Technical University of Denmark

Summary of case studies for cooperation mechanisms

Cost-Efficient and Sustainable Deployment of Renewable Energy Sources towards the 20% Target by 2020, and beyond

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PREFACE

This document is a summary report highlighting the main aspect analyzed in the RES4LESS case studies.

The document starts with an introductory chapter where the background that led to the selection of the case studies is outlined. In the following three chapters the case studies are presented, highlighting the most relevant results. A brief chapter concludes the document, giving an outlook on the follow-up activities of the RES4LESS project.

This summary is intended not only as an introduction to the RES4LESS cases studies, but also as a guideline to read and interpret the in-depth analysis carried out in the final documents that describe the case studies in detail. These documents will be published in September 2012 on the RES4LESS website, www.res4less.eu.

The authors would like to thank local stakeholders in the Netherlands, Spain, Denmark and Romania for their supportive attitude, and their contribution to the development of the case studies. In particular the authors are mostly grateful to the following organizations:

- The Dutch Ministry of Economic Affairs, Agriculture and Innovation
- The Spanish Institute for Diversification and Energy Savings, IDAE
- The Spanish Association for Thermo-solar electricity, Protermosolar
- The European Association for Thermo-solar Electricity, ESTELA
- The Romanian regulatory body ANRE
- The Romanian Ministry of Economy, Trade and Business Environment

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1. Introduction

The objective of the RES4LESS project is to develop a Roadmap to cost-efficient deployment of energy from renewable sources (RES) in Europe, via cross-border cooperation mechanisms. The Commission has indicated that the 2020 targets for renewable energy (European Commission 2009) can be achieved through cooperation between Member States. This cooperation could lead to win-win situations, when a country with a large low-cost potential for renewable electricity could sell part of its surplus to a country with a limited and/or expensive potential.

In the project, first a scoping exercise has been carried out to identify which countries could be candidates for cooperation. Next, three case studies have been elaborated to give a better view of what these cooperation mechanisms would entail in practice. The analysis has focused on renewable electricity (RES-E), although cooperation mechanisms could also be envisaged for renewable heat.

1.1 Estimated RES-E surpluses

A *Host country* is a Member State (MS) that is expected to have a relatively cheap surplus that could potentially be "sold" via cooperation mechanisms. A *User country*, on the other hand, is expected to incur high generation costs and could realize savings by importing surplus RES-E via a suitable cooperation mechanism. In Figure 1.1, the projected surpluses for 2020 are shown, broken down into the different technology components. The largest RES-E surpluses are produced from wind onshore and offshore, Photovoltaics (PV), Concentrated Solar Power (CSP) and biomass technologies. Based on these projections many possible pairs of countries that could benefit from the use of cooperation mechanisms have been identified in (Dalla Longa et al. 2011, Jacobsen et al. 2012, Tantareanu et al. 2012, Santamaria et al. 2012, and Dalla Longa 2012). These pairs of countries are referred to as Valleys of Opportunity (VoOs).

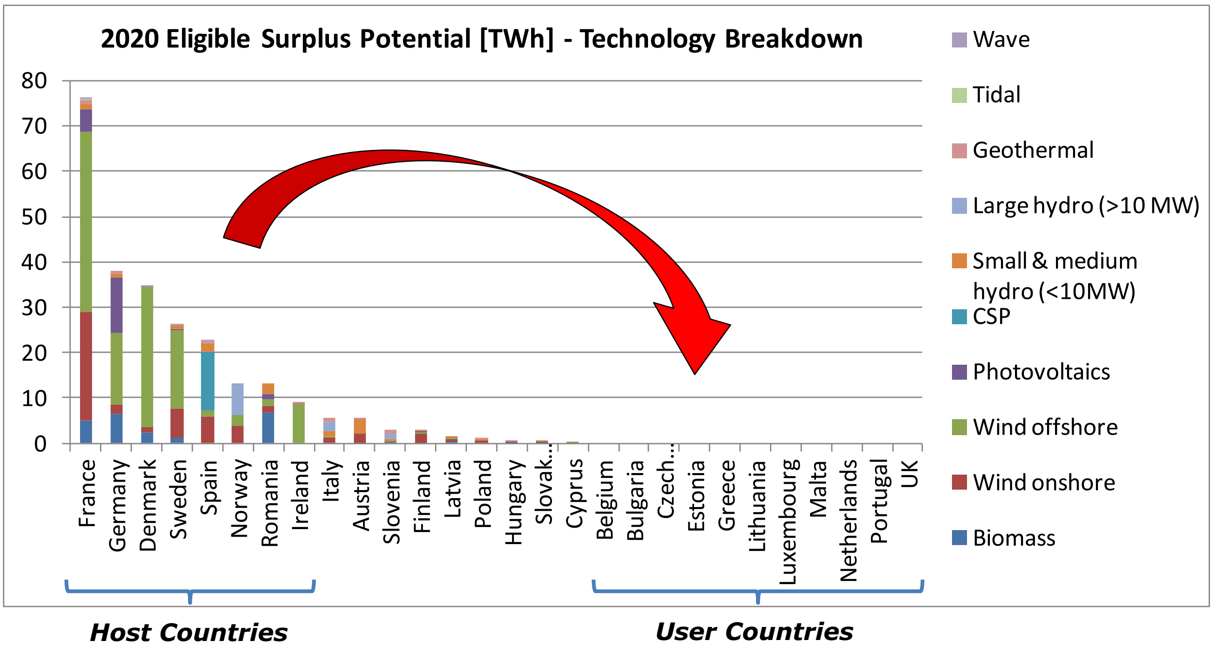

Figure 1.1: Projected RES-E surplus in 2020

The average costs of the projected RES-E surpluses in 2020 are plotted versus their sizes in Figure 1.2. The most interesting Host countries are characterized by large and relatively cheap surpluses, hence in the bottom-right part of the graph. These MSs have been labeled with the corresponding country abbreviation. It is important to keep in mind that the average costs plotted in the figure only give a general indication of what the costs of surplus may be. When focusing on a particular technology the costs may vary a lot. For example, in the case of Spain, when considering only CSP technologies, the cost of surplus would drop to ~10 €ct/kWh.

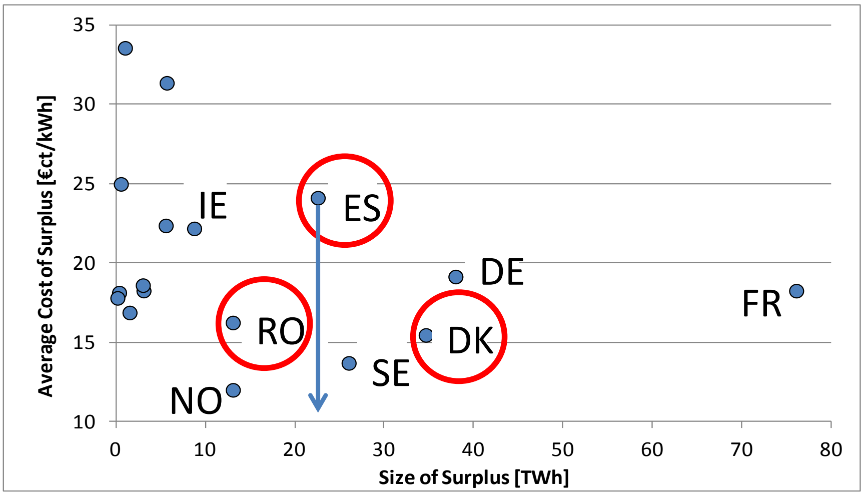

Figure 1.2: Average cost vs. size of projected RES-E surpluses

1.2 Case studies selection

Among the MSs providing the largest and cheapest surpluses identified in Figure 1.2, Denmark, Romania and Spain have been chosen as Host Countries for the RES4LESS case studies[1]. The technologies considered in the case studies are Offshore Wind for Denmark, Biomass for Romania, and CSP for Spain. The choice of host countries is not only based on the cost and size of the projected surpluses, but also on a series of criteria that could be summarized as follows:

- Cheap and large RES-E surpluses
- Realistic VoOs
- Diverse technologies and geographical areas
- Novel but achievable
- Stakeholder's interest

The Netherlands appeared to be a suitable User country in all three case studies, firstly because it could realize significant savings from cooperation mechanisms (Dalla Longa et al. 2011). Furthermore, Dutch policy makers already expressed their interest in engaging in cooperation mechanisms, if a suitable opportunity is identified. This has been remarked in several stakeholders consultation events organized by the RES4LESS consortium, and has been recently confirmed in a Letter to the Dutch Parliament from the Ministry of Economic Affairs, Agriculture and Innovation (Minister van Economische Zaken, Landbouw en Innovatie, 2012).

Many of the issues analyzed in the case studies are also relevant for other MSs that have been identified as possible User countries, such as Belgium, Luxembourg and the UK. Many other interesting combinations of countries were inevitably left out. Some of these options will be incorporated in the final RES4LESS Roadmap.

[1] Norway and Sweden, the two MSs displaying the cheapest surpluses, were not chosen as Hosts in the case studies mainly because they have already engaged in a Joint Support Scheme, while RES4LESS is looking for novel opportunities. This by no means implies that these countries could not be Hosts for cooperation mechanisms.

2. Case study: offshore wind, DK → NL

This chapter elaborates on a possible cooperation between Denmark and the Netherlands, based on Danish offshore wind. As specified in (Jacobsen et al. 2012), a valley of opportunity of some 8 TWh has been identified, corresponding to a Joint Project with a capacity of about 2 GW.

In the Danish North Sea there are several good locations for offshore wind parks, close to shore (20-25 km) and characterized by shallow waters (20-25 m depth). In particular, the 2 GW could be allocated in the Horns Rev area, including and expanding the already planned development in this site.

2.1 Economic aspects

In the RES4LESS case studies a scheme is developed to quickly visualize the direct and indirect costs and benefits of a particular cooperation mechanisms. In Figure 2.1 this scheme is applied to the present case study; all costs and prices in the figure are projections for the year 2020. In the figure a base case scenario for the Netherlands (upper half) is compared to the cooperation scenario in the present case study (lower half). In the left part of the figure, the direct costs and benefits are quantified; the results provided should be interpreted as first order estimates. The indirect effects are analyzed in the right part of the figure. In the following the figure is explained in detail.

As an alternative to engaging in cooperation mechanisms, in order to reach its 20% target, the Netherlands could develop local wind offshore resources; this is considered the base case scenario.. In 2020 wind offshore could be deployed in the Netherlands at an average generation cost of 15 €ct/kWh. The produced RES-E will be sold on the market at a price of 6.3 €ct/kWh. In order to make wind offshore projects attractive for developers, the support system should cover the difference between the generation costs and the electricity price, corresponding to 8.7 €ct/kWh. If an indicative extra cost of 0.1 €ct/kWh is assumed to account for grid connection, the direct costs of the base case scenario amount to 8.8 €ct/kWh. By developing its natural resources, the Netherlands also realizes some indirect benefits: less emissions, more local economic activities and employment opportunities, industrial leadership, energy security.

The lower half of the figure deals with the case of the Netherlands deciding to engage in a cooperation with Denmark, based on Danish wind offshore. Production costs for the Danish offshore wind in 2020 are 12 €ct/kWh. The electricity price will be 4 €ct/kWh in case of no physical transfer (RES-E sold in the local Danish market), and 6.3 €ct/kWh in case of physical transfer to the Netherlands (assuming the Cobra connection cable is in place). In both cases the Netherlands could realize some savings: ~1 and ~3 €ct/kWh, respectively.

Thanks to the cooperation, Denmark would realize some indirect benefits associated to a less carbon-intensive energy mix, while the Netherlands would lose the same benefits, hence experience some indirect costs. While it is not easy to monetize these indirect effects, it is reasonable to assume that they may play a significant role in the negotiations.

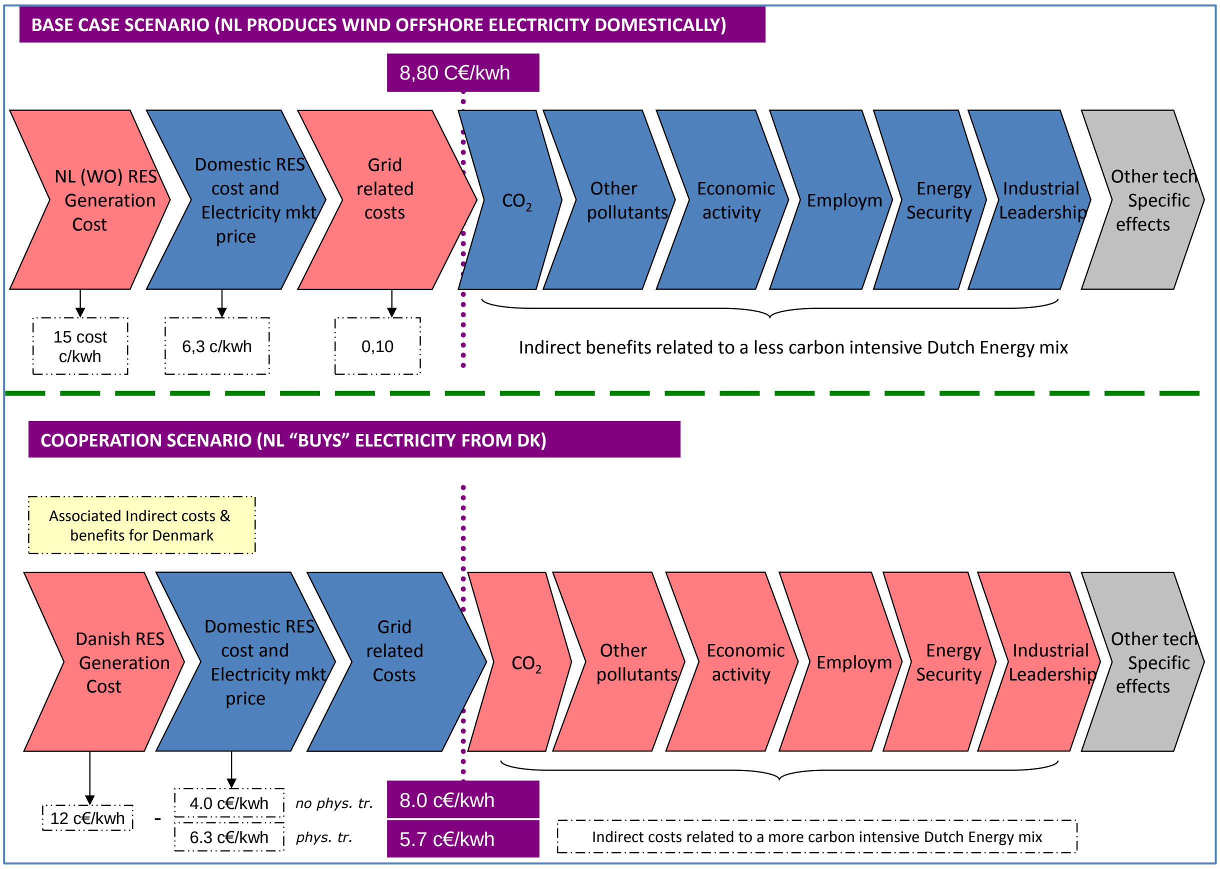

Figure 2.1: Economics of the DK → NL cooperation

2.2 Policy options

In general there exist many different policy arrangements that could be employed to support the development of a cooperation project. These arrangements should be specified in the bilateral agreement stipulated between the two cooperating countries. The necessary measures (e.g. law amendments), should be taken in the cooperating countries to make these agreements effective.

For the present case study, two policy options are considered:

1. Open the Dutch support system (SDE+) to offshore developers that operate in Danish waters
2. Completely handle the support in Denmark; the Netherlands only pays a transfer price for the RES credits in 2020

In option 1, the SDE+ would have to be modified, opening a separate section to offshore developers that operate in the sites of the Danish North Sea allocated to the cooperation project. The developers would bid into the SDE+, and the electricity price against which the support level is calculated would be either the Danish one (in the case of no physical transfer) or the Dutch one (in the case of physical transfer).
In option 2, everything would be handled in Denmark, according to the existing Danish rules, and the RES credits would then be transferred to the Netherlands. The two cooperating countries would have to agree on a transfer price. This can be a difficult matter. Typically the transfer price will depend on the production costs, the electricity price, the duration of the agreement, and the value attributed to RES credits after 2020.

2.3 Maximum achievable realizations

In Table 2.1 the main features of the present case study are summarized, looking at the maximum realistically achievable realizations.

Technology	Wind Offshore
Capacity of wind parks	200 MW
Construction time	~2 years
Generation costs	12 c€/kwh (by 2020)
Location	Horns Rev
Production	2000 MW installed capacity - 8.2 TWh/y
Number of parks	10
Cooperation mechanism	Joint project with or without physical transfer (depending on Cobra cable)

Table 2.1: Characteristics of DK → NL cooperation

The maximum size of the cooperation project has been estimated to a capacity of 2 GW. This is a rather big project, showing the great potential of this case study. Obviously such a big project carries a substantial risk. Therefore it can be expected that the negotiation process will not be easy. In general it is expected that the Host country should take most of the risk, by guaranteeing that the promised capacity will be installed on time, and that the promised RES credits will be transferred to the User Country. In Figure 2.2 a timeline is proposed to carry out the project in two phases, in the case of no physical transfer (i.e. the Cobra cable is not installed).

Figure 2.2: Timeline for realization of DK → NL cooperation

2.4 Example: a pilot project

If a substantially smaller pilot project is considered, the indirect effects and the risks associated with engaging in cooperation become less of an issue. This would make the negotiation process much easier. Therefore in Table 2.2 we explicitly consider the economics of a small pilot project, without physical transfer.

Size of the pilot project	1 wind park of 200 MW (~1 TWh/y)
Negotiations	2012 – 2014
Construction	2014 – 2016
Operational in	2017
Wind Offshore production costs in DK in 2017	~13 €ct/kWh
Displaced technology in NL	Wind Offshore (~16 €ct/kWh)
→ **Support costs in 2017 ~90 M€**	
→ **NL Saves in 2017 ~10 M€**	

Table 2.2: DK → NL pilot project

Offshore wind is a relatively mature technology. Therefore no major cost reduction is expected. Based on the model projections, it is assumed that in 2017 the average cost of offshore wind will be 13 and 16 €ct/kWh in Denmark and the Netherlands, respectively. Only considering the direct costs, the project would make the Netherlands save around 10 M€ in support costs.

2.5 Conclusions

Overall there are good opportunities for a cooperation project between Denmark and the Netherlands, based on offshore wind. The size of the project could range between 200 MW and 2 GW, and the first installations could be operational in 2016-2017. Specific advantages for the Netherlands would be the savings in support costs, and the possibility for the Dutch offshore industry of being directly involved in the development of the offshore park(s). For Denmark the advantages would be mainly those related to having more renewables in the energy mix.

In case the Cobra connection cable is in place, further cost savings on the support side could be realized in the Netherlands. Moreover the project could be a first step towards a more extended North Sea grid. Therefore other countries could indirectly benefit from this cooperation.

The main barriers to the realization of the project have been identified as:

- Cooperation may require a rather sophisticated scheme (especially the negotiations regarding the price of RES certificates may be difficult)
- Grid related: connection and upgrade may be necessary, depending on the size of the project

3. Case study: biomass, RO → NL

In this chapter, a possible cooperation between Romania and the Netherlands is considered, exploiting biomass in Romania. Despite the significant biomass resources available in Romania, RES-E from biomass technologies represents a relatively small portion in the Romanian National Renewable Energy Action Plan (NREAP), compared to wind and PV. This results in a (forecasted) unused biomass surplus. In (Tantareanu et al. 2012) a valley of opportunity between Romania and the Netherlands of some 2 TWh has been identified, corresponding to a capacity of about 280 MW.

The surplus would mainly come from *agricultural waste*, which is currently burned in rural stoves to produce heat, and *dedicated energy crops* on land that is currently unused. If the cooperation takes place, the raw materials would be used locally to produce electricity, which would be then fed into the distribution grid. Due to the nature of this case study, we focus here on a *joint framework for many small projects* distributed across the Romanian territory, rather than a localized big joint project as in the wind offshore case study.

Several biomass technologies are present in the market. In the case study, no specific technology is promoted; it is expected that the most competitive and efficient technologies in the market will win the largest shares.

3.1 Economic aspects

In Figure 3.1 the economic aspects of the present case study are analyzed; all costs and prices in the figure are projections for the year 2020. The results provided should be interpreted as first order estimates.

The base case scenario for the Netherlands in the upper part of the figure is identical to that of the previous case study.

In the lower half of the figure the economics of the present case study is analyzed. The average production costs for biomass-based electricity in Romania are 13 €ct/kWh. The electricity price is 6.4 €ct/kWh, resulting in a saving of 2.1 €ct/kWh for the Netherlands.

Apart from the indirect benefits associated to a less carbon-intensive energy mix, this cooperation would also give Romania the chance to exploit a substantial portion of its biomass resources that would otherwise remain largely unused.

3.2 Policy options

For the present case study, policy option 1 (the Netherlands opening up its support scheme to foreign developers) is considered.
Given the distributed nature of the envisioned biomass projects, mainly based on biomass resources produced and burned in local farms, the cooperation agreement will involve a large number of small, decentralized plants.

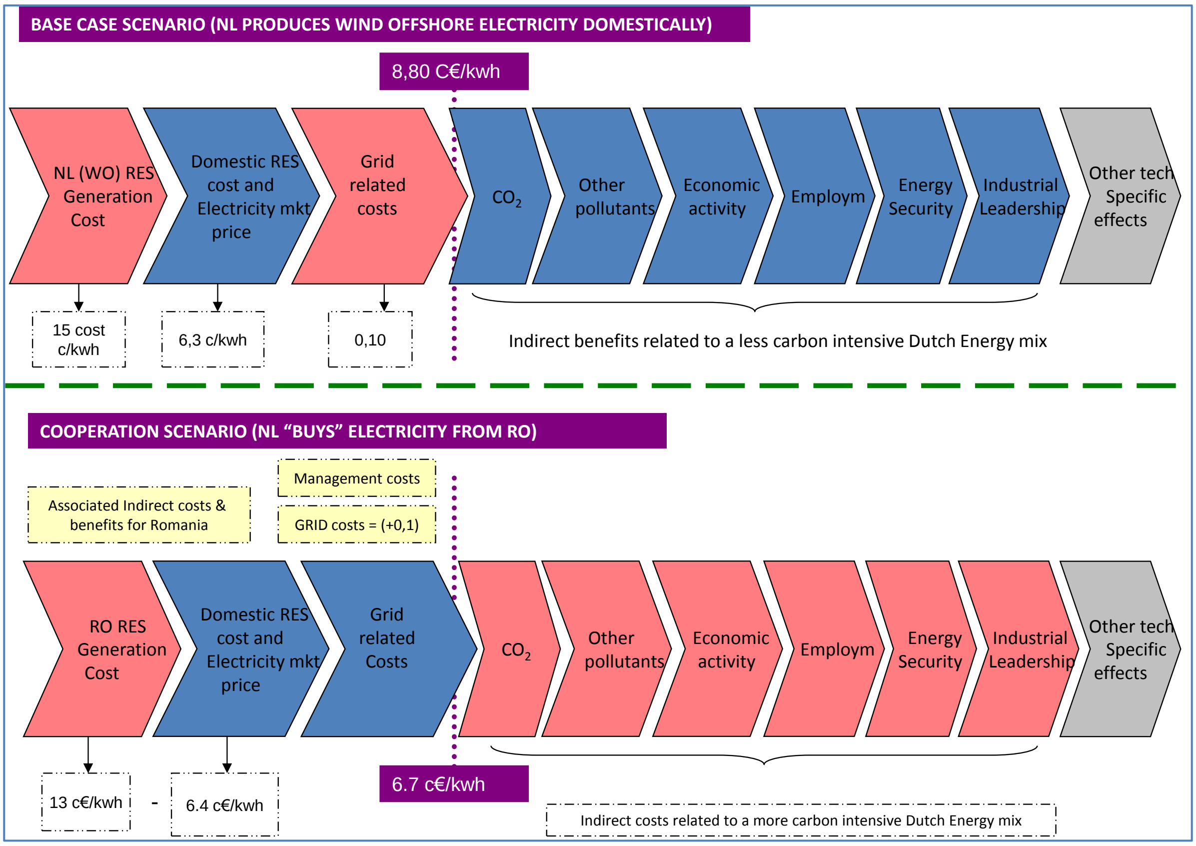

Figure 3.1: Economics of the RO → NL cooperation

3.3 Maximum achievable realizations

In Table 3.1 the maximum realistically achievable realizations of these case study are presented.

Technology	All biomass technologies competitive in the Romanian market
Capacity of biomass plants	5 – 20 MW
Construction time	~1 year
Generation costs	13 c€/kwh
Location	Distributed
Production	280 MW installed capacity - 2 TWh/y
Cooperation mechanism	Framework for several small joint projects without physical transfer

Table 3.1: Characteristics of RO → NL cooperation

Preparation of the support scheme		Launch of CM	Commissioning of first CM projects	Commissioning and operation of CM projects			
Domestic scheme							
		Cooperation scheme					
2013	2014	2015	2016	2017	2018	2019	2020

Figure 3.2: Timeline for realization of RO → NL cooperation

With a maximum estimated capacity of 280 MW, the present case study is significantly smaller than the offshore wind one. The limited size implies that the risks and the indirect effects will be relatively low, thereby making the cooperation somewhat easier to realize. In Figure 3.2 a timeline is proposed to carry out the cooperation.

Currently Romania provides national support for RES via a quota system. This support scheme is going to be phased out in 2016. Therefore it is expected that before 2016 several RES installations will be realized in order to take advantage of the support system. These installations will mainly concern wind and PV technologies, and are expected to create a surplus in 2016, which will then level out towards the Romanian NREAP target by 2020. Biomass technologies would not be highly deployed if not supported by cooperation mechanisms. In case a biomass-based cooperation is established, the corresponding projects would start around 2016 and therefore fall outside the local support system. This situation is depicted in Figure 3.3: the blue line represents the planned Romanian trajectory towards the realization of the national NREAP target, the pink line represent the expected actual development, and the green line represents the RES-E produced through the proposed cooperation mechanism.

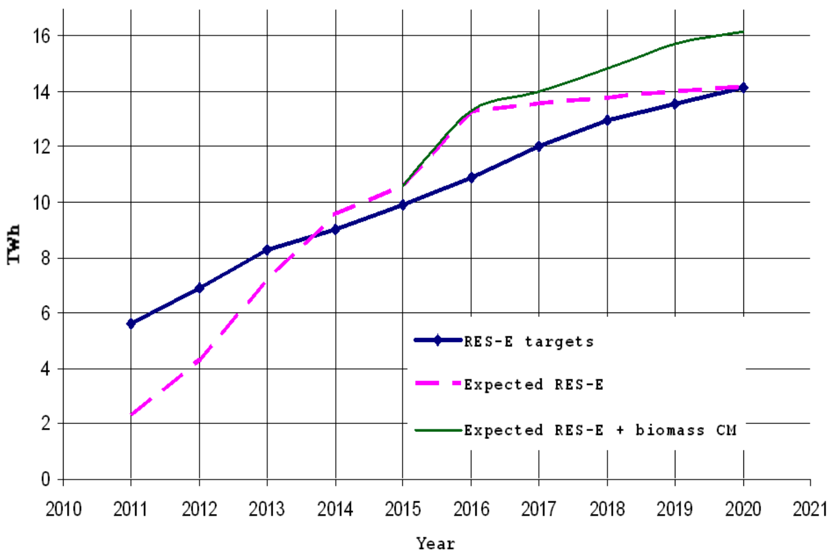

Figure 3.3: Projected deployment of RES-E in Romania. The blue line represents the planned Romanian trajectory towards the realization of the national NREAP target of 14 TWh RES-E in 2020, the pink line represent the expected actual development, and the green line represents the RES-E produced through the proposed cooperation mechanism

3.4 Example: a pilot project

The present case study entails a relative small cooperation project (when compared to the offshore wind case study). Therefore the whole achievable capacity of about 280 MW will be considered as a “pilot”. In Table 2.2 the economic aspects of the project are summarized.

Size of the pilot project	Several biomass plants totaling 280 MW (~2 TWh/y)
Negotiations	2012 – 2014
Construction	Starting in 2015
Operational from	2016
Total production in 2017	0.5 TWh
Average production costs of bio-based electricity in RO in 2017	~13 €ct/kWh
Displaced technology in NL	Wind Offshore (~16 €ct/kWh in 2017)
→ **Support costs in 2017 ~30 M€**	
→ **NL Saves in 2017 ~15 M€**	

Table 3.2: RO → NL pilot project

Only considering the direct costs, the project would make the Netherlands save around 15 M€ in support costs in 2017.

3.5 Conclusions

The case study for cooperation between Romania and the Netherlands, based on biomass RES-E, foresees the establishment of a special framework for small biomass projects, distributed across the Romanian territory. The maximum realistically achievable installed capacity is estimated to be 280 MW by 2020. Specific advantages for the Netherlands would be the savings in support costs, and the possibility to engage in a relatively small (hence low-risk) cooperation. For Romania the advantages would be those related to having more renewables in the energy mix, the chance to exploit large biomass resources that would otherwise remain unused, and the opportunity to deploy modern biomass technologies across the national territory.

The main barriers to the realization of the projects have been identified as:

- Grid related: the Romanian distribution grid (to which the biomass plants would be connected) should be able to handle the 280 MW coming from the cooperation projects without a need for major upgrades. However there may be some uncertainties about the reliability of the grid.
- As shown in Figure 3.3, RES deployment in Romania is currently lagging behind schedule. This may raise some uncertainty on whether Romania will be able to meet its own national RES target.
- The 2 TWh/y RES-E from biomass represents a significant additional production. There is some uncertainty as to what effect this will have on the national biomass market. In particular there may be issues related to sustainability and possible fluctuations of raw biomass prices.

4. Case study: concentrated solar power, ES → NL

In the scoping exercise, Spain has been identified as one of the potential Host countries for cooperation mechanisms, thanks mainly to its surplus of RES-E from Concentrated Solar Power.

As specified in (Santamaria et al. 2012), a VoO of about 5 TWh could be established between Spain and the Netherlands by 2020, corresponding to a Joint Project with a total capacity of about 1.2 GW. Building on the model projections, this result also takes into account the fact that for the cooperation project relatively big CSP plants (~200 MW) could be built[2], driving costs down and therefore allowing for a larger deployment.

Compared to Offshore Wind and to the Biomass-based technologies considered in the other case studies, CSP is a relatively young technology. This presents the specific advantage that a significant cost reduction could be achieved before 2020, depending on the size of the plants (in general, the bigger the better). It is forecasted that a CSP plant of 200 MW will be able to produce at a cost of 10 €ct/kWh in 2020. The two main CSP technologies considered in the present case study are *parabolic trough* and *central receiver (tower)*. Both technologies allow for some storage capacity (up to 9 hours), hence present an additional advantage compared to intermittent sources such as wind or PV.

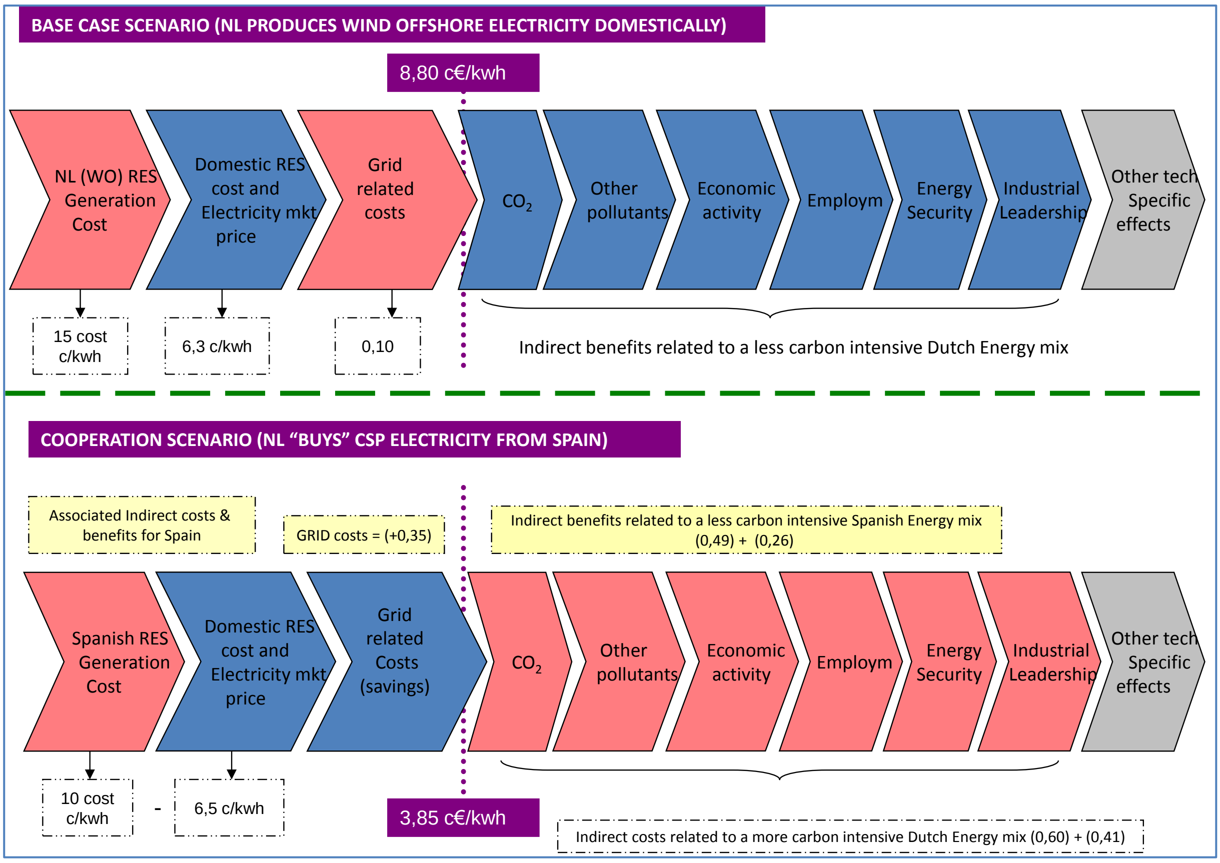

Figure 4.1: Economics of the ES → NL cooperation

2 So far in Spain mainly small (<50 MW) CSP plants have been built, the size limitation being a prerequisite for taking advantage of the national feed-in tariff support system. This regime would not apply to the CSP plants participating in the cooperation mechanism.

4.1 Economic aspects

Figure 4.1 summarizes the main economic aspects of the present case study; all costs and prices in the figure are projections for the year 2020, and should be considered as first order estimates.

In the upper half of the figure the base case scenario for the Netherlands is presented; this is identical to that of the previous case studies. In the lower half of the figure the CSP-based cooperation alternative is considered. The production costs and electricity price for CSP in Spain are 10 €ct/kWh and 6.5 €ct/kWh, respectively. Therefore the Netherlands could save about 5 €ct/kWh.

In the figure an attempt has been made to estimate the indirect costs associated with a more carbon-intensive energy mix in the Netherlands. These are only shown as an example and have not been included in the savings calculation.

4.2 Policy options

Policy option 1 (the Netherlands opening up its support scheme to foreign developers) is considered in this case study. A separate section of the Dutch support system could be opened to CSP developers that operate in Spain.

4.3 Maximum achievable realizations

In Table 4.1 the maximum realistically achievable realizations for this case study are shown.

Technology	CSP (central receiver – Tower), CSP (parabolic trough)
Construction time	~2 years
Capacity of the Plants	200 MW
Generation costs	< 11 c€/kwh (expected to be around 10 by 2020)
Location	Southern Spain
Storage capacity	9 hours
Production	1250 MW installed capacity - 5 TWh
Number of plants	6 plants (4 x 200 MW plants and 2 x 225 MW)

Table 4.1: Characteristics of ES → NL cooperation

With a maximum achievable capacity of about 1.2 GW, this case study represents a potentially large development opportunity. As already remarked in the offshore wind case study, such a big project carries a significant risk; therefore guarantees for timely transfer of the promised RES credits should be in place. A possible development path to deploy the full capacity of the joint project in two phases is shown in Figure 4.2.

MW	2014	2015	2016	2017	2018	2019	2020
Parabolic trough in construction	*200*	*400*	*400-625*	*200-425*	*225*	*0*	*0*
Tower in construction	*200*	*400*	*400-625*	*200-425*	*225*	*0*	*0*
Parabolic trough in operation	**0**	**0**	**200**	**400**	**625**	**625**	**625**
Tower in operation	**0**	**0**	**200**	**400**	**625**	**625**	**625**
							1.250

Figure 4.2: Timeline for realization of ES → NL cooperation

4.4 Example: a pilot project

In Table 4.2 we analyze the economics of a small (hence low-risk) pilot project that could be realized by 2017.

Size of the pilot project	1 CSP plant of 200 MW (~1 TWh/y)
Negotiations	2012 – 2014
Construction	2014 – 2016
Operational in	2017
Production costs of CSP-based electricity in ES in 2017	~15 €ct/kWh (conservative estimate)
Displaced technology in NL	Wind Offshore (~16 €ct/kWh)
→ **Support costs in 2017 ~85 M€**	
→ **NL Saves in 2017 ~12 M€**	

Table 4.2: ES → NL pilot project

In order to be on the conservative side, only a modest cost reduction has been considered for CSP in 2017, down to 15 €ct/kWh. Only considering the direct costs, the pilot project could make the Netherlands save around 12 M€ in support costs in 2017.

4.5 Conclusions

The CSP industry in Spain has undergone a rapid development in the last decade, both in terms of actual installations and R&D. As a result Spain is regarded worldwide as one of the most important centers for CSP technologies. However, due to the recent moratorium on the RES support in Spain, the CSP sector is now threatened to have to substantially reduce its growth pace. Therefore cooperation mechanisms represent a unique opportunity for the CSP sector to keep developing.

In the present case study a joint project is proposed between Spain and the Netherlands, based on Spanish CSP. The size of the project could range between 200 MW and 1.25 GW, and the first installations could be operational in 2016-2017. Specific advantage for the Netherlands would be the savings in support costs. For Spain the advantages would be those related to having more renewables in the energy mix, and the great opportunity for the CSP sector to keep growing.

The main barriers to the realization of the project have been identified as:

- The Netherlands is not directly active in the CSP sector. Therefore, despite the net savings in support costs, it may be difficult to justify that a relatively high tariff be provided for CSP projects in Spain, since Dutch companies cannot be directly involved in the development of the plants.
- Grid related: connection and upgrade may be necessary, depending on the size and location of the project(s).

5. Conclusions and outlook

Within the RES4LESS project, three case studies for cross-border cooperation mechanisms according the RES Directive (European Commission 2009) have been analyzed.

The first case study concerns a cooperation between Denmark and the Netherlands, involving offshore wind. A joint project could consist of several offshore wind parks in Danish waters, totaling a maximum capacity of 2 GW. A 200 MW pilot project could already be realized in 2017, corresponding to a saving of about 10 M€ for the Netherlands. A critical condition for the realization of this joint project is to engage in negotiations and discuss the different policy options and transfer prices at an early stage. Another important factor is to obtain clarity on the installation of the Cobra connection cable.

The second case study focuses on a cooperation between Romania and the Netherlands, involving bioenergy. In this case the development of a framework for small biomass projects, distributed across the Romanian territory, is proposed, totaling a maximum capacity of 280 MW. The first plants could be operational in 2017, corresponding to a saving of about 15 M€ for the Netherlands. In order to put this cooperation in place, a key condition is that Romania gets on track towards the achievement of its target. The cooperation would give Romania the chance to deploy biomass resources that may otherwise remain unused.

The third case study has elaborated the scope for a cooperation between Spain and the Netherlands, based on concentrated solar power. A joint project could consist of several CSP plants in the south of Spain, totaling a maximum capacity of 1.25 GW. A 200 MW pilot plan could already be realized in 2017, corresponding to a saving of about 12 M€ for the Netherlands. This cooperation represents a unique opportunity for the Spanish CSP sector to keep growing. A critical success factor is to achieve significant reductions in CSP production costs.

All countries considering to start up a cooperation will have to look at possible requirements for grid connections and upgrades; these aspects have been analyzed within the RES4LESS project (Heinemann, Bauknecht et al., 2012; Heinemann, Bauknecht., 2012; Heinemann, Sachs et al., 2012). Moreover, the interaction between support schemes, and possible competition between user countries for cooperation with a certain host country deserve further attention. Finally, a general barrier for cooperation is the uncertainty on non-compliance and post-2020 policy in EU. Not knowing exactly what the consequences of non-compliance with the RES target will be, many countries find it difficult to estimate the net benefits of cooperation. Not knowing what the EU post-2020 policy will be, it is difficult to assign a value to the RES produced after 2020.

Building on these case studies, in the last quarter of 2012 the RES4LESS consortium will focus on the development of a Roadmap for cost-efficient deployment of RES in EU up to 2020 and beyond, via cooperation mechanisms. This will provide the chance to briefly analyze some other interesting cooperation options next to the case studies. Like the case studies, the Roadmap will be developed in close collaboration with the relevant stakeholders, in order to achieve maximum impact on the policy processes.

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