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Improving the institutional structures for disseminating energy efficiency in emerging nations: A case study for energy agencies in South Africa*

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Abstract

Emerging nations are typically characterized by high energy intensities despite significant energy efficiency potentials and numerous project oriented efforts to introduce energy-efficient technologies. The paper argues that successful technology dissemination needs appropriate institutional structures to reduce the related transaction cost. While a project-by-project approach risks to evaporate after completion, an energy agency would allow to bundle the know-how and information gained, ease access to funding and thus reduce information search cost and increase availability of efficient technologies. In a case study for South Africa, we examine the appropriateness of this concept for emerging nations. We discuss the underlying incentive problem from a New Institutional Economics perspective and suggest an approach to the design and implementation of operable energy agencies.

Keywords: Energy efficiency, energy agency, emerging nations, South Africa, New Institutional Economics

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1 Introduction

The world's annual energy consumption is estimated to double by the year 2025, and world electricity demand will double until 2030. The biggest share of that increase is expected to come from developing countries and emerging nations, increasing their share global primary energy demand from 30 % in 2000 to 43 % (IEA, 2003). At the same time, these countries are typically characterized by high energy intensities as compared to OECD countries, despite the fact that energy consumption per capita is usually well below OECD levels (table 1).

	TPES per capita	**TPES/GDP**	**TPES/GDP (PPP)**
	toe / capita	toe / ,000 1995 US$	toe / ,000 PPP 1995 US$
South Africa	**2.51**	**0.63**	**0.29**
Africa	0.64	0.86	0.32
South Korea	4.10	0.31	0.30
Indonesia	0.69	0.70	0.25
Non-OECD	0.96	0.74	0.28
OECD	4.78	0.19	0.22
World	**1.67**	**0.30**	**0.24**

Notes. toe = tonnes of oil equivalent, PPP = purchasing power parity, GDP = Gross domestic product, TPES = Total primary energy supply.

Table 1. Energy indicators for 2000 (IEA 2002)

It is not only for the sake of climate change or the environment but also economically that growing energy demand may cause problems in developing countries or emerging nations. Except for oil or coal producing countries, any growth in energy consumption implies an increase in the national energy bill, and growth in electricity consumption is

linked to substantial capital requirements for new power generation plants. This often entails a further increase of national debt and dependence on foreign capital. Conversely, higher energy efficiency is often associated with higher productivity, as energy and production technologies are often linked, and energy efficiency implies lower costs.

Consequently, this observation triggered a large number of efficiency-oriented energy projects in emerging nations. Numerous programmes for development aid or technical assistance have been focussing on improving access to sustainable energy in recent years. Apart from a few success stories, however, experience shows that positive appraisals of many projects evaporate after completion and withdrawal of the implementing expert team. Altogether, the diffusion of sustainable technologies with higher energy efficiency and renewable energies for cooking, heating, lighting, electrical appliances and building insulation in developing countries has been slow.

This paper starts from the idea that programmes, projects and pilot studies could be more sustainable, effective and stimulating if the entire policy and implementation process was considered and redesigned from the outset. New financing and implementation processes are needed, which allow to reallocate financial resources and thus enable countries to achieve a sustainable energy infrastructure. The links between the energy policy framework, financing, organizing and implementation of renewable energy and energy efficiency projects have to be strengthened. Besides, capacity building efforts are required.

In this paper we argue that reasons for non-sustainable efficiency programmes are related to high transaction cost and lack of capacity, and that the implementation of

innovative institutional structures in the form of an energy agency can help to improve the situation. Based on the experiences from the project "Sustainable Energy Policy Concepts" (SEPCo), a consultation project for South Africa, Mexico and Cuba (08/2001 - 12/2002) financed by the German Minister for the Environment, we examine the validity of this thinking for the case of South Africa. Following the SEPCo project focus, this paper will primarily concentrate on energy efficiency and sustainable energy for low-income households.

In the following section, we develop the underlying theoretical thinking and explain the design of the case study. We summarise experiences from Germany and Mexico regarding important aspects to be considered when designing an energy agency. Then we assess the process of the SEPCo project as carried out during the 1.5 years of the South Africa case study. The last chapter gives some concluding remarks.

2 The case for energy agencies: Theoretical framework

2.1 Institutional and informational barriers to energy efficiency

In this section, we develop the theoretical framework for explaining the modest success of energy efficiency programmes and, more general, of sustainable energy policies. On the background that efficient energy technologies are often more than cost-recovering over their life-time cycle, the standard model of economic theory would suggest that any cost-effective measure is being implemented. Empirical research, however, shows that this is often not the case: Many energy saving measures with high rates of return on capital are not being realised, a phenomenon commonly labelled as "efficiency gap" (Levine *et al*., 1995).

The theoretical framework of *New Institutional Economics (NIE)* adds a set of useful explanations for the efficiency gap. NIE explain market results in the context of the surrounding institutions and as a consequence of transaction cost (Williamson, 1985). Starting from the observation of incomplete information and uncertainty, there are costs for companies and consumers not immediately reflected in market prices for goods and services (Coase, 1960). From this perspective, the following barriers for energy efficiency can be identified:

- *Informational barriers:* Information is expensive, or does not exist, or is not available to an extend that would permit an efficient investment decision. Understanding and valuating information presumes a certain level of skills. Asymmetric information causes distrust and conservative behaviour. These barriers are particularly relevant on the level of the individual households. Combined with the uncertainty about the real savings the originally "expensive" energy technology (such as efficient light bulbs) promises to deliver, the eventual decision will often be to stay with conventional energy appliances.
- *Financial barriers:* Many consumers will not make investments in energy efficiency because they lack capital to buy new energy-efficient equipment or make the required retrofit in their installations. A certain investment may be very cost effective, with fast payback, but it will not be implemented unless the consumer can meet the up-front capital costs.
- *Technological barriers and infrastructure:* Several opportunities to produce and to conserve energy depend on new technologies that may not be available

in some countries or regions. Also, many new and efficient technologies incorporate electronic components which rely on good quality power to operate. Voltage fluctuations and frequent power failures – a common problem in emerging nations – will shorten the equipment's designed lifetime.

- *Bounded rationality:* Consumers do not always behave "perfectly rational" in the sense of economic theory. The related notion of "bounded rationality" is closely linked to the first barrier above, i.e. information cost: Based on his/her experience, it may at least seem (or even be) rational to avoid further information cost and to take a "satisficing" rather than a theoretically optimal decision (Wilson, 1987).

- *Discrepancies in discount rates:* Innovative energy efficiency investments or programmes often involve a number of actors with different perceptions of costs and benefits, risks and uncertainties. Utilities, large consumers and government can more easily afford investments with longer pay-back periods: They may have an easier access to low-cost capital, can spread the risks of individual investments across a broad range of different investments, and thus apply a lower discount rate compared to private households.

- *Diversity of investment criteria and limited resources:* Even when a certain investment in energy efficiency is cost-effective, it may not be the first investment criterion. For instance, a consumer considering the purchase of a new refrigerator may prefer a less efficient model if it is available in the colour he prefers. Also, inconveniences may be related to new energy technologies, for example a change in cooking traditions, and the necessary investment may

therefore be declined. An industrial customer may prefer to spend capital on a new line of products rather than consider a retrofit in existing installations.

Many of the above listed barriers and transaction costs for disseminating energy efficiency show characteristics similar to fixed costs: The more often the same information is being used, the less the individual user must pay for it, at least in theory. The categories of NIE also help to understand the *dynamics* of emergence and diffusion of innovation such as energy efficiency technologies. Here, the framework of *evolutionary economics* offers helpful theoretical concepts. Evolutionary economists describe innovation as a search and a learning process which depends on a number of exogenous and endogenous determinants and technological paradigms ((Nelson & Winter, 1982; Nelson, 1998; Dosi, 1988). The paradigm (and its potential change) depends on factors which are usually located outside the sphere of economics. The specific path (trajectory) that is being followed within the paradigm, however, depends on innovation activities on the level of the individual company. Innovation implicates uncertainty and transaction cost, and experience with specific innovations are not a public good but in the hands of the innovating organisation. Successful innovation often depends on capacities to innovate in the past and on capacities to continue search processes and to collect experience in the future. Therefore, a certain path (trajectory) is likely to be followed, and "good" innovations may need a long time to succeed.

The above analysis of the underlying reasons for the existence of the efficiency gap offers a number of starting points for recommendations to improve the situation. *First*, risks can often be diversified when a large number of smaller risks is bundled. *Secondly*, technology or innovation diffusion can be promoted by disseminating information on

pilot studies or projects and by large-scale programmes. *Thirdly*, successful and innovative energy efficiency policies are also connected to an appropriate and efficient *institutional* setting. In particular, efficient pricing is needed, in order to signal the accurate value of resources being consumed. *Regulatory* encouragement is therefore important with respect to tariff setting, the environmental aspect, and investment decision-making criteria. Moreover, *organisational* efficiency is needed, i.e. structures which increase access to information and affordable financing and providing incentives for the development and dissemination of innovative energy efficient technologies and strategies. However, the capacities of government to improve the context for innovative and sustainable energy policies are limited, the efficiency of government organisations is often low, and the related transaction costs are high. This is true for industrialised countries, and even more so for developing countries and emerging nations.

2.2 Learning from experience in other countries

The context for energy policy in industrialised countries differs significantly from emerging nations so that it is not straightforward to learn from these experiences. Nevertheless, our experience was that substantial and valuable input to the development process of the South African energy agency initiative could be extracted from the practical know-how gained in Germany, in particular regarding the interaction of focus areas, organisational and funding aspects.

To date, Germany has a network of independent energy agencies, and a long-standing experience of almost 20 years with different kinds and organisational forms of EAs. They operate on different territorial levels as regional, local or national EAs. Latest counts yield roughly 30 agencies, including the Deutsche Energie Agentur (dena), the

new German national energy agency, founded in 2001. The regional agencies form the root and the spine of the EA network. Their foundation typically goes back to an initiative of the federal state parliament or a government institution. In most cases the establishment of the EA was realized in conjunction with the regional power supply company and/or a banking institution in order to share costs but also to assure the involvement of other key actors. EAs act as links, mediators and as realizing organizations between governments, enterprises and financing institutions. Their aim is to promote the three general objectives of energy policy: security of supply, economic viability and an environmental soundness of supply.

Regarding the legal status, German EAs are in many cases companies with limited liability (Ltd). Some are organized as registered association. The organisational structure mostly depends on the degree of its commercial orientation towards profit-making. The more an EA is oriented towards commercial profits, the more it is likely to be organized as a Ltd. The Ltd status is also generally preferred for liability reasons. Smaller EAs are often organised as associations. All legal structures include a supervising or steering committee (a supervising committee, a supervisory board or a board of heads of the association) to involve their shareholders in strategic questions and controlling. On the operational level, the management of the EA usually acts independently.

In contrast to Germany, the emerging nation Mexico set up a system of institutions under the auspices of the government, with the task to design, implant and operate energy efficiency programmes mainly by designing and introducing mandatory efficiency standards. In 1989 the Comisión Nacional para el Ahorro de Energía

(CONAE), the National Commission for Energy Saving, was founded to implement energy saving and efficiency measures. In 1990, Fideicomiso para el Ahorro de Energía Eléctrica (FIDE), the Mexican Trust Fund for Electric Energy Saving was established as a private non-profit organisation to realise actions that promote the saving and the efficient use of electric energy, whereas CONAE is responsible for energy efficiency in general as well for the promotion of the use of renewable energy. Both institutions developed numerous energy saving programmes, which resulted in an estimated avoided consumption of about 41 billion kWh by the end of 2000, plus a reduction of the growth of peak demand which avoided about 2,470 MW of new plant capacity. Investment in the agencies was estimated to be about a factor 50 lower that the related economic savings.

To summarise, experience from Germany and Mexico suggests that by strengthening the links between energy policy, financing and implementation and the final consumer, EAs allow to cut energy consumption significantly and to improve the efficiency of energy generation. It also shows that there is no single organisational model that served as a standard for any newly founded agency. Each energy agency has its own profile and design that fits to the respective specific goals and framework. In addition, the specific national framework requires a careful adoption process. Nevertheless there are a number of generally applicable success factors that need to be considered for a successful implementation process.

2.3 Preconditions for successful energy agencies

In this section, we use our findings from experience and theoretical thinking to suggest a designfor energy agencies with the purpose to improve the institutional structures for disseminating energy efficiency in an emerging nation like South Africa.

First and foremost, based on the above considerations, we suggest that information and innovation dissemination in developing countries and emerging nations should in fact be institutionalised in a more efficient way. We also advocate the implementation of independent *energy agencies* (EAs) as an appropriate tool and institutional innovation to reduce transaction cost of energy efficiency. While a project-by-project approach often risks to evaporate after completion, an EA would allow to bundle the know-how and information gained, and thus reduce information search cost and increase availability of efficient technologies appropriate for the specific energy / electricity system in South Africa. An EA may also allow to reduce financial barriers that would otherwise hinder the implementation of energy efficiency measures. Altogether, this would lead to lower transaction cost for energy efficiency and thereby improve the sustainability of existing and future energy policy programmes and development aid projects.

A successful energy agency needs an appropriate design and a surrounding „configuration that works“ (Rip & Kemp, 1998). In the following sections, we use the assessment of German and Mexican experiences to derive a number of preconditions for designing such an operative energy agency. They served as input for the workshops within the South Africa case study as described subsequently.

- *Clear definition of focus areas and tasks*

First and foremost, an EA needs a clear outline of tasks and goals: Shall the agency be responsible for public interest programmes, for information and motivation campaigns, work on a regulatory level and develop national efficiency standards or is it supposed to run independent and economically viable projects? To categorize, two major types of EAs can be distinguished. First, the information and motivation (I&M) oriented agencies, and secondly, agencies with a strong entrepreneurial focus, which sell consulting services and/or act as energy service companies (C&E). Both concepts have worked successfully in Germany, provided that the expected fields of activity were reflected in the funding structure and the political framework of the agency (Bleyl 2002).

Both approaches may also be applicable to the context of an emerging economy like South Africa. However, we suggest to start with an I&M type energy agency, because it corresponds to the predominant challenge of a lack of information dissemination. The typical tasks of this type includes information and motivation services for municipalities, governments and enterprises on rational energy supply, efficient energy use and renewable energies, public awareness and image campaigns, capacity building and qualification measures, and the promotion of innovative technologies. An I&M energy agency may also offer services to government and policy institutions such as consulting and support for regional or federal energy policy, evaluation of energy policy measures, conception and processing of subsidy and support programmes and public relation activities for state or federal policy programs. In contrast, C&E type energy agencies would rather be a future option, as they offer market-based and cost-covering consulting services including the development, planning, realization, financing and

operation of distributed heat and power generation e.g. for hospitals and schools (Bleyl, 2002).

- *Geographical location and scope*

Based on the assessment of the envisaged fields of activity and on the existing infrastructure, a decision about the location and scope of the responsibilities has to be taken. In the case of an emerging nation, both a bottom-up and a top-down approach appears to be indispensable: A national energy agency can set the umbrella organisation under which local initiatives may flourish. If designed in an appropriate way, such a setting could allow them to develop their own agendas while contributing to a national programme. Vice versa, a national agency could give political, social, and financial mandates to the success of local initiatives. A national entity can acquire a both funds, projects, and programmes (training or otherwise) on a level municipalities are not able to deliver because of their generally small capacities.

- *Sound and sustainable funding*

Any successful energy agency needs a sound financial fundament. Funding needs are directly related to the chosen focus areas of an EA; at least for the implementation phase, an initial financial support is unavoidable. It could take the form of lost government grants, accumulated deficits, loans and advances, or allowances from EU support programmes and so on. This period typically lasts in between two to four years.

An energy agency with a focus on information and motivation activities can hardly be financed through self generated income. It will need continuous financial support from government or other sources, combined with (project) funding form utilities,

municipalities, regional and national ministries. However, the amounts needed are comparatively small: For example, the energy agency in Germany with the highest public financing (EA North Rhine-Westphalia) receives the equivalent of only 0.35 € per inhabitant and year.

- *Adequate business plan and legal structure*

A carefully drafted financial business plan is crucial for the success of an EA. It needs to disclose the financial requirements and expected revenues for the envisaged fields of activity, and the legal status suitable for this purpose. The business plan also ought to outline a legal structure; the latter should include a supervising or steering committee (a supervising committee, a supervisory board or a board of heads of the association) to involve the shareholders in strategic questions and controlling. However, on the operational level, the management of the EA should be able to act independently.

- *Inclusion of societal stakeholders as partners*

Successful energy agencies need strong partners in their background: Relevant societal stakeholder should be gained as partners and shareholders. In Germany, consortia of a public body (city, federal stateor national government) as the leader, together with a financing institution (public bank) and an energy supply company have been successful models. Other stakeholders – such as chambers of commerce or unions – can be integrated via an advisory committee. The shareholders of the EA have a strong impact on its fields of activity. To rely on one single partner entangles the risk of political dependence. A diverse and broad membership structure, preferably a public-private-partnership of three to five partners suits best to guarantee independence, continuity, flexibility and development potentials.

3 Case Study: South Africa

3.1 Steps of the SEPCo project

The general objective of the SEPCo project was to identify "missing links" between existing initiatives, institutions and actors in the areas of energy efficiency and sustainable energy for low-income households, and to develop solutions for strengthening these link between energy policy, financing and implementation. The three country case studies aimed to empower the local level while making use of existing experience and know-how of local stakeholders. The project took a workshop approach with the aim to combine consultations between local stakeholders with capacity building inputs from abroad. Local actors were invited to participate in the project through a series of workshops, meetings, discussions as well as an internet-based discussion forum. Also, by conducting these workshops in the countries themselves, the project team learned about actual problems and was thus enabled to redefine the focus of the projects and to develop applicable suggestions for improving access to sustainable energy.

In short, the SEPCo project case studies consisted of three steps. During a *first* phase, a number of initial short studies on potentially relevant projects and programmes was conducted. Their purpose was to examine existing structures in the three case study countries (South Africa, Mexico, Cuba) with respect to energy policy and institutional contexts that stimulate or obstruct the projects and programmes to become sustainable, and to identify critical points of financing and implementation processes. The studies looked at a variety of project forms such as rural off-grid electrification by means of renewable energies, energy efficiency, DSM programmes for households in urban low-

income areas and the like. They formed the basis for a first round of local workshops in which the most pressing issues were selected for further investigation. The *second* phase was dedicated to elaborating solutions and suggestions for these issues. Finally, in the *third* phase, the result was presented during a second workshop series, and activities at the local level to overcome the barriers and problems were initiated. International experts were invited to moderate and support this process but not to make prescriptions.

The following sections elaborate this approach for the case study of energy agencies for South Africa. They are based on previous experience and research on the South African energy sector, its governance and institutional structures (Praetorius & Fritsche, 1998; Praetorius, 2000, Praetorius & Fecher, 2002).

3.2 Assessment of existing energy efficiency activities in South Africa

South Africa has an estimated population of 45.5 million people. The gross national income per capita amounted to US $ 2,900 in 2001.[1] According to World Bank categories, the country belongs to the group of upper middle income countries. Socio-economically, the country is divided into a small, sophisticated "first-world" part with well-developed structures, and a large "third-world" part which shows the characteristics of poorly developed countries. Analogously, South Africa disposes of a sophisticated and well-developed energy supply system on the one side. On the other side, despite an immense and successful electrification programme, a large part of the urban and rural low-income households still does not have any access to electricity and

[1] In current USD, Atlas method. In Purchasing Power Parities, the GNI per capita amounts to USD 9,510. Source: World Development Indicators Database, April 2002 (www.worldbank.com).

other forms of "clean" or sustainable energy sources. Energy supply is largely based on the abundant coal reserves of the country. In 2000, the total primary energy supply (TPES) in South Africa amounted to 4,298 PJ of which 73.7 % stem from coal and another 16.6 % from crude oil. The share of natural gas (1.4 %) and nuclear energy (3.1 %) is smaller than the one of renewables – mainly biomass – including waste (5 %). Total final energy consumption amounted to 2,193 PJ of which electricity accounts for 26 % (577 PJ).

Due to the cheap coal reserves, electricity in South Africa is amongst the cheapest in the world. In 2001, the average price for electricity sold to industry was 1.2 € c/kWh, while commercial customers paid 1.8 € c/kWh, and residential customers paid an average of 3.1 € c/kWh (Eskom, 2002). In the run-up to the 2000 local government elections in South Africa, President Thabo Mbeki announced that low-income consumers would be entitled to 50 kWh of electricity free of charge on a monthly basis (the so-called poverty tariff or Electricity Basic Support Services Tariff, EBSST).

The electricity sector is dominated by Eskom, a single, vertically integrated state-owned utility and *de facto* monopolist. In 2001, Eskom generated 182 TWh (95 %) of total electricity generation in South Africa. It owns, operates and maintains the national transmission grid. In contrast, the electricity distribution industry is highly fragmented. A restructuring process to liberalise the electricity market started in the early 1990s and is still ongoing. Since 1995, the electricity sector is regulated by the National Electricity Regulator (NER).

During apartheid, access to electricity and other forms of commercial energy for black, low-income households was limited, in particular in rural areas and townships. Since

the demise of apartheid, an ambitious electrification programme has been carried out as part of the Reconstruction and Development Programme (RDP), the ANC's government programme after the first democratic elections in 1994. As a result, the level of household access to electricity is estimated to have risen from about 36 % to around 70.4 % between 1991 and 2000. In urban areas, 84 % of households have access to electricity, whereas the figure in rural areas is at around 50 % (NER 2001).

In international comparison, South Africa's economy is *energy intensive* (table 1). One reason lies in the synthetic fuel production from coal, however, significant energy saving potentials also exist in the field of household space heating. It has been estimated that the installation of an insulation-integrated ceiling in low-cost brick houses would save 90 per cent of energy consumed for heating during winter and be cost-effective over time. However, the up-front cost for this ceiling represent a major barrier to this simple measure (Mathews & van Wyk, 1996). Even small efficient appliances such as lighting face similar problems.

Awareness for efficiency potentials at *government* levels has raised recently, but is not yet optimally implemented with respect to policy action. Energy is cheap in South Africa, and efficiency is only slowly being perceived as a crucial element of energy policy. Delivering energy services presently takes precedence over efficiency. To date, only few information campaigns took place, and with little impact. An „Energy Efficiency Business Plan" launched in 1996 by the Department for Minerals and Energy (DME) included the idea to establish an energy efficiency agency, and a pre-feasibility study was compiled later. However, very little realisation took place. A small number of energy efficiency projects and campaigns were commissioned to external consultants,

and a multi-year capacity building project in energy efficiency and renewable energy (CaBEERE) was set up by Danish funders. Government capacities on the *local* level (municipalities) are limited and awareness for the benefits of energy efficiency as well.

In 2002, the DME started with an initiative to implement *Integrated Energy Centres (IEC)* on the local level. The objective of the IEC is to disseminate information regarding renewable energy and the related technologies, and to educate households regarding energy efficiency. An underlying aim is to deliver clean energy services to low-income communities but also to address health, environmental, economic and other needs. The DME stated that the IEC shall encourage the development of cooperatives, and thereby enhance economic development activities. The ultimate aim is to implement about 20 IEC per year. A small number of pilot locations were already established so that very first experiences with IEC, rural *energy stores* and urban *energy centres* in the SEED (Sustainable Energy for Environment and Development) programme could be reported; the focus of the latter is on energy efficient housing.

Parallel to the SEPCo case study, the *regulatory framework* for energy efficiency has been subject to some changes. In 2002, the energy minister asked the NER to develop a policy to implement energy efficiency and demand side management in the South African electricity industry. Consequently, in May 2004, the NER launched a "Regulatory Policy on Energy Efficiency and Demand Side Management (EEDSM) for South African Electricity Industry" (NER 2004). It obliges the electricity industry to implement and finance appropriate measures to meet the energy efficiency targets specified by the NER – as a precondition for future approval of tariff increases. A major element of the NER suggestions is to delegate the implementation of energy efficiency

measures to electricity distributors, i.e. mainly to the local level. The underlying idea is that municipal actors are closer to customers and thus have information about their needs. The municipalities are therefore expected to be able to identify and realise appropriate energy efficiency measures. Institutionally, the NER suggested to implement an energy agency whose task would be to administer funds for energy efficiency projects and to monitor and verify the respective activities. The implementation of these policy is to be awaited, however, they offer a potentially excellent starting point for realising the results of the case study as reported in this paper.

In the electricity industry itself, *Eskom* early recognised the benefits of demand-side management, with the aim to reduce the typical demand peaks in the mornings and evenings. In the course of accelerated electrification and growing electricity demand per household, this effect becomes more pronounced. According to medium growth forecasts, additional generation capacity will have to be in operation in the year 2007. However, investments in generation capacities are progressively more risky in an environment of increasing competitive pressure, which is a result of the current restructuring process towards a liberalised electricity market. In 1996, Eskom started with developing internal *Integrated Electricity Plans*, an approach that was recently transformed into a *National Integrated Resource Planning* process under the auspices of the NER, with a first NIRP finalised in June 2002. In this context, a study of 32 potential energy efficiency programmes revealed significant peak load reductions at lower life cycle cost than those of an equivalent power station. A cumulative total of

4,808 MW installed capacity to be saved from demand-side measures over 25 years were estimated (NER, 2002).

South Africa also takes part in an international *Efficient Lighting Initiative*, a 3 years programme conducted by Bonesa, an Eskom subsidiary, and co-funded by Eskom and the Global Environment Facility. According to Bonesa, lighting with conventional light bulbs makes up 80 % of the demand in newly electrified homes. Compact fluorescent lights save up to 80 % of the energy consumed by a conventional light bulb and last 6-15 times longer. The potential for replacing conventional light bulbs has been estimated to 31.5 million bulbs. Over a 15-20 year period, savings in peak load are estimated to up to 810-820 MW of new power generation capacity. Bonesa therefore suggests to supply each home with two free energy-saving light bulbs as an alternative to the poverty tariff. Pilot studies are underway (Bredenkamp, 2002a). The Efficient Lighting Initiative also participates in the international Collaborative Labeling and Appliance Standards Programme *CLASP*, an US based initiative whose mission is to promote efficiency standards and labels in developing and transitional countries through partnerships with agencies, stakeholders and relevant institutions in those countries. A first appliance efficiency label has been launched in summer 2004. The label design is based on the European Union Energy Label; it indicates annual energy use by the appliance, along with an efficiency rating on a sliding scale from "A" (most efficient) to "G" (least efficient).

In addition to the governmental initiatives, some further promoters (mostly NGO) of energy efficiency should be mentioned. A number of independent consultants and project developers such as Sustainable Energy Africa (SEA, who runs the SEED

programme) or the Energy and Development Group as well as the Remote Areas Power Supply or RAPS programme are acting on the local level, with a focus on development and delivery. Their potential involvement and their interest in promoting energy efficiency is high, their capacities however are small. One private initiative is the US-funded International Institute for Energy Conservation (IIEC). Since 1996, IIEC conducts projects to foster energy efficiency in a couple of pilot studies such as energy efficient housing and a programme of so-called eco-home advisors. IIEC also promotes energy star computers and green buildings for Africa and supports the Efficient Lighting Initiative. Other NGO initiatives such as Earth Life Africa and the Sustainable Energy Society of South Africa (SESSA) focus more on renewable energy technologies than on energy efficiency.

At first sight, the above initiatives are on the right track. Knowledge about sustainable energy services is small on the level of the individual households, and marginal or non-existing in most of the rural and urban low-income areas. As an important step towards closing the information gap, local activities such as energy stores and energy centres improve access to knowledge and to sustainable energy technologies.

However, the assessment also reveals high transaction cost related to the fact that there are no institutional structures on a *national* level. The reasons for this conclusion are threefold. *First*, on the level of local initiatives, there is a major lack of information and coordination of the different activities. There is no doubt that local action and initiatives are a very important element of an overall efficiency strategy (bottom-up). However, many initiatives double their initial experience, i.e. they produce similar brochures, all published in small numbers only etc. They would thus benefit financially from

cooperation and information in many ways. *Secondly*, to become sustainable, these decentralised initiatives need to be integrated into regional or national institutional structures and energy strategies A successful energy centre also needs a stable organisational and financial foundation. Here, continuous support from government levels appears to be indispensable if lost investments into these initiatives are to be avoided. *Thirdly*, municipalities have little capacity and hence awareness of sustainable energy technologies and efficiency measures. Raising the level of capacity and awareness on the local governance level is thus a major challenge of a future energy efficiency policy. Last, but not least, electrification is an ongoing process in South Africa. Combining the implementation of a system of energy agencies or centres with electrification would represent a unique window of opportunity to achieve an efficient delivery of energy services to the country.

We conclude that South Africa would benefit from implementing a national institution such as an energy agency. It could enable and enhance existing and future initiatives on the local level. It would also be perceived as a manifestation of the policy of the government. It would thus have the potential to lead the way in spreading good policies nationally and thus make use of economies of scale with respect to the use of the know-how gained in earlier projects.

3.3 The case study: An energy agency for South Africa?

3.3.1 Design of the case study

Phase I and first workshop (November 2001): Stock-taking and initial case studies

In November 2001, the first South African workshop took place in Pretoria. A small working group of selected experts and potential key players was invited to join the workshop sessions, including the National Electricity Regulator, Eskom, a number of local NGOs representing energy efficiency, renewable energy, green and local development initiatives, government representatives from the DME, energy and policy research institutes, technology companies and project developer.

To summarise the results, the initial hypothesis of a missing link between policy and strategy was confirmed: Implementation processes were not well integrated, and despite some initiatives, the institutional framework was still weak. In general, there was a perception that many projects and activities are taking place in isolated ways, and without sharing the information about it. This results in lost opportunities and projects going wrong because information was missing and isolated solutions fail. For example, insulation helps to reduce moisture and to keep constant temperatures, which gives a better physical environment for energy efficient light bulbs to last longer. Many projects take place and disappear without sharing the experiences and learning effects or using them for improving future project implementation designs. The following starting points for more in-depth activity within the SEPCo project were identified:

Supporting the process of policy formulation through information: South Africans expressed strong interest in receiving comments on South African policy papers and

bills in progress, such as the Energy Bill and the Renewable Energy Act as well as the White Paper on Renewable Energy. These comments shall be given in an informal way. Participants also asked for in-depth information on codes and standards for efficiency as well as on international experiences with incentives for sustainable energy technologies.

Improving institutional structures for information collection and dissemination Participants expressed great interest in improving the institutional and informational structures for energy projects, and articulated a need to empower existing or new institutions. For this, one should consider existing structures instead of creating completely new institutions. There are some existing information initiatives from the side of SESSA, the Minerals and Energy Centre (MEPC) and Earthlife Africa. However, it was also suggested that founding a new, independent institution (NGO) might be useful because it would be regarded as neutral. Such an energy agency would need the backing of a broad stakeholder structure.

Fostering South-South co-operation: Participants expressed interest in exchanging experiences with other developing countries, such as Mexico and Cuba. The European perspective is perceived as sometimes biased towards industrialised countries. It might be useful to also learn from other developing countries which experience similar situations. Also, information flows between developing countries are not yet institutionalised. The workshop participants therefore support an internet-based exchange of information between these and other developing countries.

Phase II and second workshop (November 2002): Fostering the implementation of a "South African Energy Agency" (SA EA) Initiative

For the second phase of SEPCo, the results of the first phase were condensed to two key policy measures which were of crucial interest to the South African project partners: First, regulations to promote renewable electricity generation, and secondly, improving the institutional structures for both renewable energy and energy efficiency by means of an energy agency. This paper only focuses on the second measure.

South African Experts who are working in information dissemination, project implementation and capacity building were invited to give their inputs. As an input from abroad, and in order to benefit from the experience and expertise from Germany and Mexico, two experts involved in energy agencies from these countries were invited to actively participate in the workshop. They talked about experiences in implementing national, regional and local energy agencies in different contexts, and helped to identify critical issues and possible solutions to these problems.

As in the case of the first workshop, and in order to assure continuity, the second workshop was also attended by participants from the government, the energy regulator, researchers, policy and engineering consultants, project developers, NGOs, the energy industry and international organisations. The aim of the workshop on energy centres and agencies in South Africa was to discuss and develop institutional structures which are appropriate to support both energy efficiency and renewable energy technologies on all levels – national, regional and local, and would help to close the "missing link" between policy and strategy.

3.3.2 Outcomes of the workshop

The participants of the one-day workshop discussed the issues and problems listed above and assessed possible solutions. They eventually decided to initiate a "South

African Energy Agency Initiative" on the national level. To this end, they specified potential actors and stakeholders, organisational and institutional structures as well as mandates, tasks and financial sources of such an energy agency. A proposal was formulated to put such an initiative forward, including an initial presentation to the Minister of Minerals and Energy. The presentation and the formulation of a draft business plan or alike were to be prepared by a small task group which was founded during the workshop.

At the outset, three main *criteria* were identified to be crucial for the *success* of an energy agency in South Africa. First, *government ownership of the idea to create EAs (and IECs) is crucial to success.* There are multiple *motivations* for an SA EA which may also convince an energy minister to support such an initiative: Energy saving allows for national benefits; there is a need to create an enabling environment to meet the objectives of the Energy / Environment White Papers and policies, and a coordination of pilot and research projects would help disseminating the results of these projects. An EA could also serve as a "one stop forum" for the minister in meeting the relevant players and stakeholders in the South African energy efficiency and renewable energy community.

Secondly, *private sector involvement and participation is also crucial.* Only when private partners support the energy agency with action, the initiative will be able to realise its plans. Private sector institutions would benefit from energy efficiency initiatives by saving energy and by improved environmental standards.

Thirdly, *credibility and independence of the new institution must be guaranteed.* All actors involved must be able to trust such an institution. At first sight, founding a *new*

institution would be the easiest way towards independence, however, for its realisation, it would make sense to use the existing infrastructure to host a new EA and not to add further institutions to an environment filled with many institutions already. This would also help the new EA to gain support from existing institutions and individuals. At a later point, the EA may break away from its parent organisation and become an NGO.

In the following, the results of the participatory process of specifying the design of an EA for South Africa are presented along the recommended design features as learned from international experience.

- *Geographical scope*

For the location and level of activity of an SA EA, one must consider the different levels of awareness and capacity. On the local level, a number of initiatives already exist, but their capacities are limited and information about other parallel activities is low. Therefore, the need for a *national* institution was identified; it would allow to coordinate local activities, capacity building on local levels and to realise economies of scale.

- *Focus areas*

Regarding the tasks and major activities and services of a SA EA, the following focus areas were identified: *First*, an EA would assist and advise in realising government policies, and administer the respective public funds. *Secondly*, it would coordinate activities of national and local levels, act as a forum for collective bargaining and support government in creating an enabling environment for local energy centres and the like. *Thirdly*, its focus would be on public interest work such as to foster

information dissemination, to establish and maintain an up-to-date, accurate and accessible energy-efficiency databank for South Africa, and to offer training for local and decentralised institutions such as municipalities and local actors. A *fourth* focus could be to build awareness (through campaigns) and to create capacity, aimed at encouraging citizens, the public and private sector organisations to adopt energy efficiency practises. In this latter focus area, a close cooperation with Eskom's DSM mandate would be recommended.

- *Business plan*

The SA EA initiative would have to draft a business plan; earlier draft business plans would be taken into consideration. An important aspect in the founding or continuation of an EA is proof of the economic advantages of such agencies. For instance, Mexico's CONAE was surprised this summer to be facing proposals to do away with the energy agency. Besides a number of important stakeholders who supported to keep CONAE alive, concrete cost-benefit analyses proved the benefits of the agency. Concrete results must be created to ensure that these agencies can continue working in the long term.

- *Funding*

Finding the balance between the two extremes of totally government versus totally private sector funded must be guided by the following considerations. Practical experience with similar organisations in South Africa indicates that national priorities might be neglected where an organisation is dependent on the private sector for the major share of its revenue. On the other hand, there is a danger that the programme assumes a "budget commitment" (i.e. the implementing organisation becomes an end in itself) in the case where the government is the sole provider of funds for this initiative.

For these reasons, an appropriate mix of public and private funding seems most promising. For the first three to four years, the funding would most likely need to be substantially donor-driven (seed funding) with some money by government. Later, a composition may consist of 30 % government base funding, 15 % government contracts, another 15 % from contracts with multi and bi-lateral funders or donors, 15 % through energy audits, 15 % through seminars and capacity building activities, and another 10 % through other activities such as the sale of publications, demonstrations, and so on (Bredenkamp, 2002b). The SA EA would most likely have to start with initial external (international) funding, but would ultimately be mostly self-sustaining through a mixture of income-generating activities and different funding sources including consulting contracts with government and private partners.

- *Organisational form*

Regarding the organisational form of an SA EA, workshop participants suggested to start with a national initiative combined with a Steering Committee. For a successful initiative, a private public partnership was considered to be most promising. Also, guaranteeing continuity of work and knowledge is an important aspect: Any successful initiative needs continuity and therefore permanent staff (at least 2-3 persons), in order to be able to benefit from experiences and learning.

- *Partners and shareholders*

Successful Energy Agencies need strong partners in their background. A Steering Committee that comprises of individuals from the different institutions concerned with various components of energy policy and practice would be recommendable. This may help to avoid overlaps and unfruitful competition with existing institutions. As the

shareholders of the EA have a strong impact on its fields of activity, a diverse and broad membership structure, preferably a public-private-partnership may suit best for independence, flexibility and development potentials.

An important partner is the government, i.e. the respective ministries (for energy, the environment, and industry). Private partners would include Eskom, the Energy Intensive Users Group, the Development Bank of South Africa and other relevant institutions. Furthermore, international partners should be found, not only as a financier, but also in order to establish and reinforce international links to existing energy agencies (e.g. in Mexico and Germany). Last but not least, NGOs also play a crucial role in establishing a South African Energy Agency.

4 Conclusions and perspectives

The SEPCo case study in South Africa confirms our theoretical thinking that a major barrier to successfully implementing and disseminating energy efficiency technologies is the existence of transaction cost caused by information gaps and lack of capacity on all levels. The implementation of an energy agency can be considered an appropriate tool to improve the situation. For the concrete case of South Africa, we suggest implementing a national energy agency using the existing infrastructure, working under the auspices of the NER but with the ultimate aim to become an independent institution.

The SEPCo case study project was effectively a pre-study of the need and potential for implementing a South African energy agency on a national level. It initiated the foundation a task force, the “SA Energy Agency Initiative” and formulated recommendations to the South African government, pointing to necessary subsequent

support and next steps. The task force suggested to develop the initial idea, to map out the way forward, and to ask the South African energy minister for her support and for appointing a permanent counterpart within the DME. A business plan was to be drawn up, including suggestions for an organisational structure. Moreover, the task force intended start lobbying for funding and support from stakeholders.

From the case study, the following steps can be derived as being supportive for successfully implementing an energy agency in the context of an emerging nation like South Africa: First, the formation of an initiative or association (e.g. a ”South African Energy Agency Committee”) to join forces would alleviate the coordination of activities. Secondly, an organisation needs to be found which is willing to host the energy ageny in its starting phase. Thirdly, public support is essential; for this purpose, a suitable public partner on either the national or a local level should be identified. In any case, the new energy agency should stay clear from becoming part of a public institution. Fourthly, a small number of further partners, preferably from the energy supply industry and from the public financing sector, are required. Further partners may join later into a Steering Committee. For the initial phase, a too large number of partners may complicate the implementation of the energy agency. Fifthly, a concept study, financed by an independent body, would result in a draft and discussion of a business programme, the draft and discussion of a preliminary business plan and financial provision, and the draft and discussion of the organisational structure of the organisation. These initial activities would be a valuable fundament for gaining support from other stakeholders and for the actual start of implementing the energy agency.

The task force approach initiated during the case study in South Africa appears to lead into the right direction. However, a crucial point for continuity of such an initiative is the availability of resources to further push the idea forward, and the ambitious plans still wait for their realisation. Therefore, a larger and longer-term consultation project with sufficient funding would be crucial.

To finish, the prospects for successfully implementing an energy agency in South Africa are reasonably good. The conclusions fit well into the most recent announcements to institutionalise energy efficiency policies under the roof of an energy agency. The tasks of this energy agency are yet to be specified. This window of opportunity could be used to implement an energy agency along the ideas discussed in this paper. A national conference with all local initiatives and the national institutions potentially involved could allow on all levels to take ownership of the ideas and to form a Steering Committee for the future South African energy agency. With such an initial setting, the physical implementation of the actual agency may start along the ideas mapped out in this paper. However, there is still some way to go. Continuous consulting and support would be helpful and necessary for the eventual implementation of an energy agency.

5 References

Bleyl, J. W., 2002. The Case of Energy Agencies: German Experiences. Report to SEPCo, Berlin, 24 October.
(http://www.ises.org/sepconew/Pages/EAs_in_Germany/0.html)

Bredenkamp, B., 2002a. How the environmental benefits of efficient lighting can assist in poverty alleviation in South Africa. Bonesa Electricity, September.

Bredenkamp, B., 2002b. The Case for energy centres and agencies in South Africa. Presentation at the 2nd SEPCo Workshop, Pretoria, November 4-5.

Coase, R.H., 1960. The Problem of Social Cost. Journal of Law and Economics 3, 1-44.

Dosi, G., 1988. The nature of the innovative process. In: Dosi, G., *et al.* (Eds.), Technical Change and Economic Theory. London and New York, Pinter, pp. 221-238.

Eskom, 2002. Embracing sustainable development. Annual Report 2001.

IEA, 2002. Key World Energy Statistics. International Energy Agency, Paris.

IEA, 2003. World Energy Outlook 2002 International Energy Agency, Paris

Levine, M. D., Koomey, J. G., McMahon, J. E., Sanstad, A. H., 1995. Energy Efficiency Policy and Market Failures. Annual Review of Energy and the Environment 20, 535-555.

Mathews, E. H., van Wyk, S. L., 1996. The effect of ceilings and insulation integrated ceilings on the energy efficiency of formal low-cost housing in the Gauteng area. Cape Town.

Nelson, R., Winter, S., 1982. An Evolutionary Theory of Economic Change Cambridge Belknap Press of Harvard University Press,. Massachusetts and London.

Nelson, R., 1998. The co-evolution of technology, industrial structure and supporting institutions. In: Dosi, G., Teece, D. J., Chytry, J. (Eds.), Technology, Organization and Competitiveness. Oxford, pp. 319-35.

NER, 2001. NER Electricity Regulatory Journal, National Electricity Regulator, Pretoria, June.

NER, 2002. First National Integrated Resource Plan for 2001. National Electricity Regulator, Pretoria, June.

NER, 2004. Regulatory Policy on Energy Efficiency and Demand Side Management for South African Electricity Industry. National Electricity Regulator, Pretoria, 25 May.

Praetorius, B., 2000. Power for the people. Die unvollendete Reform der Stromwirtschaft in Südafrika nach der Apartheid. Lit-Verlag, Münster.

Praetorius, B., Fecher, R., 2002. Residential demand-side management and climate change mitigation. In: Davidson, O., Sparks, D. (Eds.), Developing energy solutions for climate change. Publications of the Energy & Development Research Centre, Cape Town, pp. 58-66.

Praetorius, B., Fritsche, U., 1998. Umweltorientierte Transformation des Energiesektors in Südafrika. Technisch-wirtschaftliches Potential und politische Kapazität zur Umsetzung einer effizienten, umwelt- und klimaschonenden Energienutzung. Final report to the Volkswagen Foundation, Berlin.

Rip, A., Kemp, R., 1998. Technological Change. In: Rayner, S., Malone, E. L. (Eds.), Human Choice and Climate Change. Battelle Press, Columbus, Ohio, Vol. 2, pp. 327-399.

Williamson, O., 1985. The Economic Institutions of Capitalism. New York

Wilson, Ch. 1987. Adverse Selection. In: Eatwell, J., Milgate, M., Newman, P. (Eds.), Allocation, Information and Markets. The New Palgrave Dictionary of Economics, New York, London, pp. 31-34.

WPEP, 1998. White Paper on the Energy Policy of the Republic of South Africa 1998. Government Printer, Department of Minerals and Energy, Pretoria.