environmental Protection
- research and development (n)

- ❖ Program performed by Serbian Energy Efficiency Agency
financed by European Agency for Reconstruction
- demonstration projects for public sector (1+1)
- public awareness campaign

- ❖ World Bank Programme for Energy Efficiency
- demonstration projects for rehabilitation of heating systems
in public sector (0)

- ❖ GTZ program for municipalities (EE and RES)
- demonstration projects for small municipalities (1)

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PROJECTS

- Studies on energy potential
 - solid biomass
 - biodiesel
- Research and development projects
 - gasification, small scale
 - straw bale combustion, wood pellets combustion, boilers
- Feasibility study
 - old liquid fuel → biomass boilers in a centralised heating system in agricultural area (5 MW)
- Demonstration projects
 - replacement of old liquid fuel boilers with biomass boilers in a school in a forest region (2 x 350 kW)
 - replacement of liquid fuel boiler in a school with a boiler burning pellets (250 kW)

❖ Individual projects in industry

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OBSTACLES FOR BIOMASS USE AS ENERGY SOURCE

- Biomass characteristics (“hard” fuel)
 - Lack of adequate public awareness on energy saving and environment protection
 - Logistic obstacles (have to be comprised several entities, transportation, necessity of internal organisation for biomass manipulation)
 - Financial obstacles
 - greater investment costs, high interest rate of banks
 - Lack of incentives
 - energy price, special loans, lower tax, CO₂ tax
- ⇒ **AWARENESS and PROMOTION**
- non-financial support

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EXAMPLE 1 Heating energy self sufficiency for Pannonian village

Average heating space 56 m² per family

Heating power 160 W/m² i.e. 9 kW per household

Annual need about 650 MJ/m² i.e. 36 GJ per household

or **93.6 TJ** for whole village

Potentials of biomass – crop residues, net heating value 15 MJ/kg, 60% average efficiency – effective heating energy about 9 MJ/kg

Crop	Acreage, ha	Total yield of crop residues, t/a	Effective biomass, t/a	Effective heating energy potential, TJ/a
Cereals	4,680	6,550	5,200	46.8
Maize	3,300	8,250	4,000	36.0
Soybean	1,000	3,000	2,500	22.5
Total			11,700	105.3

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EXAMPLE 2 - 400 kW heating plant, natural gas or straw

¹ Payback 10 years, 8% annual interest.

² Presumed 1%.

³ Presumed 2%.

⁴ Means two controls during heating season.

⁶ This includes not complete salary of the person working on fueling

	Natural gas	Straw
Purchase		
Facility price with montage, din	950,000	1.950,000
Additional installation, din	100,000	–
Total price of facility, din	1.050,000	1.950,000
Annual costs		
Anuitets ¹ , din	47,250	87,750
Relatively fixed maintenance costs, din	10,000 ²	39,000 ³
Chimney cleaning, din	500	2,000
Fuel costs, din	693,000	480,000
Fueling, ash removal, cleaning of heat exchanger and monitoring, din	2,000 ⁴	60,000
Total per year, din	752,750	668,750
Total net energy delivery, net, MJ/a	1.440,000	
Total costs for delivered energy		
din/MJ	0.523	0.464
din/kWh	1.88	1.67

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PLANNING

ACTIVITIES PLANED:

1. Improvement of existing facilities using demonstrations projects. Intention: to increase efficiency to ca. 60% and reduce emission of pollutants. Simultaneous support for rural development.
2. Creation of awareness of RES use benefits.
3. Creation of economic support of use of RES.
4. Development of “best available” RES practice in the country.
5. Development of consequent policy in the region, followed by adequate funds and legislation, international cooperation, dissemination of use of renewables in rural areas of the region.

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Round Table on Rural Areas Development in SEE

Organization of Agricultural Engineering of Southeastern Europe – AESEE, a member of CIGR since 2005, has recognized importance of rural development in the region and world wide. The round table

“Agricultural Engineering and its Role in Development of Rural Areas|

Bulgaria, Romania, Serbia, Turkey, individual members Bosnia and Herzegovina, FYRM

Organized by Turkish Chamber of Agricultural Engineers, Izmir Branch, on 25th to 27th of September in Izmir and village Şirince. Next Rond Table planned for September 2007.

Implementation of renewable energies can be a good tool for development of rural areas through which local materials and human resources can be used. Prof. Dr. Milan Martinov is given the responsibility searching for funds and drawing a concept of a regional project on this topic.

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SUMMARY OF RENEWABLE ENERGY SOURCES DATA

NEW MEMBER STATES

CYPRUS

General country data

Country population	785,000
Country area	9,250 km ²

Energy Production

Total energy production (2004)	7,955 TJ
Total electricity production	4,348 GWh
Total electricity consumption	3,939 GWh
Total heat production (2004)	196 TJ
Total installed capacity (electricity) (2005)	988 MW
Total installed capacity (heat)	N.A.

RES share

RES share in primary energy supply (2005)	4.30 %
RES share in electricity consumption (2006)	0.04 %
Share of biofuels in fuel transportation	-

RES national targets (2010)

RES share in the primary energy sources	6 %
RES share in the electricity consumption	9 %

Primary energy balance (2004)

Coal & petroleum coke	8,440 TJ
Oil	99,250 TJ
Solar	4,839 TJ
Total Primary energy supply	112,529 TJ

RES in energy supply

Large hydro	-
Small hydro	-
Wind	1.3 TJ
Solar thermal	1,468.8 TJ
Solar electric	4.5 TJ
Biomass	NA
Geothermal	-
Total RES	1.474.5 TJ

RES installed capacity (electricity and heat) (2006)

Large Hydro	-
Small hydro	-
Large wind (approved)	206 MW
Small wind (up to 30 KW)	227 kW
PV systems	526 kW
Grid connected	526 kW
Stand alone	450 kW
Solar thermal (solar collectors)	> 730,000 m ²
Biomass	-
Biogas	-
Geothermal	-

RES Electricity production

Hydro	-
Wind	355 MWh

Solar	1,240 MWh
Biomass	-
Biogas	-
Geothermal	-
Total RES electricity production	1,595 MWh

RES Heat production

Solar	1,468.8 TJ
Biomass	-
Biogas	N.A.
Geothermal	N.A.
Total RES Heat production	1,468.8 TJ

Biofuels production

Number of biodiesel plants	6
Biodiesel production per year	33,100 t
Number of bioethanol plants	N.A.
Bioethanol production per year	N.A.
Biodiesel plant capacity	N.A.
Bioethanol plant capacity	N.A.

RES estimated potential

Hydro	1 MW (8 GWh)
Wind	150-250 MW (260-440 GWh)
Solar	N.A.
Biomass	Not estimated
Geothermal	-

CYPRUS

Present RES situation

- About 90% of primary energy supply is based on oil, while solar energy contribution to primary energy supply is 4.2 %.
- Solar: Extensive use for water heating in the domestic sector, further prospects in the tourist sector and for electricity production (90% of individual houses, 80% of apartments, and 50% of hotels are equipped with solar water heating systems). Approximately 1 m² of installed solar thermal collectors per capita. Latest estimations show about 730,000 m² of solar collectors installed in Cyprus. Prospects exist for further 40,000-80,000 m² until 2010.
- Wind: Unexploited available wind potential estimated at 150-250 MW
- Biomass: Unexploited available biomass potential with limited water availability. The potential of biofuels from domestic biomass is limited. However, biofuels production from imported material is seen as an alternative.
- Small Hydro: limited unexploited available potential.
- The upgraded grant scheme 2006 provides financial incentives as grants/subsidies for the installation and operation of energy saving systems and renewable energy systems.
- Grant schemes apply for two investment categories: energy conservation (category A) and Renewable Energy Sources (RES - Category B). The grants and purchase price of electricity (including subsidy) depend on the technology. New, more generous, scheme is being developed for the promotion of energy production from biomass. The new scheme will allow investors to choose between subsidy on initial investment or only running support (PV).

RES Policy

Purchase Obligation

The Electricity Authority of Cyprus (EAC) is obliged to buy electricity produced from renewable energy sources at a fixed price (currently set to 3.7 CY cents per kWh). EAC installs dual meters in the cases of electricity production with PV in the domestic sector.

Action Plan for RES (2002–2010)

An Action Plan (2002–2010) for supporting RES applications in Cyprus has been prepared. The Action Plan aims at doubling RES contribution to the national energy balance by 2010 and the establishment of the supportive environment for RES investments.

Grant Scheme

The first Grant Scheme aimed to provide financial incentives in the form of governmental grants for investments in energy conservation and substitution of conventional fuels with RES. The aid scheme was addressing only to existing enterprises in the sectors of the manufacturing industry, hotels and agriculture. The grant was set at 30 % of the total investment cost, with the maximum amount of grant not exceeding £30,000. The scheme was in operation in 1999–2003.

The Grant scheme was revised in 2004. A substantially higher number of entities are eligible to apply for a grant including the domestic sector. The upgraded Grant scheme in 2005 provides financial incentives in the form of governmental grants/subsidies for the installation and operation of energy saving and renewable energy systems.

B1 Wind

B1.1 Large commercial systems: Electricity price (first 5 years) 5.40 c£, meaning 5.40-3.70=1.70 c£ subsidy. Electricity price (next 10 years): 2.80 – 5.40 £.

B1.2 Small systems of up to 30 kW capacity: Subsidy amount to 40 - 55%. Maximum amount of grant is £ 10,000. Electricity price: 3.70 c£. No operating support is offered.

B1.3 Small water pumping systems Subsidy amount to 40-55%. Maximum grant £10,000.

B2. Solar

B2.1 Central water heating systems: Subsidy of 30-45% of eligible costs. Maximum amount of grant is £10,000.

B2.2 Space heating and cooling: Subsidy of 40-55 % of eligible costs. Maximum amount of grant is £50,000.

B2.3 Domestic solar systems: Subsidy of 20 % of eligible investment, maximum amount £100 for category B2.3a and £200 for categories B2.3b and B2.3c.

B2.4 Swimming pool water heating systems: Subsidy of 30 %-45 % of eligible investments, maximum amount of grant £10,000.

B3. Biomass Grants of 40 -55 % of eligible costs. The maximum amount of grant is £68.750 for district heating, £11.000 for households and £400.000 for enterprises. Electricity price is 3.7 c£ per kWh. No operating support is offered with current scheme.

A new scheme is under development for energy production from biomass. Support of up to 7.5 cents per kWh is offered for electricity depending on the category of investment.

B4. Photovoltaic Systems

B4.1. Small PV systems of 5 kWp capacity, grid connected. For households and other entities not engaged in economic activities the grant is 55 % of eligible costs, maximum amount of grant of 9,500 £. For enterprises, the grant is 40 % of eligible costs, maximum amount of grant 7,000 £. The electricity price is 12 c£ (EAC 3.7 c£ + SF 8.3 c£).

The new scheme will allow investors to choose between subsidy on investment or operating support only, with electricity price of 22.4 c£ for households and 19.6 c£ for companies.

B4.2. Autonomous / hybrid, of up to 5 kWp capacity. For households and organizations not engaged in economic activities, the grant is set to 55 % of eligible costs, up to a maximum of 9,500 £. For enterprises the grant is 40 % of eligible costs with a maximum amount of 7,000 £.

B5. RES desalination. The subsidy amounts to 40-55 % of eligible costs. The total amount of grand should not exceed the amount of 100,000 £.

B6. Small Hydro systems Subsidy of 40-55 % of eligible costs. The maximum amount of grant is 30,000 £. The electricity price 3.70 c£ per kWh. No operating support is offered.

CZECH REPUBLIC

General country data

Country population	10,240,000
Country area	78,866 km ²

Energy Production

Total energy production	1,596,414 TJ
Total electricity production	82,578.6 GWh
Total electricity consumption	69,944.8 GWh
Total heat production	906,903.0 TJ
Total installed capacity (electricity)	17,391.7 MW
Total installed capacity (heat)	N.A.

RES share (2005)

RES share in primary energy supply	3.99 %
RES share in electricity consumption (2004)	4.04 %
RES share in electricity consumption	4.48 %
RES share in the gross electricity production	3.78 %

RES national targets (2010)

RES share in the primary energy sources	6.00 %
RES share in the electricity consumption	8.00 %
Share of biofuels in fuel transportation	5.75 %

Primary energy balance

Lignite	646,659 TJ
Black coal	323,330 TJ
Oil	344,885 TJ
Gas	431,106 TJ
Nuclear	344,885 TJ
RES	64,666 TJ
Total Primary energy supply	2,155,533 TJ

RES in energy supply (2005)

Large hydro (> 10 MW)	31,838 TJ
Small hydro (< 10 MW)	18,418 TJ
Wind	518 TJ
Solar PV	8 TJ
Biomass	7,369 TJ
Biomass (co-firing)	6,256 TJ
Municipal solid waste	259 TJ
Geothermal	-
Total RES	64,666 TJ

RES installed capacity (only electricity)

Large Hydro	742.8 MW
Small hydro	276.7 MW
Wind	22.5 MW
Solar PV (2006)	650.0 kWp
Biomass	1,182.0 MW
Biogas	-
Heat pumps installed capacity	36.5 MW

RES Electricity production

Hydro	2,380.0 GWh
Wind	21.4 GWh
Solar	0.4 GWh
Biomass	560.0 GWh
Biogas	161.0 GWh
Municipal solid wastes	10.6 GWh
Geothermal	-
Total RES electricity production	3,133.5 GWh

RES Heat production (2005)

Solar	103 TJ
Biomass	17,437 TJ
Biomass (household)	23,455 TJ
Biogas	1,010 TJ
Solid municipal waste	2,969 TJ
Heat pumps	545 TJ
Total RES heat production	45,519 TJ

Biofuels production

Number of biodiesel plants	N.A.
Rapeseed oil methyl ester production	131,000 t
Number of bioethanol plants	N.A.
Bioethanol production per year	N.A.
Biodiesel plant capacity	N.A.
Bioethanol plant capacity	N.A.

RES estimated potential

Hydro	3,380 – 3,980 GWh
Small hydro potential	1,570 GWh
Wind technical potential	35,000 GWh
Wind economic potential	6,200 GWh (2,200 MW)
Solar thermal	11,500-14,400 TJ
Biomass	76,850 TJ
Geothermal	4,641 MW

CZECH REPUBLIC

Present RES situation

- Financial incentives for RES include feed-in tariffs or green bonuses differentiated for different RES technologies, subsidies from national and operational programmes and exemptions for income tax for 5 years
- RES Electricity is produced (2005) mainly in hydro plants (3.4 %), biomass (0.8 %), biogas (0.23 %), wind (0.03 %), municipal solid wastes (0.02 %) and solar.
- RES Heat is produced (2005) mainly from biomass in household (51.53 % of RES heat), biomass (38.31 %), solid municipal wastes (6.53 %), biogas (2.22 %), heat pumps (1.2 %) and solar (0.23 %).
- Wind installed capacity rose by 5.5 MW in 2005 to 22.5 MW in 47 wind power plants. Most of the wind plants (32) have a capacity of more than 100 kW. New projects are foreseen until 2012 to a capacity of 1541 MW.
- Total hydro installed capacity is 1,020 MW in 1359 power plants, with share of big hydro plant capacity being 73 %.
- Photovoltaic technology is in the market development stage with a total installed capacity of only 650 kWp in 2006, from 469 kWp in 2004.
- Many specific problems for biomass small projects (low efficiency, large investment cost) but also for large projects (transport, uncertainty of biomass availability). Almost all RES heat is produced for self-consumption.
- Insufficient subsidy for cultivation of energy crops (2,000 CZK/ha-70 €). There is no direct government support for biofuels.
- Czech Republic is 4th biggest producer of rapeseed oil methyl ester in Europe (131,000 t, almost entirely exported).

RES Policy

Act on promotion of Use of Renewable Sources (August 1st, 2005)

The act was intended to promote the use of renewable energy sources and to contribute to the economical use of natural resources and sustainable development. It creates conditions for fulfilment of the indicative target for the share of electricity from RES in the gross consumption of electricity in the Czech Republic amounting to 8% in 2010.

It allows preferential connection to the grid, obliging operators of the regional grid systems and the operator of the transmission system to purchase all electricity from renewable sources made available to them. It provides two main financial incentives – feed-in tariffs or a system of green bonuses (producers can choose if they sell electricity for purchase prices or offer it to trader for market-price and simultaneously get extra green bonuses which are paid by the operator of the relevant regional grid or the operator of transmission system).

The purchase prices as well as green bonuses are fixed by the energy regulator (ERU) on a yearly basis. The purchase prices are guaranteed for 15 years (in contrast to green bonuses), taking into account the price index of industrial products.

Financial incentives

- feed-in tariff and green bonuses;
- income tax exemption in the year of putting in operation and for following 5 years;
- subsidies through national programmes (no legal claim, low budget);
- subsidies through Operational programmes => these programmes are managed by Ministry of Industry and Trade, Ministry of Environment, Ministry of Agriculture (MPO, MŽP, MZE).

RES	Feed - in tariff [€/kWh]	Green bonus [€/kWh]
Small hydro*	0,09	0,05
Combustion of landfill gas*	0,08	0,04
Wind energy**	0,09	0,07
Geothermal energy *	0,16	0,12

Photovoltaics*	0,48	0,46
Biomass	0,12-0,08	0,04-0,08

*for installations in operation from 2006

** for installations in operation from 2007

Operational Programmes –in the phase of preparation, some conditions could be changed.

Ministry of Industry and trade - Eko – Energy Programme

It is managed by Ministry of Industry and Trade in the frame of Operational programme Enterprise and Innovation, set to provide support in two forms as soft loan or subsidy. The fund available for the period of – 2007-2013 amounts to 4 bln. CZK (about 140 mil €). Subsidies are provided to up to 100 mil CZK (about 3.5 mil €) covering up to 60 % of investment costs. Soft loans are granted only for SME, 1 %, for a period of 15 years, max 50 mil CZK (about 1.75 mil €). (http://www.mpo.cz/default_en.html)

Ministry of Environment

In the frame of Operational Programme Environment, the total available funds for the period 2007-2013 amount to 19 bln. CZK (673 mil €). It provides support for non profit organisations (municipalities, NGO`s etc.). The level of subsidy will depend upon financial and economic analysis.

Ministry of Agriculture

In the frame of Programme for countryside development, it provides support for utilisation of biomass for energy needs. Subsidies apply for boiler houses, biogas stations, energy distribution etc.

State Programmes

Part A - managed by Ministry of Industry and Trade - Programme Efekt 2007 focuses on further education in the field of energy (RES), energy planning, investment of small scale and pilot actions.

Part B – managed by Ministry of Environment, investment subsidies for plants for Utilisation of Renewable Sources of Energy.

ESTONIA

General country data

Country population	1,324,000
Country area	45,226 km ²

Energy Production (2005)

Total energy production	157,544 TJ
Total electricity production	9,114 GWh
Total electricity consumption	6,403 GWh
Total heat production	10,514 GWh
Total installed capacity (electricity)	2,733 MW
Total installed capacity (heat)	11,032 MW (5,593 power plants)

RES share (2005)

RES share in primary energy supply	12.1 %
RES share in electricity consumption	1.3 %
Share of biofuels in fuel transportation	< 1 %

RES national targets (2010)

RES share in primary energy sources	12.0 %
RES share in electricity consumption	5.1 %
RES share in electricity consumption (2015)	8.0 %

Primary energy balance (2005)

Oil-shale	129,423 TJ
Peat	3,547 TJ
Firewood	11,969 TJ
Wood waste	12,279 TJ
Wood briquettes and pellets	179 TJ
Wind & hydro power	270 TJ
Other fuel	150 TJ
Import- export	59,704 TJ
Total Primary energy supply	216,079 TJ

RES in energy supply

Large hydro	-
Small hydro	77 TJ
Wind	200 TJ
Solar	-
Biomass	24,427 TJ
Geothermal	270 TJ
Total RES	24,974 TJ

RES installed capacity (electricity and heat) (2006)

Large Hydro	-
Small hydro	5.5 MW
Wind	58.0 MW
Solar	-
Biomass	836.0 MW
Biogas	2.0 MW
Geothermal	-
Other	4.3 MW
Total RES installed capacity	905.8 MW

RES Electricity production (2005)

Hydro	21.5 GWh
Wind	55.1 GWh
Solar	-
Biomass	27.8 GWh
Biogas	-
Geothermal	-
Black liquor	4.1 GWh
Landfill gas	1.1 GWh
Total RES electricity production	109.6 GWh

RES Heat production

Solar	-
Wood	1,922 GWh
Wood residues, biogas, black liquor	687 GWh
Biogas	-
Geothermal	75 GWh
Total RES heat production	2,609 GWh

Biofuels production

Number of biodiesel plants	3
Biodiesel production per year	7,000 t
Number of bioethanol plants	-
Bioethanol production per year	-
Biodiesel plant capacity	10,000 t (in 2005); 20,000 t (in 2006)
Bioethanol plant capacity	-

RES estimated potential

Hydro	300 GWh (40 MW)
Wind	1-3,000 GWh
Solar	150-600 GWh
Biomass	18,000 GWh
Energy crops	10,000 GWh
Geothermal	300 GWh
Total RES estimated potential	29,800 – 32,200 GWh

ESTONIA

Present RES situation

- Oil shale covers most of the primary energy sources (55.9 %), while wood and peat covers 12.3 %, hydro and wind 0.12 %, natural gas 12.7 %, liquid fuels 18.3 % and coal 0.7 %.
- More than 90% of electricity is produced in two power plants using domestic oil-shale (2,142 MW), in a natural gas plant (171 MW), in CHP plants on natural gas, oil shale, wood and wood residues (85 MW) and wind, hydro, biogas plants (35 MW).
- District heating covers ca 70% of total heat need in buildings. From the total heat, 65 % is produced in boilers (3,924 boilers) and 35 % in CHP plants (37 units).
- A significant share of heat (24.8 %) is from RES, of which 73.7 % from wood and 26.3 % from wood residues, biogas and black liquor.
- RES electricity in 2005 (109.6 GWh - 1.71 % of electricity consumption) was produced from wind (50.3 %), biomass (25.4 %), hydro (19.6 %), black liquor (3.7 %) and landfill gas (1 %).
- Most of the RES capacities in electricity are from wind (58 MW), hydro (5.5 MW) and other (4.3 MW).
- Wind is the most rapidly developing area (from 32.75 MW in 2005, to about 58 MW in 2006). There are currently 13 projects under development with a capacity of 300-350 MW. Wind development is limited due to low integration capacity of grid (to about 400 MW) and lack of fast start generation units to compensate wind power fluctuations.
- Biomass is the most promising resource, particularly for heat production and local co-generation, providing almost two thirds (65.4%) of RES based energy. Wood covers nearly 75% of total energy need in households. Forests cover about 50% of country territory.
- Hydro technical potential is moderate (40 MW). At present, there are 35 small hydro plants (from 10 to 1,100 kW) and a number of micro plants (<10 kW) with a total capacity of 5.4 MW. In nearest future 4 new plants (2 MW) will be installed and about 8 MW by 2010.
- There are nearly 3500 heat pumps installed, with total heat production ca 75 GWh. Over 1300 heat pumps were installed in 2005.
- There are 36 small PV installations supplying lighthouses and two schools.
- RES promotion includes purchasing obligation and feed-in tariffs for RES electricity (equal for all technologies), CO₂ taxation and excise tax exemption for biofuels.

Promotion of use of RES

RES Legislation

Purchasing obligation for electricity produced from RES By the Estonian Electricity Market Act, the network operator must purchase the electricity generated from renewable energy sources at a price of 5.2 €cents/kWh.

The renewable energy sources considered are water, wind, solar, wave, tidal and geothermal energy sources, landfill gas, sewage treatment plant gas, biogas and biomass.

Both transmission and distribution network operators are obliged to purchase the energy produced from renewable sources at a fixed price of 81 Estonian cent/kWh. This is almost twice the market price. In the beginning of the regulation period undertakings submit a prognosis of the quantity of renewable energy, which is adjusted annually together with the indexation of network charges.

CO₂ taxation.

CO₂ taxation is regulated under the Environmental Charges Act of Estonia. From January 1, 2006 the tax for CO₂ emission is 15.65 Estonian kronas/t (1€/t). The tax is not applied to biomass in the meaning of the Electricity Market Act or to the energy production from wastes.

Biofuels legislation

Excise tax exemption for biofuels.

Under the Alcohol, Tobacco and Fuel Excise Duty Act of Estonia, biofuel is free of excise duty. If biofuel is added to fossil fuels, the portion of biofuel contained in such fuel is exempt from excise duty.

Feed-in tariff

As mentioned above, the feed-in tariff applies at the same rate for all RES technologies, the rate being 81 Estonian cents per kWh (5.2 €cents/kWh).

RES support Programmes

Support to energy projects linked with the use of RES is given under the EU energy-related programmes and projects.

HUNGARY

General country data

Country population	9,981,000
Country area	93,030 km ²

Energy Production (2004)

Total energy production	428,519 TJ
Total electricity production	33,708 GWh
Total electricity consumption	31,818 GWh
Total heat production	57,400 TJ
Total installed capacity (electricity)	8,600 MW
Total installed capacity (heat)	N.A.

RES share (2005)

RES share in primary energy supply	3.6 %
RES share in electricity consumption	4.5 %
	(4.8 % including waste incineration)
Share of biofuels in fuel transportation	-

RES national targets (2013)

RES share in the primary energy sources	14.0 %
RES share in the electricity consumption	11.4 %

Primary energy balance (2014)

Coal	146,622 TJ
Oil	268,165 TJ
Gas	490,232 TJ
Nuclear	130,628 TJ
RES	40,905 TJ
Electricity	26,879 TJ
Total Primary energy supply	1,103,431 TJ

RES in energy supply

Hydro	754 TJ
Wind	-
Biomass	36,467 TJ
Solar	3,600 TJ
Geothermal	84 TJ
Total RES	40,905 TJ

RES installed capacity (electricity and heat) (2005)

Large Hydro	30.0 MW
Small hydro	7 MW
Wind (2006)	36.3 MW
Solar PV	0.01 MW
Biomass	572 MW
Biogas	1 MW
Geothermal	350 MW

RES Electricity production (2005)

Hydro	182 GWh
Wind	12 GWh
Solar	-
Biomass	1,305 GWh

Biogas (2004)	21 GWh
Waste electricity	100 GWh
Geothermal	-
Total RES electricity production	1,726.9 GWh

RES Heat production (2004)

Solar	1 TJ
Biomass	143 TJ
Waste	396 TJ
Biogas	39 TJ
Geothermal	228 TJ
Total RES heat	807 TJ

Biofuels production

Number of biodiesel plants	-
Biodiesel production per year	-
Number of bioethanol plants	-
Bioethanol production per year	-
Biodiesel plant capacity	-
Bioethanol plant capacity	-

RES estimated potential

Hydro	1,389 GWh
Wind	2,000 GWh
Solar	4,000 TJ
Biomass	58,000 TJ
Geothermal	50,000 TJ
Total RES estimated potential	124,200 TJ

RES-electricity target in 2013

Biomass	3,992 GWh
Biogas	262 GWh
Wind	710 GWh
Other	436 GWh
Total	5,400 GWh

RES energy target for 2013

Heat from RES-electricity production	56,600 TJ
Biofuel	30,000 TJ
Heat from Solid biomass	50,000 TJ
Biogas	10,000 TJ
Solar collector	400 TJ
Other	18,000 TJ
Total	165,000 TJ

Source Prepared from the Presentation at the Workshop

HUNGARY

Present RES situation

- RES support includes a feed-in tariff of 23.83 HUF/kWh (9.38 c/kWh) in 2006, equal for all RES, of which 13 HUF is subsidy. There is also a 2.07 HUF levy at source on consumption per kWh. Obligatory purchase of RES electricity is valid until 30 December 2010.
- RES electricity (4.8 % of total electricity consumption) is produced mainly in biomass plants (79.6 %), but also in hydro plants (11.1 %), waste (6.1 %), biogas (2.4 %) and wind (0.7 %).
- The wood extraction in 2005 was 5.9 Mm³, of which 1 Mm³ was used in 7 biomass plants. The increasing natural gas price provoked a new demand for fire wood and, consequently, the fire wood price increase by 40%.
- The installed wind plants in 2006 reached about 36.3 MW, while new wind plants permits were released for 330 MW to be built before 2010. The system management limits the development of wind plants.
- Support for RES is planned to be given through the National Development Plan (2007-2013) to provide up to 20% investment subsidy (considering existing feed-in tariff support). Support is provided for biomass, waste, liquid manure and waste water treatment biogas, geothermal heat pumps, solar, wind and lifetime extension of existing hydro.
- Biofuels are supported by being exempted from excise tax until 2007 and differentiated taxation up to 2010.

Support – Feed-in tariff system

The Feed-in tariff system was set by the Act on Electricity 110/2001 amended by the 79/2005 Act and the Decree of Ministry of Economy and Transport 78/2005 (X.7), amending Decree on regulations of a feed-in and pricing 56/2002 (XII.29). It stipulated obligatory purchase of RES electricity until 30 December 2010.

The feed-in tariff for electricity from RES, not considering the technology type or plant capacity, is 23 HUF/kWh (9.05 €/kWh) and 23.83 HUF/kWh in 2006 (increased by inflation), of which around 13 HUF is subsidy. Besides, a levy of 2.07 HUF / kWh applies on consumption.

National Support Schemes

Support for residential projects on energy efficiency and renewable energy sources was provided by National Support Schemes. It was opened only for 11 days in 2006, when more than 6300 proposals were received.

National Development Plan 2 (2007-2013)

The Draft of National Development Plan 2 (2007-2013) provided up to 20% investment subsidy (considering existing feed-in tariff support).

The following projects are supported biomass (waste fractions - oil and animal fat, liquid manure and waste water treatment biogas), geothermal heat, heat pumps, solar, lifetime extension of existing hydro, autonomous wind projects.

The total funds available for the period 2007-2013 (support share) is about 40-50 billion HUF (~160-200 million EUR).

First commercial credit for RES

This applies for household applications, providing loans for max 30 years, with variable, relatively low interest rate. The minimum amount is 500.000 HUF (~2.000 EUR).

Biofuel

Government Decree 2233/2004 (IX. 22.) set a target of 2 % biofuels up to 2010. The Parliament Communication 63/2005 (VI. 28. OGY) to Government set a target of 4% biofuels to be reached up to 2010. Exemption from excise tax applies for biofuels until 2007. Differentiated taxation also applies up to 2010.

Source Prepared from the Presentation at the Workshop

LATVIA

General country data

Country population	2,275,000
Country area	64,589 km ²

Energy Production (2004)

Total energy production	89,598 TJ
Total electricity production	4,683 GWh
Total electricity consumption	5,900 GWh
Total heat production	31,093 TJ
Total installed capacity (electricity)	2,130 MW
Total installed capacity (heat)	N.A.

RES share

RES share in primary energy supply (2005)	35.7 %
RES share in electricity consumption (2004)	46.5 %
Share of biofuels in fuel transportation	-

RES national targets (2010)

RES share in the primary energy sources	37.0 %
RES share in the electricity consumption	49.3 %

Primary energy balance (2004)

Coal	2,093 TJ
Oil	58,070 TJ
Gas	55,768 TJ
Biomass	57,652 TJ
Hydro	11,179 TJ
Geothermal, solar	168 TJ
Electricity	7,536 TJ
Total Primary energy	195,509 TJ

RES in energy supply (2004)

Hydro	11,179 TJ
Wind	176 TJ
Biomass (wood)	57,652 TJ
Geothermal and solar	168 TJ
Total RES	69,175 TJ

RES installed capacity (electricity and heat) (2005)

Large Hydro	N.A.
Small hydro	-
Wind	12.0 MW + 100 MW (in 2006)
Solar	-
Biomass	-
Biogas	9.5 MW
Geothermal	-
Total RES installed capacity	21.5 MW

RES Electricity production (2004)

Hydro	3,109 GWh
Wind	49 GWh
Solar	-
Biomass	32 GWh

Biogas	32 GWh
Geothermal	-
RES electricity production	3,190 GWh

RES Heat production

Solar	-
Biomass	4,499 TJ
Biogas	26 TJ
Geothermal	-
Total RES heat production	4,525 TJ

Biofuels production (2006)

Number of biodiesel plants	N.A.
Biodiesel production per year	16,500 t
Number of bioethanol plants	N.A.
Bioethanol production per year	13,000 t
Biodiesel plant capacity	N.A.
Bioethanol plant capacity	N.A.

RES estimated potential

Hydro	100 MW
Wind	800 – 4,500 TJ
Solar	N.A.
Wood potential	44,500 – 82,500 TJ
Straw	2,200 – 8,200 TJ
Biogas	2,000 TJ
Geothermal	N.A.
RES estimated potential	N.A.

RES electricity targets for 2010

Electricity consumption	7,642 GWh
Large hydro plants	2,790 GWh
Small hydro plants	70 GWh
Wind	353 GWh
Biomass and biogas	555 GWh
Total RES	3,768 GWh

LATVIA

Present RES situation

- Most of the renewable primary energy is from wood (82.9 %) and hydro (16.4 %), while wind and biogas have together a small share (0.7 %).
- Bioenergy has the highest potential in Latvia (wood, forest and wood residues), and some hydro and wind energy potential.
- Permissions were issued in 2005 for wind plants (12 MW), biomass cogeneration (9.5 MW). New proposals were received in 2006 for wind and solar plants (100 MW).
- RES is supported mainly through the National Development Plan. Funds are from the European structural funds, Environmental Investment Funds, CEEF programme, Energy Efficiency Fund, commercial banks and state budget subsidies for biofuel production.
- Biofuels support is 230 Euro for 1000 litres of biodiesel and 185 Euro for 1,000 litres of bioethanol.
- No subsidies are given to RES electricity. However, for hydro plants (< 2MW) built before 2003 double tariff applies during 8 years, as well as for wind and small CHP (< 4 MW) with licence received before 2001. The Electricity tariff for cogeneration will be determined by a formula that take into account RES from January 1st 2007.

RES Policies

Feed-in tariffs

According to the new modifications in the Energy Law in 2005, no subsidies are provided for RES electricity. However, double tariff applies for some RES plants

HPP < 2 MW built before 2003 - double tariff during 8 years

Wind – licence received before 2001

CHP < 4 MW licence received before 2001

The new electricity tariff applies for cogeneration from January 1st 2007, according to the following formula $C = T_g * k * n / 9.2$

- k - load coefficient
1.11 - < 0.08 MW;
1.05 - 0.08 – 0.8 MW;
1 - 0.8 – 4 MW
- T_g – tariff of natural gas, Ls/1000 m³;
- n – fuel coefficient
3.8 – for fossil fuels;
4.5 – for RES

Subsidies to biofuel production

Subsidies to biofuel production were granted for specific quotas for biodiesel and bioethanol in 2006 16,455,696 litres bioethanol and 18,181,818 litres biodiesel.

The amount of financial support for biofuels was 230 Euro for 1,000 litres of biodiesel and 185 Euro for 1,000 litres of bioethanol.

Programmes promoting RES

Green Investment Scheme (GIS)

From the World Bank marketing study about GIS projects, 10 types of projects are eligible for support, including RES solar thermal, biogas, biomass, wind energy and hydro energy.

LITHUANIA

General country data

Country population	3,586,000
Country area	65,200 km ²

Energy Production

Total energy production	365,769 TJ
Total electricity production	14,784 GWh
Total electricity consumption	11,818 GWh
Total heat production	49,900 TJ
Total installed capacity (electricity)	4,966 MW
Total installed capacity (heat in DH plants)	9,617 MW

RES share (2005)

RES share in primary energy supply	8.70 %
RES share in electricity consumption	3.89 %
Share of biofuels in fuel transportation	0.30 %

RES national targets (2010)

RES share in the primary energy sources	12 %
RES share in the electricity consumption	7 %

Primary energy balance

Coal	7,189 TJ
Oil	110,437 TJ
Gas	103,692 TJ
Other	112,709 TJ
RES	31,742 TJ
Total Primary energy supply	365,769 TJ

RES in energy supply (2005)

Large hydro	1,377.5 TJ
Small hydro	247.0 TJ
Wind	8.4 TJ
Solar	-
Firewood and wood waste	29,672.0 TJ
Agriculture waste (straw)	113.0 TJ
Biogas	75.5 TJ
Geothermal	121.0 TJ
Total RES consumption	31,760.0 TJ

RES installed capacity (electricity and heat) (2005)

Large hydro	105.0 MW
Small hydro	24.8 MW
Wind (2006)	54.3 MW
Solar	-
Biomass (heat in DH plants)	420.0 MW
Biomass (CHP)	12.0 MWe
	36.0 MW heat
Biogas	0.75 MWe
	1.3 kW heat
Geothermal	17.0 MW heat
Total RES installed capacity	196.9 MWe
	474.3 kW heat

RES Electricity production (2005)

Hydro	450.7 GWh
Large hydro	384.6 GWh.
Small hydro	66.1 GWh
Wind	1.8 GWh
Solar	-
Biomass	7.4 GWh
Biogas	7.0 MWh
Geothermal	-
Total RES electricity production	459.9 GWh

RES Heat production

Solar	-
Biomass	29,735 TJ
Biogas	76.97 TJ
Geothermal	121 TJ
Total RES heat production	29,933 TJ

Biofuels production (2005)

Number of biodiesel plants	1
Biodiesel production per year	3,256 t
Number of bioethanol plants	1
Bioethanol production per year	1,250 t
Biodiesel plant capacity	10,000 t
Bioethanol plant capacity	10,000 t

RES estimated potential

Hydro	1,500 GWh
Wind	850 GWh
Solar	1,300 GWh
Biomass	14,190 GWh
Geothermal	800 GWh
Total RES estimated potential	18,640 GWh

LITHUANIA

Present RES situation

- From the gross inland consumption of total primary energy, 8.68 % is from RES, with firewood and wood waste having the highest share (93.41 %), followed by large hydro (4.33 %), small hydro (0.77 %), geothermal (0.38 %), straw (0.36 %), biogas (0.24 %) and wind energy (0.03 %), bioethanol (0.11 %) and biodiesel (0.37 %).
- Traditional RES used in Lithuania are firewood, wood waste, straw and hydro energy. The most popular recent projects are hydro, biomass combustion, and wind energy.
- RES pilot projects include wind, biogas, geothermal and solar energy.
- The first wind turbine (630 kW) was built in 2004. In 2006 the first wind park of 11 turbines (2 MW each) was erected and connected to the electricity network. The wind plants capacities target is 200 MW for 2010 year and 500 MW for 2020. There are large environmental constraints for wind parks. The electricity network needs to be improved.
- RES electricity is based on large hydro (105 MW) and 77 small hydro plants with a capacity of 24.8 MW. The hydro energy potential is reduced due to environmental requirements. Electricity production in cogeneration units from biomass, biogas and in wind parks is only at initial stage.
- Biomass is used mainly for heat generation. Biomass has started lately to be used into CHP for production of heat and electricity. Most efforts are aimed at developing the use of biomass (wood, chips, wood waste, straw and biogas) and small hydro projects.
- There are some biogas pilot cogeneration units for the production heat and electricity with a capacity of 790 kWe/1268 kWth.
- In 2005 the total capacity of installed wood-chip-fuelled boilers reached 450 MW. No serious obstacles are seen for extension of wood fuel usage. There is created local industry for production biomass combustion equipment.
- Biofuels started (biodiesel and bioethanol) to be produced in 2004.
- There are fixed purchase prices and purchase obligation for RES electricity according to quota up to 2010 year for wind, hydro and bioenergy (without quota for wind turbine capacity below 250 kW).

RES legislation

The major legal acts relevant to local and renewable energy sources (RES) have been selected and revised. These acts include

Law on Energy

The Law on Energy adopted on May 16th, 2002 defines the main objectives of the State in energy regulation

- security of supply;
- energy efficiency;
- reduction of the negative environmental impact;
- promotion of competition;
- promotion of the local and renewable energy use.

According to this Law, the National Control Commission for Prices and Energy approves the purchase price of electricity produced from renewable energy sources.

Law on Electricity

The state encourages consumers to buy electricity produced from renewable and waste energy resources. Electricity produced from renewable and waste energy sources is purchased by long-term tariffs approved by National Control Commission for Prices and Energy (NCCPE) which shall be differentiated according to their type.

Grid operator shall ensure that electricity produced from renewable and waste energy sources should be transported by transmission networks with priority against other electricity (when transport capability is limited).

Law on heat

Objectives of the Law are reliable and high-quality supply of heat on long-term, least cost basis, introduction of motivated competition in the heating sector, enhancement of efficiency of heat production, transportation and consumption, enhancement of usage of local fuel, biofuel and renewable fuels in heat production and reduction of negative impact of energy on environment.

National Energy Strategy

A comprehensive policy on alternative energy was formulated over ten years (1990–2000). A strategy to promote the use of alternative energy sources like biomass, small hydropower, biogas and wind energy has been adopted.

Fixed purchase prices for RES electricity

According to the legislation, electricity suppliers must purchase the electricity produced from RES in Lithuania, up to a limit not exceeding of the established government quota.

There is a fixed purchase price according to quota up to year 2010 or sometimes for a longer period. Beyond 2010, the electricity price will be determined by the market conditions. The quota obligation does not include wind turbine with a capacity less than 250 kW. The fixed purchase price applies for:

- Wind energy 22 ct LTL/kWh (6.37 €ct/kWh);
- Hydro energy (less than 10 MW) 20 ct LTL/kWh (5.80 €ct/kWh);
- Bioenergy – 20 ct LTL/kWh (5.80 €ct/kWh).

Biofuels legislation

The biofuels legislation set by the Law on Biofuel, Biofuels for Transport and Bio-oils, established the share of 5.75 % of biofuels in the total transportation fuels up to 2010.

National Energy Efficiency Programme

This is a Special Programme set as financing instrument for implementation of actions related to energy saving and utilisation of local and renewable energy sources.

The main goals of the programme are the following

- Developing, revising and updating studies and programmes for the utilization of local, renewable and waste energy resources and their implementation.
- Implementation of solar and wind or other demonstration projects for RES utilization. Developing methods and schemes for collecting wood residue and straw for fuel, evaluation and implementation of the methods and schemes.
- Production of equipment that uses local and renewable energy resources while providing necessary assistance to the equipment producing companies.

MALTA

General country data

Country population	400,000
Country area	316 km ²

Energy Production (2004)

Total energy production	-
Total electricity production	2,216 GWh
Total electricity consumption	1,930 GWh
Total heat production	-
Total installed capacity (electricity)	582 MW
Total installed capacity (heat)	-

RES share (2005)

RES share in primary energy supply	N.A.
RES share in electricity consumption	-
Share of biofuels in fuel transportation	0.52 %

RES national targets (2010)

RES share in the primary energy sources	N.A.
RES share in the electricity consumption	5 %

Primary energy balance

Coal	-
Oil	38,100 TJ
Gas	-
Other	-
RES	N.A.
Total Primary energy supply	38,100 TJ

RES in energy supply

Large hydro	-
Small hydro	-
Wind	-
Solar	N.A.
Biomass	-
Geothermal	-
Total RES	N.A.

RES installed capacity (electricity and heat)

Large Hydro	-
Small hydro	-
Wind	-
Solar	11,000 SWH units
Solar PV	10 kWp
Biomass	-
Biogas	-
Geothermal	-
Total RES installed capacity	-

RES Electricity production

Hydro	-
Wind	-
Solar	-

Biomass	-
Biogas	-
Geothermal	-
Total RES Electricity production	-
RES Heat production	
Solar	N.A.
Biomass	-
Biogas	-
Geothermal	-
Total RES heat production	-
Biofuels production	
Number of biodiesel plants	N.A.
Biodiesel production per year	812 t
Number of bioethanol plants	N.A.
Bioethanol production per year	-
Biodiesel plant capacity	N.A.
Bioethanol plant capacity	-
RES estimated potential	
Hydro	-
Wind onshore	82 GWh
Wind offshore	52 GWh
Solar PV	138 GWh
Solar SWH	74 GWh
Biomass (solid and liquid waste)	84 GWh
Geothermal	-
Total RES estimated potential	430 GWh

Source Prepared from the IEA Statistics and Presentation at the Workshop

MALTA

Present RES situation

- Malta has a limited land area (316 km²), of which 21% built-up, and a high population density of 1,273 per km².
- The main RES potential for electricity is from solar photovoltaic (6.9 %), onshore wind (4.1 %), offshore wind (2.6 %), solid and liquid waste (4.2 %) and solar water heaters (electricity to be displaced - 3.7%).
- RES is supported through grants for installing solar water heaters, roof top PV installations and micro-wind turbines. Net metering applies for electricity from PV systems.

RES Policy

An energy regulator - the Malta Resources Authority (MRA) has been set up.

Draft Energy Policy

A Draft Energy Policy is currently under review after public consultation. Institute for Energy Technology (IET) formulated several recommendations such as:

- Considering the small scale projects too as well as realistic turbine sizes not just extremes (micro and 2-5MW) and giving more importance to wind energy;
- Improvement of the feed-in system proposed and increasing the limit of 3.7 kWp for PV systems that can be grid connected;
- Acknowledge that the renewable sources potential is significantly higher and set realistic but attainable targets.

RES investment support

The Government budget law (2006) included incentives in the form of grants that were extended to apply to most energy saving or electricity displacing systems.

Enemalta offers a grant of 162 € for Solar Water Heating (SWH) installations, applicable to new customers only, as well as 15 % up to 230 € grant towards installing a SWH (for households). A 20% grant for roof top PV installations and micro-wind turbines is also provided. Net metering is set for the electricity from PV systems, which yields to €ct 12.6/kWh. Surplus exported to the grid amount at 6.3 €ct /kWh. There is a one-off charge of 46 € for the extra meter.

POLAND

General country data

Country population	38,537,000
Country area	312,685 km ²

Energy Production (2004)

Total energy production	3,299,826 TJ
Total electricity production	154,159 GWh
Total electricity consumption	130,510 GWh
Total heat production	345,888 TJ
Total installed capacity (electricity)	30,840 MW
Total installed capacity (heat)	N.A.

RES share

RES share in primary energy supply (2003)	4.0 %
RES share in electricity consumption (2005)	3.1 %
Share of biofuels in fuel transportation (2004)	0.3 %

RES national targets (2010)

RES share in the primary energy sources	7.5 %
RES share in the electricity consumption	10.5 %

Primary energy balance (2004)

Coal	2,268,994 TJ
Oil	907,238 TJ
Gas	497,183 TJ
Electricity export	33,453 TJ
RES	201,092 TJ
Total Primary energy	3,841,054 TJ

RES in energy supply (2004)

Hydro	3,961 GWh
Wind	142 GWh
Solar	-
Biomass	190,261 TJ
Biogas	1,953 TJ
Geothermal	318 TJ
Total	206,791 TJ

RES in energy supply (2003)

Large hydro	N.A.
Small hydro	8,000 TJ
Wind	20 TJ
Solar	30 TJ
Biomass	164,000 TJ
Geothermal	500 TJ
Total RES	173,000 TJ

RES installed capacity (electricity and heat) (2004)

Large hydro	638 MW
Small hydro	243 MW
Wind	65 MW
Solar	122,240 m ²
Biomass	51.9 MWe

Biogas	22 MWe
Geothermal	-
Total RES installed capacity	1,020 MW

RES Electricity production (2005)

Hydro	2,175 GWh
Wind	135 GWh
Solar	-
Biomass CHP	467 GWh
Biomass co-firing	877 GWh
Biogas CHP	103 GWh
Geothermal	-
Total RES electricity production	3,757 GWh

RES Heat production (2004)

Solar	-
Biomass	3,621 TJ
Biogas	549 TJ
Geothermal	-
Total RES heat production	4,170 TJ

Biofuels production (2005)

Number of biodiesel plants	-
Production of biodiesel per year	-
Number of bioethanol plants	N.A.
Bioethanol production per year	87,416 t
Biodiesel plant capacity	-
Bioethanol plant capacity	-

RES estimated potential

Hydro	49,000 TJ
Wind	281,000 TJ
Solar	445,000 TJ
Biomass	755,000 TJ
Geothermal	220,000 TJ
Total RES estimated potential	1,750,000 TJ

RES-Electricity from different sources in 2010

Biomass	2.5 %
Hydro	2.0 %
Wind	2.5 %
Biogas	0.5 %
Total	7.5 %

Source Prepared from the Presentation at the Workshop

POLAND

Present RES situation

- The Polish support system for green electricity production after 2000 is a mixed system investment support and quota system. The support for the investment is provided from national ecological funds (grants or preferential credits) and EU programmes.
- Within the primary energy balance, RES energy comes from biomass (94.8 %), small hydro (4.6 %), geothermal (0.3 %), solar (0.02 %) and wind (0.01 %).
- RES electricity in 2005 was produced from hydro (58 %), biomass co-firing (23 %), biomass CHP (12 %), wind (4 %) and biogas (3 %).
- Solar thermal capacity in Poland 2005 reached 122,240 m² (in 94,105 individual systems and 28,135 collective systems), of which 27,653 m² installed in 2005.
- Biomass heat was produced in 2005 in 250,000 individual wood boilers (> 500 kW) with a total capacity of 6,500 MW, 250 wood district heating systems with a total capacity of 820 MW, 150,000 individual wood boilers (<500 kW) with a total capacity of 730 MW, 120 straw district heating (>500 kW) with a total capacity of 185 MW and 250 small scale straw fired boilers (<500 kW) with a total capacity of 48 MW.
- From a production of 87,416 t ethanol in 2005, only 59,814 t was used on the internal market while from a production of 63,866 t RME, only 2,122 t were used for internal consumption.

RES policy

The Energy law and decree of Ministry of Economy set an obligation of purchase of energy produced from RES. A quota of 10.5 % RES in the total electricity supply to final consumers was set by 2010 (equivalent of 7.5 % in the gross electricity consumption according to indicative target).

RES support

Quota obligation

A mixed system is set investment support and quota system. The support for the investment is provided from national ecological funds (grants or preferential credits) and EU programmes. A quota obligation and tradable Green Certificates operated since 2005 (7.5 %) together with the penalties followed by voluntary charge for non-compliance (240 PLZ/MWh). The standard charge for non-compliance amounts to 240 PLZ/MWh and the penalty for non-compliance is 1.3 x standard charge. Distribution companies are obliged to buy green electricity at the market price of black electricity. Certificates of origin should be provided for the green electricity produced. Biomass co-firing is considered eligible as green electricity. The quota obligation was increased from 7.5 % to 9 % in 2010. The total income for the RES electricity (small hydro plants < 5MW, wind - 30MW, large hydro - 100 MW, biomass CHP – 10 MW, biomass co-firing - 2000 MW) comprises the price of electricity (118 PLZ /MWh) and price of Tradable Green Certificates (estimated at 200 PLZ /MWh).

Operational programme

Programme Infrastructure and environment

The supported RES related priorities/activities are included within the Priority 10 “Energy infrastructure friendly to environment”, action 10.2 “Increased generation of energy from RES”
The projects types eligible for support (above 5 MEuro) include biomass electricity (up to 10 MWe), biomass and geothermal CHP, green heat production, biofuels (biodiesel) production and renewable energy technologies (all type) equipment production facilities. The funds are provided from EU/national/private contributions amounting 334.2/59/219 M€, respectively.

Programme Innovative economy

The RES related priorities/activities for support are included under the Priority 4 “Investment in innovative technologies and products” (including especially those having positive impact on environment). The eligible projects types (above 5 M Euro) include RTD projects, development and implementation of know-how, investment in modern (national scale at least) research and innovation and investment support for industrial and private research and development centres. The funds come from EU and national contributions, amounting respectively to 2,838 and 425 M Euro.
Source Prepared from the Presentation at the Workshop

SLOVAKIA

General country data

Country population	5,440,000
Country area	48,845 km ²

Energy Production (2005)

Gross inland consumption	802,000 TJ
Total electricity production	31,294 GWh
Total electricity consumption	28,572 GWh
Total heat production (2004)	62,535 TJ
Total installed capacity (electricity)	8,297 MW
Total installed capacity (heat)	729 MW

RES share (2004)

RES share in primary energy supply	3.9 %
RES share in electricity consumption (2005)	15.9 %
Share of biofuels in fuel transportation	3.9 %

RES national targets (2010)

RES share in the primary energy sources	6.7 %
RES share in the electricity consumption	19.0 %

Primary energy balance (2005)

Coal	171,924 TJ
Oil	237,686 TJ
Gas	247,134 TJ
Other	109,942 TJ
RES	35,470 TJ
Gross inland consumption	802 156 TJ

RES in energy supply (2005)

Hydro	16,697 TJ
Wind	25 TJ
Solar	1 TJ
Biomass	18,410 TJ
Geothermal	337 TJ
Total RES	35,470 TJ

RES installed capacity (electricity and heat)

Large Hydro	1,633 MW
Small hydro	70 MW
Wind	1.2 MW
Solar	-
Biomass	28 MW
Biogas	1.3 MW
Geothermal	131 MW _{th}
Total RES installed capacity	1,864.5 MW

RES Electricity production (2004)

Hydro	4,100 GWh
Wind	6 GWh
Solar	-
Biomass	33 GWh
Biogas	2 GWh

Geothermal	-
Total RES electricity production	4,141 GWh

RES Heat production (2004)

Solar	45 TJ
Biomass	1,354 TJ
Biogas	-
Geothermal	144 TJ
Total RES heat production	1,543 TJ

Biofuels production

Number of biodiesel plants	-
Biodiesel production per year	-
Number of bioethanol plants	-
Bioethanol production per year	-
Biodiesel plant capacity	-
Bioethanol plant capacity	-

RES estimated potential

	Electricity	Heat
Large Hydro	5,600 GWh	
Small Hydro	1,000 GWh	
Wind	600 GWh	
Solar	1,540 GWh	34,000 TJ
Biomass	1,300 GWh	75,600 TJ
Biogas	500 GWh	6,900 TJ
Geothermal	60 GWh	22,700 TJ
Total	10,600 GWh	139,200 TJ

Source Prepared from the Presentation at the Workshop

SLOVAKIA

Present RES situation

- Slovak Republic is strongly dependent on the import of primary energy sources - 77 % of coal, 98 % of gas, and 99 % of crude oil.
- The hydro power plants include 27 hydro power plants including 1 pumped storage and one accumulation with pumped storage, hydropower plant Gabčíkovo, with a total capacity of 2,273 MW, producing about 9% of electricity in Slovakia (4,632 GWh in 2005).
- RES electricity (14.4 % share in total electricity production in 2004) is produced in hydro power plants (96.93 %), wind power plants (0.14 %), biomass (2.88 %), and biogas (0.05 %).
- RES heat is mainly produced from biomass (1,354 TJ) and in a small amount from geothermal (45 J) and solar energy (45 TJ).
- The highest RES exploitable potential for electricity production comes from hydro (5,900 GWh), followed by biomass (1,300 GWh), wind power (550 GWh), biogas (500 GWh), geothermal (40 GWh) and solar energy (10 GWh).
- Biomass has the relatively highest share of available potential for RES heat. This comes mainly from forestry biomass, but also agricultural biomass and biogas.
- Feed-in prices are set only for the years 2006 and 2007, on the assumption of maximum pay-back period of 12 years, but they do not take into account the plant capacity.
- A license is not necessary for the construction, start-up and operation of power plants producing RES electricity under 5 MW capacity, or for production of biogas.
- There is an obligation on the heat distribution company to buy the heat supplied by the RES at a fixed feed-in price without increasing the price for final consumer.
- RES are promoted through national programmes (scheme supporting energy conservation and RES exploitation and environmental fund) and Structural Funds of the EU.

The Energy Act (Act No 656/2004 Coll. on Energy)

A license is not necessary for the construction, start-up and operation of power plants producing RES electricity under 5 MW installed capacity. No license is necessary for the production of biogas. Ministry of Economy can set the obligation of preferential access to the grid, preferential transmission and distribution of RES electricity and preferential supply of RES electricity.

The Govt. Regulation No 124/2005 Coll. on the Rules governing the functioning of electricity market put an obligation on the distribution system operators to buy preferentially RES electricity.

RES heat

The Act No 657/2004 Coll. on Heat Energy Management included the obligation of the operators of heat distribution network to buy the heat supplied by the RES operator at feed-in price set by the Office for the Regulation of Network Industries. The regional support for RES heat is declared through the obligatory development plan of the region, district and municipality.

Biomass for energy purpose

The Government Regulation No 1149/2004 on the Concept of Exploitation of the Agricultural and Forest Biomass for Energy Purpose addresses the possibility of annual production of agricultural & forest biomass suitable for energy exploitation and its energy potential.

The Act No 555/2005 Coll. on Energy Efficiency of Buildings includes the obligation to evaluate the possibility of RES utilisation in new large buildings.

Biofuels legislation

The Government Decree No1022/2005 on the National Programme of Biofuels Development was adopted for the implementation of Biofuels Directive 2003/30 EC and Directive 2003/96/EC on energy taxation. It also approved the Biofuels strategy in Slovakia up to 2010. The Govt. Regulation 246/2006 on the Minimum Amount of Motor Fuels Produced from RES set the target of the bio component to reach the share of 2 % (by energy content) in motor fuels (Diesel oil, petrol) consumption up to December 31st 2009 and the bio component target of 5.75 % for January 1st 2010.

Feed-in prices

The Decrees No 2/2005 and No 2/2006 of the Regulatory Office for Network Industries introduced fixed feed-in prices for electricity produced by RES.

Feed-in prices are set only for the years 2006 and 2007.

Regulatory Office for Network Industries set the feed-in prices on the assumption of maximum pay-back period of 12 years.

Small hydro (< 5 MW)	Installed before 2005	4.9 €cent / kWh
	Installed after 2005	5.9 €cent / kWh
Solar power		20 €cent / kWh
Wind Power	Installed before 2005	6.5 €cent / kWh
	Installed after 2005	7.3 €cent / kWh
Biomass	Dedicated biomass	7.8 €cent / kWh
	Waste biomass inst. before 2005	5.2 €cent / kWh
	Waste biomass inst. after 2005	7.0 €cent / kWh
Biogas combustion		6.5 €cent / kWh

National programmes

Different National Programmes for RES promotion include a scheme supporting energy conservation and RES exploitation and the Environmental Fund.

Industry & Services operational Programme

The Structural Funds of the EU provide funding for the Agriculture and Rural development as Investments into agricultural farms, Improvement of processing and marketability of agricultural products. It also provides Support of energy conservation and RES exploitation (Priority 1.4)

The Support of energy conservation and RES exploitation consists of 2 schemes

- **De minimis** support scheme for smaller projects (support from 2600 EUR to 100 000 EUR). It provided support for 17 projects in the implementation phase, of which 6 projects RES (1 small hydro power plant, 1 geothermal heating plant, 4 biomass utilisation).
- **State Support Scheme** for bigger projects (from 50,000 EUR up to 5,000,000 EUR). It provided “State Support” for 34 bigger projects implemented, of which 16 RES projects (small hydro power plants, geothermal heating plants, biomass utilisation).

SLOVENIA

General country data

Country population	2,000,000
Country area	20,273 km ²

Energy Production (2004)

Total energy production	140,215 TJ
Total electricity production	15,279 GWh
Total electricity consumption	13,650 GWh
Total heat production	9,720 TJ
Total installed capacity (electricity)	2,965 MW
Total installed capacity (heat)	N.A.

RES share (2005)

RES share in primary energy supply	11.6 %
RES share in electricity consumption	24.0 %
Share of biofuels in fuel transportation	-

RES national targets (2010)

RES share in the primary energy sources	15 %
RES share in the electricity consumption	33.6 %

Primary energy balance (2004)

Coal	63,765 TJ
Oil	107,224 TJ
Gas	37,597 TJ
Nuclear	59,578 TJ
Hydro	14,779 TJ
Biomass	20,097 TJ
Total Primary energy supply	300,235 TJ

RES in energy supply (2004)

Hydro	14,779 TJ
Wind	-
Solar	-
Biomass	20,097 TJ
Geothermal	-
Total RES	34,876 TJ

RES installed capacity (electricity and heat)

Large Hydro	831	MW
Small hydro	143	MW
Wind	0.01	MW
	+ 28.9	MW (authorised)
Solar PV	0.1	MW
Solar thermal	80.000 – 100.000	m ² solar collectors
Biomass	21	MW
Sewage plants capacity	1.8	MW
Biogas	5	MW
Geothermal	-	
RES electricity installed capacity	1,031	MW

RES Electricity production (2004)

Hydro	4,102	GWh
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Wind	-
Solar	-
Biomass	96 GWh
Biogas	30 GWh
Geothermal	-
Small RES units	470 GWh
Total RES electricity production	4,228 GWh

RES Heat production

Solar	N.A.
Biomass	405 TJ
Biogas	N.A.
Geothermal	-
Total RES heat production	405 TJ

Biofuels production

Number of biodiesel plants	N.A.
Biodiesel production per year	N.A.
Number of bioethanol plants	-
Bioethanol production per year	-
Biodiesel plant capacity	N.A.
Bioethanol plant capacity	-

RES estimated potential in 2020

Small hydro	200 MW
Wind	600 MW
Solar	10 MW
Biomass	40 MW
Geothermal	40 MW
Total RES estimated potential	695 MW
Total RES estimated potential	39,000 TJ

Source Prepared from IEA Statistics and the Country Presentation at the Cyprus Workshop

SLOVENIA

Present RES situation

- The RES electricity capacity in Slovenia is about 923 MWe, of which 796 MWe in large Hydro and 127 MWe in small capacity (<10 MW) small hydro (100 MW), biomass (21 MW), Landfill gas (4.3 MW), sewage gas (1.8 MW), biogas (0.5 MW), PV (0.1 MW), wind (0.01MW).
- More than 30 % of electricity is produced from RES (5th EU-25), including large hydro plants (470 GWh in small RES units and 2655 GWh in large plants).
- The support schemes for RES include the feed-in tariffs (FIT) for qualified producers. Uniform price or binomial tariff (day/night, seasons) applies. The premium for electricity is varied by technology and primary source

Energy legislation

The Energy policy gives priority to energy efficient use and renewable energy supply rather than from non-renewable energy sources. It sets legal basis to grid system issues for qualified producers (QP) using renewable sources or high efficiency cogeneration.

The energy law sets the status of “Qualified electricity producers” (QP) having a CHP average efficiency above 78 % and use of renewable energy sources (RES).

The network system operators are obliged to purchase all electricity offered by qualified producers at the price determined by the Government. They are obliged to conclude long-term (10 years) feed-in contracts and for a payment of a premium for the independent electricity sales of qualified producers.

Feed-in Tariffs (FIT) for Qualified Producers (QP)

Uniform price or binomial tariff (day/night, seasons) applies. The premium for electricity is varied by technology and primary source

- 100% for independent electricity sales;
- 30% for own electricity use (without use of public network).

The feed-in tariffs are reduced by 5% on transmission network, after 5 years, for each 10 % investment subsidy and by 10 % after 10 years of operation. For micro installations (< 36 kW), a household tariff is applied according to a net metering of electricity. The feed-in tariff is renewed once per year according to inflation rate. The feed-in tariffs are:

		Uniform price	Premium
Landfill	< 1 MWe	5.3 €ct/kWh	2.0 €ct/kWh
	< 1 MWe	4.9 €ct/kWh	1.6 €ct/kWh
Geothermal		5.9 €ct/kWh	2.5 €ct/kWh
Wind	< 1 MWe	6.1 €ct/kWh	2.7 €ct/kWh
	< 1 MWe	5.9 €ct/kWh	2.6 €ct/kWh
Small hydro	< 1 MWe	6.1 €ct/kWh	2.8 €ct/kWh
	< 1 MWe	5.9 €ct/kWh	2.6 €ct/kWh
Biomass	< 1 MWe	7.0 €ct/kWh	3.6 €ct/kWh
	< 1 MWe	6.7 €ct/kWh	3.4 €ct/kWh
Biogas		12.1 €ct/kWh	8.7 €ct/kWh
PV	< 1 MWe	37.4 €ct/kWh	6.4 €ct/kWh
	< 1 MWe	34.0 €ct/kWh	3.1 €ct/kWh

SUMMARY OF RENEWABLE ENERGY SOURCES DATA

CANDIDATE COUNTRIES

BULGARIA

General country data

Country population	7,385,000
Country area	110,910 km ²

Energy Production (2004)

Total energy production	879,895 TJ
Total electricity production	38,600 GWh
Total electricity consumption	24,040 GWh
Total heat production	50,754 TJ
Total installed capacity (electricity)	13,850 MW
Total installed capacity (heat)	N.A.

RES share (2005)

RES share in primary energy supply	4.9 %
RES share in electricity consumption	5.1 %
Share of biofuels in fuel transportation	< 1 % (expert estimation)

RES national targets (2010)

RES share in the primary energy sources	5.2 %
RES share in the electricity consumption	11 %

Primary energy balance (2005)

Coal	345,891 TJ
Oil	215,727 TJ
Gas	117,738 TJ
Hydro	7,908 TJ
Biomass	34,895 TJ
Nuclear	177,862 TJ
Total primary energy supply	900,020 TJ

RES share in energy supply

Hydro	7,908 TJ
Wind	-
Solar	-
Biomass	34,895 TJ
Geothermal	-
Total RES	43,144 TJ

RES installed capacity (electricity and heat)

Large Hydro	2,563 MW
Small hydro	22.956 MW
Wind	7.665 MW
Solar thermal	42 MW
Biomass	18.750 MW
Biogas	~ 0 MW
Geothermal	94.5 MWth
Total installed RES capacity	2,748.871 MW

RES Electricity production

Hydro	36.416 GWh
Wind	4.3 GWh
Solar	-

Biomass	-
Biogas	-
Geothermal	-
Total RES electricity production	40.716 GWh

RES Heat production

Solar	162 TJ
Biomass	10,242 TJ
Biogas	-
Geothermal	1,368 TJ
Total RES heat production	11,772 TJ

Biofuels production

Number of biodiesel plants	3
Biodiesel production per year	N.A.
Number of bioethanol plants	-
Bioethanol production per year	-
Biodiesel plant capacity	N.A.
Bioethanol plant capacity	-

RES estimated potential

Hydro	26,540 GWh
Wind	3,283 GWh
Solar	4,535 GWh
Biomass	113,000 TJ
Geothermal	14,667 TJ
Total RES estimated potential	251,000 TJ

BULGARIA

Present RES situation

- The available RES potential in Bulgaria comes from biomass (113,000 TJ), hydro (26,540 GWh), geothermal (14,667 TJ), solar (4,535 GWh) and wind energy (3,283 GWh).
- The biomass energy potential comes from wood (1,100 ktoe), agricultural plant waste (1,000 ktoe), agricultural animal waste (320 ktoe), oil crops (rapeseed and sunflower, 117 ktoe), industrial waste (77 ktoe) and landfill gas (68 ktoe).
- The solar thermal installations have a total area of 56,000 m² in Bulgaria with total installed capacity of about 42 MW. Solar thermal market is estimated to be around 5,000 m²/year.
- RES electricity is produced in 26 small hydro plants (36,416 MWh) with a capacity of about 23 MW and in 6 wind turbines (4,300 MWh) with a capacity of 1 MW.
- RES heat is produced in 12 geothermal plants (80,040 MW thermal power) with installed capacity of 26.7 MW and in biomass plants (56,250 MWh) with a capacity of 18.750 MW.
- The highest share in the RES electricity in the next 10 years will come from hydro and biomass; geothermal and solar thermal installations will provide the major share of heat.

RES legislation

The main RES legislation includes the Energy Law (2006), Energy Efficiency Law (2004) and the Environment Protection Act, which introduces the scheme for trading quotes for greenhouse gasses. The Water Act (1999) deals with building small hydro plants and geothermal installations.

Possibilities for financial support of RES

The Kozloduy International Decommissioning Support Fund (KIDSF)

The financial support under Kozloduy International Decommissioning Support Fund (KIDSF) administered by EBRD could be also provided for the use of RES (wind, hydro, biomass, solar). The support could be as a pure grant or partial financing in various co-financing structures with other loan applications. Usually the RES projects receive a 20% discount on the loan after project completion.

USAID Programme

Under this programme between USAID and some banks (credit lines), it will guarantee up to 50% of the credit. Additionally a consultant helps the clients to develop the respective projects.

Energy Efficiency Fund

The Energy Efficiency Fund supports the introduction of solar collectors in the building sector, an activity which is considered energy efficient.

Biofuels support

The production of biofuels in Bulgaria is in its infancy. The biodiesel is free of excise duty, which makes it more able to compete with the traditional diesel.

CROATIA

General country data

Country population	4,495,000
Country area	56,542 km ²

Energy Production (2995)

Total primary energy supply	411,660.0 TJ
Total electricity production	12,458.9 GWh
Total electricity consumption	17,571.8 GWh
Total heat production	9,723.6 TJ
Total installed capacity (electricity)	3,983.26 MW
Total installed capacity (heat)	2,358.0 MW

RES share (2005)

RES share in primary energy supply	3.60 % (fuel wood)
	0.05 % (other than fuel wood)
RES share in electricity consumption	0.12 %
Share of biofuels in fuel transportation	-

RES national targets (2010)

RES share in the primary energy sources	N.A.
RES share in the electricity consumption	N.A.

Primary energy balance

Coal	32,932.8 TJ
Oil	181,953.7 TJ
Gas	100,856.7 TJ
Hydro	62,572.3 TJ
Fuel wood	14,819.8 TJ
Other RES	205.8 TJ
Electricity	18,524.7 TJ
Total Primary energy supply	411,660.0 TJ

RES in energy supply

Large hydro	17,380.0 GWh
Small hydro	108.3 GWh
Wind	9.5 GWh
Solar electricity	50.1 MWh
Biomass heat	14,770.0 TJ
Biomass electricity	10.9 GWh
Geothermal heat	547.0 TJ
Total RES in energy supply	77,590.0 TJ

RES installed capacity (electricity and heat - 2005)

Large Hydro	2,056.3 MW
Small hydro	26.7 MW
Wind	5.95 MW
	+ 17.2 MW (new)
Solar PV	48.8 kW
Biomass thermal	512 MW
	+ 3 MW (new)
Biomass electricity	-
Biogas electricity	2 MW (new)

Geothermal thermal	114 MW
Total RES installed capacity	2,108 MWe + 629 MWth

RES Electricity production

Large Hydro	6,431.0 GWh
Small Hydro	108.3 GWh
Wind	9.5 GWh
Solar	50.14 MWh
Biomass	- GWh
Biogas	10.9 GWh
Geothermal	- GWh
Total RES electricity production	6,559.75 GWh

RES Heat production

Solar	N.A.
Biomass	14,767 TJ
Biogas	0 TJ
Geothermal	547 TJ
Total RES heat production	15,314 TJ

Biofuels production

Number of biodiesel plants	-
Biodiesel production per year	-
Number of bioethanol plants	-
Bioethanol production per year	-

RES estimated (technical) potential

Hydro (> 5 MW) (economic)	88,500 TJ
Hydro (< 5 MW)	6,600 TJ
Wind	10,000 TJ
Solar (economic)	3,900 TJ
Biomass	39,000 TJ
Biofuels	8,000 TJ
Geothermal	14,000 TJ
Total RES estimated potential	170,000 TJ (46% of 2001 TPES)

CROATIA

Present RES situation

- Within total primary energy supply (411.66 PJ), hydro has a share of about 15.2 %, fuel wood about 4,5% and other RES than fuel wood is 0,05%.
- RES electricity is produced in small hydro (26.7 MW) plants, 5.95 MW wind turbines, 2 MW biogas plants and in small solar plants of 48.84 kW.
- RES heat in 2005 was mainly produced in biomass plants (14,767 TJ in industrial plants and households) with a capacity of 512 MW only in industrial heating plants but also in the geothermal plants (547 TJ) with a capacity of 114 MW.
- Wood is an important source for households as fuel wood, but there is also a significant production of briquettes, charcoal and pellets.
- Most recent RES projects in Croatia include a new wind power plant with a total capacity of 17 MW, a biomass district heating plant of 3 MW and a landfill gas plant of 2 MW, but also two biodiesel plants of 20,000 and 6,000 t/year, respectively.
- RES legislation is still in preparation and includes a feed-in tariffs proposal. It is expected to be in place in 2007.
- The biofuels legislation (Energy Act) recognised biofuels as RES, defined quality standards and requirements and national indicative target of 5.75% by end of 2010. There are no incentives (tax exemption) regulations.

RES electricity legislation

Legislation in preparation since 2001. At beginning of 2007 the following acts has been sent to Government for approval

- Regulation on the minimum share of RES&C electricity
- Tariff system for RES&C electricity
- Regulation on compensation for RES&C electricity incentives

The following acts are in final preparation phase and will be sent soon for Government approval

- Ordinance on RES&C utilisation
- Ordinance regarding eligible producer status

RES Heat Legislation

The RES Heat Legislation - Law on production, distribution and supply of heat - includes two sublaws on RES heat addressing the minimum share of RES heat and providing financial incentives for RES heat. Not yet in place.

Biofuels Legislation

Within the energy Act biofuels are recognised as RES. The law provides definition and classification of biofuels. The Regulation of quality standards for biofuels (November 2005) defines quality standards and requirements and also defines the national indicative target of 5.75 % by end of 2010. The incentives (tax exemption) regulation is not adopted. In 2007 the Government has adopted the Plan for placing biofuels on the domestic market, with the indicative share of 0.9 % of biofuels in total motor fuels consumption for 2007.

Feed-in tariffs (proposal) for RES&C electricity

	<1 MW	>1 MW
Small hydro	9.20 €cent/kWh	6.20 €cent/kWh
Wind	7.97 €cent/kWh	7.70 €cent/kWh
Biomass	12.84 €cent/kWh	11.22 €cent/kWh
Geothermal	16.89 €cent/kWh	16.89 €cent/kWh
Biogas, liquid biofuels	11.89 €cent/kWh	10.95 €cent/kWh
Landfill gas	4.86 €cent/kWh	4.86 €cent/kWh
Wave, tidal	8.00 €cent/kWh	6.67 €cent/kWh
Solar PV (<30 kW, >30 kW)	45.95 €cent/kWh	39.86 €cent/kWh

Source Prepared from the Presentation at the Workshop

ROMANIA

General country data

Country population	22,300,000
Country area	238,390 km ²

Energy Production (2004)

Total energy production	1,176,910 TJ
Total electricity production	56,499 GWh
Total electricity consumption	38,775 GWh
Total heat production	135,425 TJ
Total installed capacity (electricity)	19,626 MW
Total installed capacity (heat)	N.A.

RES share (2004)

RES share in primary energy supply	12.2 %
RES share in electricity consumption	29.9 %
Share of biofuels in fuel transportation	-

RES national targets (2010)

RES share in the primary energy sources	11.0 %
RES share in the electricity consumption	33.0 %
Mandatory RES-E quotas for suppliers	8.3 %

Primary energy balance (2004)

Coal	371,076 TJ
Oil	406,120 TJ
Gas	583,766 TJ
Hydro	59,453 TJ
Nuclear	60,541 TJ
Biomass	134,982 TJ
Geothermal	3,349 TJ
Imported electricity	4,270 TJ
Total Primary energy supply	1,618,450 TJ

RES share in energy supply (2004)

Hydro	59,453 TJ
Wind	-
Solar	-
Biomass	134,982 TJ
Geothermal	3,349 TJ
Total RES	197,784 TJ

RES installed capacity (electricity and heat)

Large Hydro	6,139 MW
Small hydro	196 MW
Wind	1.4 MW
Solar	-
Biomass heat	1,242 MWth
Biomass electricity	0.2 MW
Biogas	-
Geothermal heat	320 MWth
Total RES installed capacity	6336.6 MWe + 1562 MWth

RES Electricity production (2004)

Large hydro	15,855 GWh
Small-scale hydro	658 GWh
Wind	2 GWh
Solar	-
Biomass	4 GWh
Biogas	-
Geothermal	-
Total RES Electricity production	16,518 GWh

RES Heat production (2004)

Solar	167 TJ
Biomass	127,572 TJ
Biogas	-
Geothermal	2,847 TJ
Total RES heat production	130,586 TJ

Biofuels production

Number of biodiesel plants	-
Biodiesel production per year	-
Number of bioethanol plants	-
Bioethanol production per year	-
Biodiesel plant capacity	-
Bioethanol plant capacity	-

RES estimated potential

Large Hydro	34,000 GWh
Small Hydro	6,000 GWh
Wind	23,000 GWh
Solar thermal	60,000 TJ
Solar electricity	1,200 GWh
Biomass thermal	318,000 TJ
Biogas potential	24,600 TJ
Geothermal	7,000 TJ
Total RES estimated potential	64,200 GWh
	+ 409,600 TJ

Source Prepared from IEA Statistics and the Presentation at the Workshop

ROMANIA

Present RES situation

- From the total primary energy sources, biomass (including fuel wood) is about 6.4 % and hydro and nuclear 5.2 %.
- RES electricity is mainly produced in large and small hydro plants. Nuclear still seen as technology of priority, and large hydro covering all "clean energy obligations".
- Decreasing use of biomass for heating in rural areas, replaced by the natural gas utilisation, in the conditions of the extension of natural gas network.
- Solar thermal of 300 MW installed, of which only about 1/3 are operational, almost all need refurbishment / modernisation.
- In 2004, the first 660 kW wind plant became operational. In 2005, 5 more units of 1.4 MW were installed. About 100 MW small hydro plants are in operation in 2005.
- Intended investments for new RES capacities in the period 2003-2010, amount for 887.5 M€ in total, of which 75 M€ for solar thermal plants, 7.5 M€ for solar PV, 120 M€ for wind, 150 M€ for hydro plants, 240 M€ for biomass thermal, 280 M€ for biomass electricity, 15 150 M€ geothermal projects.
- The planned yearly RES-electricity production by 2010 amount 1.86 GWh from PV, 0.3 TWh from wind, 18.2 TWh from hydro (1.1 TWh of it small hydro) and 1.1 TWh from biomass.

RES policies

The RES policies are set by the Electricity Law No. 318/2003, National strategy for RES use (Government Decision (GD) No.1535/2003) and GD No. 443/2004 for Promotion of the Electricity produced from RES.

Green certificates

A mandatory quota system with Tradable Green Certificates (TGC) for RES-E has been adopted in 2004 (GD No.1892/2004 and No.958/2005) to promote electricity production from renewable energy sources. The mandatory quota increases from 0.7 % in 2005 to 8.3 % in 2010.

The Green Certificates are issued to electricity production from wind, solar, biomass or hydro power generated in plants with less than 10 MW capacity. Guaranties of Origin for all electricity produced from renewable energy sources are issued and monitored by the regulator (GD No.1429/2004 - certification rules for the origin of power supply produced by RES).

The system was adopted since it is seen as a market oriented mechanism that allows a fair allocation of costs among final electricity consumers.

The minimum and maximum price levels for Green Certificates are established by the regulator (minimum value 24 Euro / MWh and maximum value 42 Euro / MWh). Penalties for non fulfilment of the quota are 63 Euro/Certificate between 2005 and 2007 and 84 Euro/Certificate between 2008 and 2012. The collected penalties are designated to RES producers for investments necessary to promote the use of RES.

Programmes

The Romanian Energy Efficiency Fund (2002) includes support for the use of RES for heating. Support is provided for financing environmental projects for businesses, NGOs, local public authorities and education institutions in the form of loans and grants. The payment is made after the projects are completed.

A Programme has been introduced for local public authorities for the rehabilitation of district heating systems, intending to increase efficiency and reducing the consumption of fossil fuels.

The programme offers a support of 30 % of co-financing for the refurbishment, modernisation of production systems or thermal energy networks and for investments in RES for existing or new district heating systems (it applies only for local public authorities).

Source Prepared from the Presentation at the Workshop

TURKEY

General country data

Country population	72,600,000
Country area	780,580 km ²

Energy Production (2005)

Total energy production	1,054,445 TJ
Total electricity production	162,619 GWh
Total electricity consumption (2004)	119,618 GWh
Total heat production (2004)	18,831 TJ
Total installed capacity (electricity) (2006)	39,500 MW
Total installed capacity (heat)	N.A.

RES share (2005)

RES share in primary energy supply	11 %
RES share in electricity consumption	25 %
Share of biofuels in fuel transportation	-

RES national targets (2010)

RES share in the primary energy sources	-
RES share in the electricity consumption	26 %

Primary energy balance (2005)

Coal	1,080,655 TJ
Oil	1,390,060 TJ
Gas	982,475 TJ
Hydro	146,915 TJ
RES	428,443 TJ
Total	3,776,493 TJ

RES in energy supply (2005)

Hydro	39,658 GWh
Wind	59 GWh
Solar	16,119 TJ
Biomass and waste	224,203 TJ
Geothermal electricity	94 GWh
Geothermal heat	38,770 TJ
Total RES	428,443 TJ

RES installed capacity (2005)

Large Hydro	11,967.4 MW
Small hydro	939 MW
Wind (2006)	54 MW
Solar PV	0.3 MW
Biomass	N.A.
Biogas	N.A.
Waste plants	10 MW
Geothermal electricity	20.4 MW
Geothermal heating	1,229 MWth

RES Electricity production (2005)

Large and small hydro	46,084 GWh
Small Hydro	1,989 GWh
Wind	56.6 GWh

Solar	-
Biomass	46 GWh
Biogas (2004)	30 GWh
Wastes	24 GWh
Geothermal	104 GWh
Total RES Electricity	48,333.6 GWh

RES Heat production

Solar	N.A.
Biomass	N.A.
Biogas	N.A.
Geothermal	640 GWh
Total RES heat production	N.A.

Biofuels production

Number of biodiesel plants	-
Biodiesel production per year	-
Number of bioethanol plants	-
Bioethanol production per year	-
Biodiesel plant capacity	-
Bioethanol plant capacity	-

RES estimated potential

Hydro economical potential	129,000 GWh
Wind technical potential	88,000 MW (220,000 GWh)
Wind economical potential	48,000 MW (25,000-30,000 GWh)
Solar PV	32.671 GWh
Biomass	293,000 TJ
Geothermal electricity	4,500 MW 3,000 GWh
Geothermal heat	31,500 MWth 230,275 TJ
Wave energy resource	9,000 MW 18,000 GWh

Source Prepared from the Presentation at the Workshop

TURKEY

Present RES situation

- Electricity production in Turkey from the Renewable Energy Resources (2005) is from small hydro plants (capacity of 939 MW), wind (capacity 54 MW), geothermal (17.5 MW capacity) and waste (10 MW capacity).
- The Renewable Energy Law of Turkey allows the wind electricity to be supplied to the grid. It provides conditions for implementation in most adequate wind sites while it does not support PV and wind energy implementation in less favourable sites. The RES electricity receives the average market price of electricity purchase.
- Turkey is largely dependent on hydropower to meet its electricity needs and 40 % of its total installed capacity is hydroelectric. The current total capacity of hydro plants of 12.4 GW is planned to rise to 13.9 GW in 2005 and 18.8 GW in 2010.
- Wood, plant, and animal waste have been traditionally used for heating and cooking. Lately, the forestry sector has emphasized the use of wood as an alternative to using fossil fuels.
- The RES in energy supply comes mainly from biomass and waste, large hydro, geothermal, wind and solar.
- RES electricity is produced mainly in small hydro (1,989 GWh) but also in geothermal (104 GWh), wind (56.6 GWh) and wastes (24 GWh).
- The solar energy produced is less than 1 % of the total energy production. The installed PV capacity is about 300 kW and is used for communication stations, fire watch stations, lighthouses and motorway lighting. Solar energy generation is not included in the current Five years Development Plan.
- The target for geothermal electricity generation by the year 2010 is 500 MWe. The current Turkish geothermal heating capacity is 820 MW, used for space heating, greenhouses and district heating. Turkey has the 7th largest geothermal resources in the world. 140 high-temperature geothermal resources are identified. After 1990, development of direct use increased steeply by a total of 185% during 1990-1995 and 173.4% during 1995-1998.

RES Legislation

The aim of Renewable Energy Law of Turkey (Law 5346 / 2005) is to increase the utilization of RES for electricity production, in a secure, economic and qualified manner, to increase the diversification of energy resources, to reduce greenhouse gas emissions, to assess waste products, to protect the environment and to develop the related manufacturing industries for achieving these objectives.

The law allows the wind produced electricity to be supplied to the grid and also provides conditions for implementation only in best wind potential sites. The law does not support PV implementation and wind energy in less favourable sites. However, for RES electricity, the tariffs are the average market price of electricity purchase.

Electricity Selling Prices

Until the end of 2011, the applicable price for electricity to be purchased is the average whole-selling price, as determined and published by EMRA for the year before. At the beginning of each year, the Council of Ministers is entitled to raise this price by 20 %.

The electricity selling price from the State Electric Trade Company (TETAŞ) to the distribution companies is the industrial consumer price of 9.50 USD cent /kWh in 2005 (Electricity price –Industry 0,1428 YTL/kWh, Electricity - household 0,1583 YTL/kWh).

Source Prepared from the Presentation at the Workshop

SUMMARY OF RENEWABLE ENERGY SOURCES DATA

WESTERN BALKAN COUNTRIES

BOSNIA AND HERZEGOVINA

General country data

Country population	3,832,300
Country area	51,129 km ²

Energy Production (2003)

Total primary energy production	125,500 TJ
Total electricity production	11,257 GWh
Total electricity consumption	10,407 GWh
Total heat production	N.A.
Total installed capacity (electricity)	3,957 MW
Total installed capacity (heat)	N.A.

RES share

RES share in primary energy supply (2000)	8.2 %
RES share in electricity consumption (2002)	37.86 % (HPP)
Share of biofuels in fuel transportation	N.A.

RES national targets (2010)

RES share in the primary energy sources	N.A.
RES share in the electricity consumption	N.A.

Primary energy balance in 2000

Coal	94,200 TJ
Oil	82,900 TJ
Gas	8,300 TJ
Firewood	4,000 TJ
Hydro	17,300 TJ
Total Primary energy supply	209,700 TJ

RES in energy supply

Large hydro and Small hydro	17,300 TJ
Wind	-
Solar	N.A.
Biomass	4,000 TJ
Geothermal	-
Total RES	21,300 TJ

RES installed capacity (electricity and heat)

Large Hydro	2,000 MW
Small hydro	31 MW
Wind	-
Solar	-
Biomass	-
Biogas	-
Geothermal	-
Total RES installed capacity	2,126 MW

RES Electricity production

Hydro	4,806 GWh
Wind	-
Solar	-
Biomass	-

Biogas	-
Geothermal	-
Total RES Electricity production	4,806 GWh
RES Heat production	
Solar	-
Biomass	N.A.
Biogas	-
Geothermal	-
Total RES heat production	N.A.
Biofuels production	
Number of biodiesel plants	-
Biodiesel production per year	-
Number of bioethanol plants	-
Bioethanol production per year	-
Biodiesel plant capacity	-
Bioethanol plant capacity	-
RES estimated potential	
Small Hydro	2,500 GWh
Wind	600 MW
Solar	685 PJ
Biomass	7,200 TJ
Geothermal heat	33 MWth
Total RES estimated potential	N.A.

Source Prepared from the Presentation at the Workshop

BOSNIA AND HERZEGOVINA

Present RES situation

- Energy sector reform has started, but is not completed. Statistics and laws within energy sector are missing.
- The two major renewable energy sources are hydropower for electricity production and biomass for heat production.
- RES utilisation includes biomass use in heat boilers, limited use of biomass for electricity and limited use of solar energy in flat plate collectors.
- The estimated number of small hydro plants is about 140, in operation or in construction, with a capacity from 1 to 5 MW each.
- There are several locations with favourable wind conditions, with an estimated economic potential of about 600 MW that could be installed by 2010.
- Geothermal, lower temperature energy sources are limited to exploitation for heat generation.
- There is a significant potential for biomass energy in forestry sector (about 50 % of land in Bosnia & Herzegovina is covered by forests) and agricultural sector. Estimated unused potential of appreciatively 1 million m³/year of forest residues and wood waste.

RES legislation

International obligations in the energy sector

At the moment, there are several international documents related to energy ECSEE Treaty, Energy Charter Treaty (ECT), Protocol on Energy Efficiency and Related Environmental Aspects (PEEREA) and the Stabilization and Association Agreement (SAA).

National Energy Strategy

The National Energy Strategy is under preparation through the EU Europe Aid/CARDS project for “Technical Assistance to Support the Energy Department of MoFTER in Bosnia & Herzegovina”, which has the objective to prepare the Energy Strategy of Bosnia & Herzegovina (planned to be completed in February 2008).

Legislation on state level

The state level Legislation includes the Law on Electric Power transmission, system regulator and operator in B&H (Of. Gazette B&H, No 7/02, 13/03) and the Law on establishment of electricity transmission company in B&H (Of. Gazette Bosnia & Herzegovina No 35/04).

Legislation on Entity level

At the Entity level, the Legislation includes the electricity laws in the different entities from Bosnia & Herzegovina, having one of the objectives the RES use

- Law on electricity in Bosnia & Herzegovina (Of. Gazzette FB&H 41/02,24/05,38/05)
- Law on electricity in Republika Srpska (Of. Gazzette RS 66/02, 29/03, 86/03,111/04)
- Law on electricity in Brčko District (Of. Gazzette BD, br.36/04)

Tariff systems for RES electricity

A Decision on methodology of determination of level of purchase prices of electric power from RES with installed power up to 5 MW was adopted (Of. Gazette B&H 32/2002, Of. Gazette RS 71/2003).

Two power utility companies in Bosnia & Herzegovina are obliged to take over the electricity produced from RES. According to decisions, the tariff system for RES electricity is

- | | |
|--------------------------------------|------------------|
| • Small Hydro plants | 3.96 € cents/kWh |
| • Landfill biogas and biomass plants | 3.81 € cents/kWh |
| • Wind and geothermal plants | 4.95 € cents/kWh |
| • Solar power plants | 5.44 € cents/kWh |

MACEDONIA

General country data

Country population	2,050,000
Country area	25,333 km ²

Energy Production (2005)

Total energy production	71,343 TJ
Total electricity production	8,196 GWh
Total electricity consumption	8,196 GWh
Total heat production	5,858 TJ
Total installed capacity (electricity)	1,534 MW
Total installed capacity (heat)	N.A.

RES share (2005)

RES share in primary energy supply	9.20 %
RES share in electricity consumption	7.75 %
Share of biofuels in fuel transportation	-

RES national targets (2010)

RES share in the primary energy sources	18.67 %
RES share in the electricity consumption	18.77 %

Primary energy balance (2005)

Coal	58,825 TJ
Oil	-
Gas	-
Other	-
RES	12,477 TJ
Total Primary energy supply	83,820 TJ

RES in energy supply (2005)

Hydro	5,527 TJ
Wind	-
Solar	-
Biomass	6,490 TJ
Geothermal	502 TJ
Total RES	12,477 TJ

RES installed capacity (electricity and heat)

Large Hydro	398 MW
Small hydro	42.4 MW
Wind	-
Solar	-
Biomass	N.A.
Biogas	-
Geothermal	62.3 MW
Total RES installed capacity	502.7 MW

RES Electricity production

Large Hydro	1,384 GWh
Small Hydro	147 GWh
Wind	-
Solar	-

Biomass	-
Biogas	-
Geothermal	-
Total RES Electricity production	1,531 GWh
RES Heat production	
Solar	-
Biomass	6,490 TJ
Biogas	-
Geothermal	502 TJ
Total RES heat production	6,992 TJ
Biofuels production	
Number of biodiesel plants	-
Biodiesel production per year	-
Number of bioethanol plants	-
Bioethanol production per year	-
Biodiesel plant capacity	-
Bioethanol plant capacity	-
RES estimated potential	
Hydro technical	5,524 GWh
Wind	N.A.
Solar	N.A.
Biomass heat	4,702 GWh
Biomass electricity	1,193 GWh
Biogas technical potential	635 GWh
Geothermal	875 GWh
	(2,500 GWh)
Total RES estimated potential	12,929 GWh
	(14,554 GWh)

(Source Summary Energy Balances and indicators of the Republic of Macedonia)

MACEDONIA

Present RES situation

- The possibilities for development of RES projects in Macedonia are quite limited due to the present unfavourable conditions.
- About 27 % of hydro potential is used to produce about 1,384 GWh in large hydro plants and about 147 GWh in small hydro plants.
- Geothermal potential include low temperature sources.
- Biomass in Macedonia participates in the energy balance of Macedonia with the production of heat with 12.7 %, of which forest wood with 10.52 %.
- There is no development strategy and the legal background for RES, a convenient system of RES funding or a convenient economic environment for investing in RES.
- There is no particular financial support for RES development in Macedonia, with the exception of some activities initiated and financed by EC funds, USAID, Word Bank and other international programmes.
- Possible development could be expected in biomass heat plants, geothermal energy and solar thermal collectors for heat production, in small hydro plants and biomass cogeneration or biofuels.
- NOTE Most of the data are estimations based on previous measurements.

RES legislation

There is no particular law related to RES development or use in the Republic of Macedonia. There is not a complete legal background allowing easy permissions, concessions, funds etc. enabling application of RES. The Law on Concession Rights partially covers the geothermal and water resources use rights, but without noticeable results.

RES Strategy

Some actions for definition of concrete strategies for development are present. However, the country still does not have a concrete strategy for RES development.

RES tariffs

There is an obligation for the confirmation of the tariff of geothermal heat sold to third parties, as well as for the electricity from small hydro plants.

RES Programmes

There are no defined programs and solutions in Macedonia for particular measures for supporting development of concrete RES. There are no financial resources for supporting RES development.

MONTENEGRO

General country data

Country population	630,000
Country area	13,812 km ²

Energy Production (2004)

Total energy production	43,343 TJ
Total electricity production	3,308 GWh
Total electricity consumption	4,632 GWh
Total heat production	3,008 TJ
Total installed capacity (electricity)	868 MW
Total installed capacity (heat)	N.A.

RES share (2004)

RES share in primary energy supply	67.0 %
RES share in electricity consumption	48.3 %
Share of biofuels in fuel transportation	-

RES national targets (2010)

RES share in the primary energy sources	-
RES share in the electricity consumption	-

Primary energy balance (2004)

Coal	13,769 TJ
Oil	14,961 TJ
Gas	-
Other	-
RES	29,227 TJ
Total Primary energy supply	57,957 TJ

RES share in energy supply (2004)

Large hydro	26,741 TJ
Small hydro	288 TJ
Wind	-
Solar	-
Biomass	2,198 TJ
Geothermal	-
Total RES	29,227 TJ

RES installed capacity (electricity and heat) (2004)

Large Hydro	649 MW
Small hydro	9 MW
	(232 MW planned)
Wind	-
Solar	5.5 MW
Biomass	2 (4) MW planned
Biogas	-
Geothermal	-
Total RES installed capacity	663.5 MW

RES Electricity production (2004)

Small Hydro	23.8 GWh
	(644 GWh planned)
Wind	1.25 – 1.80 GWh planned

Solar	-
Biomass	14 (28) GWh planned
Biogas	-
Geothermal	-
Total RES electricity production	23.8 GWh (without Large Hydro)

RES Heat production (2004)

Solar	N.A.
Biomass	2,070 TJ
Biogas	-
Geothermal	-
Total RES heat production	2,070 TJ

Biofuels production (2004)

Number of biodiesel plants	-
Biodiesel production per year	-
Number of bioethanol plants	-
Bioethanol production per year	-
Biodiesel plant capacity	-
Bioethanol plant capacity	-

RES estimated potential*

Hydro	11,172 GWh
Wind	N.A.
Solar	N.A.
Biomass	N.A.
Geothermal	no substantial
Total RES estimated potential	N.A.

*Renewable Energy Resource Assessment Study (Wind, Solar and Biomass Energy) is in finalization phase.

MONTENEGRO

Present RES situation

- The Energy Development Strategy until 2025 is under preparation. A study on renewable resources (wind, sun and biomass) is also in preparation.
- The most important renewable resources in Montenegro are hydro, biomass, solar and wind. No substantial geothermal water resources have been revealed so far in Montenegro.
- About 17 % of overall hydropower potential is been used. The share of small hydro power plants production in total average annual production is 0.83 %. 70 small hydro power plants are projected with a total installed power of 232 MW.
- Biomass is used for heating or for technological steam generation (150,000-200,000 m³/year). There are plans for a biomass power plant with an installed power of 2 (4) MW and annual production of 14 (28) GWh.
- Solar energy is used at small scale for heating, hot water preparation and low temperature processes.
- There are some potential areas for wind plants; some detailed measurements were undertaken in some locations. The first wind project has a capacity of 500 kW to produce 1.25-1.80 GWh/year)

Energy Policy

The main goals and objectives of the Energy Policy adopted in 2005 are the secure, qualitative, reliable and diversified energy supply and reduction of energy import dependence.

The energy policy aims at creation of conditions for higher utilisation of renewable energy resources, combined production of heat and electricity and utilisation of fossil fuels through clean technologies. It also includes provision of institutional and financial incentives for energy efficiency improvement and energy intensity reduction in all sectors.

Sustainable production and utilisation of energy are also viewed in relation to environmental protection, and international cooperation in this field, particularly in reduction of GHG emissions.

Energy legislation

The energy legislation includes Energy Policy (2005), Energy Law (2003) and Energy Community Treaty signed in 2005.

The Energy Efficiency Strategy was adopted in October 2005 and Strategy for Small Hydro Power Plants Development in Montenegro was adopted in April 2006. The design of Energy Development Strategy until 2025 is also underway.

SERBIA

General country data

Country population 9,400,000
Country area 88,361 km²

Energy Production

Total energy production	365,465 TJ
Total electricity production	34,203 GWh
Total electricity consumption	26,758 GWh
Total heat production	49,823 TJ
Total installed capacity (electricity)	7,120 MW
Total installed capacity (heat)	6,500 MW

RES share (2005)

RES share in primary energy supply	1.3 %
RES share in electricity consumption	0.056 %
Share of biofuels in fuel transportation	-

RES national targets (2010)

RES share in the primary energy sources	12.0 %
RES share in the electricity consumption	2.8 %

Primary energy balance

Coal	287,172 TJ
Oil	27,047 TJ
Gas	9,749 TJ
Other	40,050 TJ
RES	5,024 TJ
Total primary energy supply	369,042 TJ

RES in energy supply

Large hydro	40,050 TJ
Small hydro	54 TJ
Wind	-
Solar	-
Biomass	N.A.
Geothermal	-
Total RES	40,104 TJ

RES installed capacity (electricity and heat)

Large Hydro	2,831 MW
Small hydro	5 MW
Wind	-
Solar	-
Biomass	N.A.
Biogas	-
Geothermal	-
Total RES installed capacity	2,836 MW

RES Electricity production

Hydro	11,250 GWh
Wind	-
Solar	-
Biomass	-

Biogas	-
Geothermal	-
Total RES Electricity production	11,250 GWh

RES Heat production

Solar	-
Biomass	83,700 TJ
Biogas	-
Geothermal	-
Total RES Heat production	83,700 TJ

Biofuels production

Number of biodiesel plants	-
Biodiesel production per year	-
Number of bioethanol plants	-
Bioethanol production per year	-
Biodiesel plant capacity	100,000 t (under construction)
Bioethanol plant capacity	-

RES estimated potential

Small Hydro	4,652 GWh
Wind	N.A.
Solar	N.A.
Biomass	31,400 GWh
Geothermal	2,152 GWh
Total RES estimated potential	38,204 GWh

SERBIA

Present RES situation

- Biomass is used in old, inefficient equipment in stoves and boilers in households, food processing companies, public sector, agricultural farms and wood processing companies.
- Biomass projects for electricity generation and liquid biofuel production are hindered mainly due to financial obstacles (large investment costs, high interest rate), non-financial support and lack of incentives (special loans, lower tax, CO₂ tax, etc.).
- Besides the lack of financial incentives, there is a great problem of low public awareness about benefits of using biomass instead of fossil fuels for heat production.
- A biodiesel plant of 100,000 t/year is under planning for construction.
- The main RES projects include studies on energy potential for solid biomass and biodiesel, as well as research and development projects for gasification, straw bale combustion, wood pellets combustion, development of boilers.
- There are some demonstration projects for replacement of old liquid fuel boilers with biomass boilers in a school in a forest region (2 x 350 kW) and for replacement of liquid fuel in a school with a boiler burning pellets (250 kW) and some individual projects in industry.

Legislation

Serbia has signed the Memorandum of Understanding on the Regional Energy Market in South East Europe and its Integration into the European Community Internal Energy Market.

The energy legislation includes the Energy Strategy (2004), the Energy Law (2004, under change), Article on Energy Permission for power plants construction (for plants over 1 MWe) and Rules on Energy License for energy production, transmission and distribution (electricity, heat, gas, oil). At the moment, there are several acts in preparation, including the Program for Energy Strategy Implementation and the Rule on privileged producers of electricity.

Programmes

Main programmes are related to the development and preparation of tools for RES implementation in accordance with Programme of Energy Strategy. Development of legislation and concrete support for implementation of Programme are under development.

National Energy Efficiency Program

The National Energy Efficiency Program (including RES) is financed by the Ministry of Science and Environmental Protection and it addresses research and development projects.

Program of Serbian Energy Efficiency Agency

The Program performed by Serbian Energy Efficiency Agency is financed by the European Agency for Reconstruction. Projects regarding energy efficiency measures in industry, public buildings and public district heating systems are implemented, but also projects related to the utilisation of RES increase of public awareness, feasibility studies and demonstration projects.

World Bank Programme for Energy Efficiency

The World Bank Programme for Energy Efficiency supports demonstration projects for rehabilitation of heating systems in the public sector.

GTZ program for municipalities (Energy Efficiency and Renewable Energy Sources)

GTZ program for municipalities (Energy Efficiency and Renewable Energy Sources) supports demonstration projects for small municipalities.

Workshop Agenda

Wednesday 15th of November 2006

Opening Session

- 9:30** Welcome Address and Scope of the Meeting
Mr. Jean-Francois Dallemand , DG JRC, EC [10 min]
- 9:40** Opening Addresses of Croatia Authorities:
Mr. Julije Domac, Energy Institute Hrvoje Pozar, Zagreb, Croatia [10 min]
- 9:50** Presentation of the Participants – Tour de table. *[10 min]*

Session 1:

Introduction Update on ongoing international data gathering

Chair: Mr. Jean-Francois Dallemand , DG JRC, EC

- 10:00** Renewable Energy Implementation in the European Union and perspectives. *[30 min]*
Invited key-note speaker: Mrs. Christine Lins, General Secretary of the European Renewable Energies Council, EREC, Brussels
- 10:30** The Scientific Technical Reference System for Renewable Energies and Energy End-Use Efficiency: Present and future of Renewable Energies in Europe.
Mr. Nicolae Scarlat, DG JRC, E.C.) [20 min]
Q & A and Discussion *[10 min]*
- 11:00** *Coffee Break [30 min]*

Session 2:

Mediterranean New Member States

Chair: Mr. Julije Domac, Energy Institute Hrvoje Pozar, Zagreb, Croatia

- 11:30** Latest developments on RES policy, implementation and planning in **Cyprus**
Mr. Christodoulos Pharconides, Cyprus Institute of Energy
[15 min]
Q & A *[5 min]*
- 11:50** Latest developments on RES policy, implementation and planning in **Malta**
Mr. Mario Fsadni, Insitute For Energy Technology, Malta [15 min]
Q & A *[5 min]*
- 12:10** Latest developments on RES policy, implementation and planning in **Slovenia**
Mr. Tomaž Fatur, Energy Efficiency Centre Head, Slovenia [15 min]
Q & A *[5 min]*
- 12:30** Q & A and Discussion *[30 min]*
- 13:00** *Lunch [1 hr 30 min]*

Wednesday 15th of November 2006

Session 3:

Central Europe New Member States

Chair: Mrs. Christine Lins, General Secretary of the European Renewable Energies Council, EREC

- 14:30** Latest developments on RES policy, implementation and planning in **Czech Republic**
Mr. Petr Klimek, Czech Renewable Energy Agency, Prague, Czech Republic [15 min]
Q & A [5 min]
- 14:50** Latest developments on RES policy, implementation and planning in **Hungary**
Mr. Peter Bodo, The Regional Environmental Center for Central and Eastern Europe, Business and Environment Programme [15 mins.]
Q & A [5 min]
- 15:10** Latest developments on RES policy, implementation and planning in **Slovakia**
Mr. Jan Rousek, Slovak Energy Agency, Bratislava, Slovakia [15 min]
Q & A [5 min]
- 15:30** Latest developments on RES policy, implementation and planning in **Poland**
Mr. Grzegorz Wisniewski, EC BREC Institute for Renewable Energy, Poland [15 min]
Q & A [5 min]
- 15:50** Q & A and Discussion [20 min]
- 16:10** **Coffee Break [20 min]**

Session 4:

Candidate Countries

Chair: Mr. Nicolae Scarlat, DG JRC, EC

- 16:30** Latest developments on RES policy, implementation and planning in **Bulgaria**
Mrs. Violetta Groseva, Sofia Energy Centre, Bulgaria, [15 min]
Q & A [5 min]
- 16:50** Latest developments on RES policy, implementation and planning in **Romania**
Mr. Dan Teodoreanu, Research Institute for Electrical Engineering, Department of New Energy Sources, Romania [15 min]
Q & A [5 min]
- 17:10** Latest developments on RES policy, implementation and planning in **Croatia**
Mr. Julije Domac, Energy Inst. Hrvoje Pozar, Dept. of Renewable Energy Sources and Energy Efficiency [15 min]
Q & A [5 min]]
- 17:30** Latest developments on RES policy, implementation and planning in **Turkey**
Mr. Tanay Sidki Uyar, Marmara University, Faculty of Engineering, Goztepe Kadikoy, Istanbul, Turkey [15 min]
Q & A [5 min]
- 17:50** Q & A and Discussion [30 min]
- 18:20** **Meeting adjourned**

Thursday 16th of November 2006

Session 5:

Baltic New Member States

Chair: Mr. Grzegorz Wisniewski, EC BREC Institute for Renewable Energy, Poland

- 9:00** International Energy Agency data collection on RES [30 min]
Invited key-note speaker: Mrs. Samantha Olz, International Energy Agency IEA [30 min]
- 9:30** Latest developments on RES policy, implementation and planning in **Estonia**
Mr. Peeter Raesaar, Tallinn University of Technology, Estonia [15 min]
Q & A [5 min]
- 9:50** Latest developments on RES policy, implementation and planning in **Lithuania**
Mr. Vladislovas Katinas, Lithuanian Energy Institute, Lithuania [15 min]
Q & A [5 min]
- 10:10** Latest developments on RES policy, implementation and planning in **Latvia**
Mrs. Dagnija Blumberga, Riga Technical University [15 min]
Q & A [5 min]
- 10:30** Q & A and Discussion [20 min]
- 10:50** **Coffee Break [20 min]**

Session 6:

Invited States

Chair: Mrs. Samantha Olz, International Energy Agency IEA

- 11:10** Latest developments on RES policy, implementation and planning in **Bosnia & Heregovina**
Mrs. Semra Fejzibegovic, Hydro-Engineering Institute and Center for Environmental Sustainable Development in Sarajevo, Bosnia & Heregovina [15 min]
Q & A [5 min]
- 11:30** Latest developments on RES policy, implementation and planning in **Macedonia**
Mr. Kiril Popovski, St. Kliment Ohridski University – Bitola, Faculty of Technical Sciences – Bitola, Macedonia [15 min]
Q & A [5 min]
- 11:50** Latest developments on RES policy, implementation and planning in **Montenegro**
Mrs. Andrijana Mirkovic, Ministry of Economy, Montenegro [15 min]
Q & A [5 min]
- 12:10** Latest developments on RES policy, implementation and planning in **Serbia**
Mr. Milan Martinov, University of Novi Sad, Serbia [15 min]
Q & A [5 min]

- 12:30** Final wrap-up discussion round [30 min]

*Chair: Jean-Francois Dallemand - DG JRC EC, Mrs. Christine Lins - EREC, Mrs. Samantha Olz – IEA,
Mr. Julije Domac -Energy Institute Hrvoje Pozar*

- 13:00** **End of Meeting**

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Energy Units and Terms

J = Joule

kJ = kilojoule (10^3 J)

MW = megajoule (10^6 J)

GJ = gigajoule (10^9 J)

TJ = terajoule (10^{12} J)

PJ = petajoule (10^{15} J)

Wh = Watt-hour

kWh = kilowatthour (10^3 Wh)

MWh = megawatthour (10^6 Wh)

GWh = gigawatthour (10^9 Wh)

TWh =terawatthour (10^{12} Wh)

W = Watt

kW = kilowatt (10^3 W)

MW = megawatt (10^6 W)

GW = gigawatt (10^9 W)

TW = terawatt (10^{12} W)

kWp = photovoltaic electrical capacity (10^3 Wp)

MWe = megawatt (10^6 W electrical capacity)

MWth = megawatt (10^6 W thermal capacity)

kWh = kilowatt-hour (10^3 Wh)

MWh = megawatt-hour (10^6 Wh)

GWh = gigawatt-hour (10^9 Wh)

TWh =terawatt-hour (10^{12} Wh)

Mtoe = million tonnes of oil equivalent

Conversion factors:

1 TJ = 0.2778 GWh

1 TJ = 2.388×10^{-5} Mtoe

1 GWh = 3.6 TJ

1 GWh = 8.6×10^{-5} Mtoe

1 Mtoe = 41868 TJ

1 Mtoe = 11630 GWh

List of Acronyms

CARDS – Community Assistance for Reconstruction, Development and Stabilisation
CHP – Combined Heat and Power
DH – District Heating
EAC – Electricity Authority of Cyprus
EBRD – European Bank for Reconstruction and Development
EREC – European Renewable Energies Council
EC – European Commission
ECSEE – Energy Community of South Eastern Europe
ECT – Energy Charter Treaty
EE – Energy Efficiency
EEA – European Environment Agency
FIT – Feed In Tariff
GIS – Geographic Information System
GIS – Green Investment Scheme
HPP – Hydro Power Plants
IEA – International Energy Agency
JRC – Joint Research Centre
JRC – Joint Research Centre
PV – photovoltaic
QP – Qualified Producer
PEEREA – Protocol on Energy Efficiency and Related Environmental Aspects
R&D – Research & Development
RES – Renewable Energy Sources
RES-E – Renewable Energy Sources – Electricity
RES-H – Renewable Energy Sources – Heat
RME – Rapeseed Methyl Ester
SSA – Stabilisation and Association Agreement
SWH – Solar Water Heater
TGC – Tradable Green Certificates
TPES – Total Primary Energy Sources
USAID – United States Agency for International Development
WB – World Bank

European Commission

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Abstract

The present Proceedings include the presentations made at the Workshop Data Gathering on Renewable Energies for New Member States and Candidate Countries, which was held on 15-16 November 2006 in Cavtat-Dubrovnik, Croatia. The workshop was organised by the Joint Research Centre of the European Commission - Institute for Environment and Sustainability, Renewable Energies Unit Action: Scientific Technical Reference System on Renewable Energy and Energy End-use Efficiency, in cooperation with the Energy Institute Hrvoje Pozar, Croatia.

The primary aim of workshop was the collection of the data on the latest achievements in the field of Renewable Energy in the New Member States and Candidate Countries. The governmental and institutional specialists and scientists in the field of sustainable energy development presented the latest information and on RES development at EU level and market developments in their own countries. The presence, for the first time of the specialists from West Balkan Countries at a workshop organised by JRC for RES was an important extra added value.

The key note speeches of the experts from European Renewable Energy Council (EREC) and International Energy Agency (IEA) provided a general view on the latest data on the trends and developments of RES at international level. The completeness of presentations, the wealth of newest, updated and complementary information on RES brought together by the workshop participants, contributed to the achievements of the meeting objectives and represents a great success.



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Mission of the JRC

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