

Neuhoff, Karsten; Winzer, Christian; Sasso, Loredana

Research Report

Policies for international transmission investment: Unlocking North Africa's renewable energy portfolio - for local use and international exchange. Final report

DIW Berlin: Politikberatung kompakt, No. 74

Provided in Cooperation with:

German Institute for Economic Research (DIW Berlin)

Suggested Citation: Neuhoff, Karsten; Winzer, Christian; Sasso, Loredana (2013) : Policies for international transmission investment: Unlocking North Africa's renewable energy portfolio - for local use and international exchange. Final report, DIW Berlin: Politikberatung kompakt, No. 74, ISBN 978-3-938762-65-3, Deutsches Institut für Wirtschaftsforschung (DIW), Berlin, https://nbn-resolving.de/urn:nbn:de:0084-diwkompakt_2013-0748

This Version is available at:

<https://hdl.handle.net/10419/84888>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

74

Politikberatung kompakt

Deutsches Institut für Wirtschaftsforschung

2013

Policies for International Transmission Investment

Karsten Neuhoff, Christian Winzer, Loredana Sasso

IMPRESSUM

© DIW Berlin, 2013

DIW Berlin
Deutsches Institut für Wirtschaftsforschung
Mohrenstraße 58
10117 Berlin
Tel. +49 (30) 897 89-0
Fax +49 (30) 897 89-200
www.diw.de

ISBN-10 3-938762-65-9
ISBN-13 978-3-938762-65-3
ISSN 1614-6921
urn:nbn:de:0084-diwkompakt_2013-0748

Alle Rechte vorbehalten.
Abdruck oder vergleichbare
Verwendung von Arbeiten
des DIW Berlin ist auch in
Auszügen nur mit vorheriger
schriftlicher Genehmigung
gestattet.

DIW Berlin: Politikberatung kompakt 74

Karsten Neuhoff* (Project Manager)

Loredana Sasso **

Christian Winzer***

Policies for International Transmission Investment Unlocking North Africa's renewable energy portfolio - for local use and international exchange

Final report

This study has been supported by the Dii GmbH

Berlin, 5. April 2013

* DIW Berlin, Abteilung Klimapolitik. kneuhoff@diw.de

** DIW Berlin, Bergamo University and Università Cattolica del Sacro Cuore di Milano,
loredanasasso@hotmail.com

*** DIW Berlin and University of Cambridge, c.b.winzer@gmail.com

Table of Contents

1	Executive summary.....	1
2	Introduction	10
3	Aspects for interconnection investment specific to business model	13
3.1	Existing business models.....	13
3.2	Regulated investment.....	15
3.2.1	Issues associated with regulated investments	17
3.2.2	Solutions for regulated investments	20
3.3	Concession based investment.....	27
3.3.1	Issues associated with concession based investments	28
3.3.2	Solutions for concession based approach	32
3.4	Merchant based investment.....	34
3.4.1	Issues associated with merchant investments	36
3.4.2	Solutions for merchant investments	39
3.5	Summary of interconnection aspects specific to business model.....	42
4	Aspects of interconnections investments beyond specific business models	44
4.1	Desert power in general	44
4.1.1	Issues associated with desert power projects in general.....	44
4.1.2	Solutions for desert power project in general.....	46
4.2	Interconnection specific aspects.....	51
4.2.1	Issues specific to interconnections.....	52
4.2.2	Solutions for interconnection specific issues	53
4.3	Summary of issues relating to transmission	61
5	Options to match approach to renewable energy remuneration and transmission regulation	62
5.1	Cross-cutting topics for all options	65
5.1.1	Long-term contracts	65
5.1.2	Efficient use of interconnector	67
5.1.3	Carbon leakage	68
5.2	Option 1: Regional tender.....	69
5.3	Option 2: EU Tender.....	75
5.4	Option 3: EU premium or quota system.....	77
5.5	Criteria to compare options.....	78
6	Conclusion.....	82
	References.....	85

List of tables, figures and boxes

Tab. 1	Summary of most frequently mentioned concerns by interviewees and in literature.....	5
Fig. 1	Figure 1 Structure of analysis of issues, solutions and their enabling components.....	12
Box 1	Box 1. Spain-Morocco interconnector as an example of regulated based investment.....	16
Fig. 2	Figure 2. Issues and solutions for regulated investment.....	18
Fig. 3	Solutions and enabling components for regulated investment	21
Fig. 4	Issues, solutions and enabling components for concession based investment	28
Box 2	UK Offshore Transmission Owners as an example of concession based invest-ment	31
Fig. 5	Solutions and enabling components for concession based investment	32
Box 3	BritNed interconnector as an example of merchant investment.....	36
Fig. 6	Issues and solutions for merchant investment.....	37
Fig. 7	Solutions and enabling components for merchant investment	39
Tab. 2	Summary of most frequently mentioned concerns by interviewees and in literature	43
Fig. 8	Generic Issues and solutions for international desert power projects	44
Fig. 9	Solutions and enabling components for international desert power projects	46
Fig. 10	Generic Issues and solutions for transmission projects	51
Fig. 11	Solutions and enabling components for generic issues of transmission projects.....	54
Box 4	Energy Community as an example of an institutional umbrella.....	59
Tab. 3	Summary of most frequently mentioned concerns by interviewees and in literature	61
Fig. 12	Arrangements for combining renewable remuneration mechanisms and transmission rights.....	63
Fig. 13	Critical points along the transmission path that need to be addressed by the regulatory framework, transmission investors or renewable investors in case of a regional tender	70
Fig. 14	Critical points along the transmission path that need to be addressed by the regulatory framework, transmission investors or renewable investors in case of an EU tender	75
Fig. 15	Critical points along the transmission path that need to be addressed by the regulatory framework, transmission investors or renewable investors in case of an EU premium	77
Fig. 16	Contractual responsibilities, risks and benefits for different aspects of international export arrangements under the three options: Regional tender, EU tender and Premium/Quota	82

1 Executive summary

I. Objective of the study

The study aims to identify suitable regulatory frameworks and business models for transmission investment to enable international exchange and local use of renewable energy across the EU and MENA regions.

The analysis explores how policy frameworks can support the realization of individual transmission lines and their use to support renewable project investment and energy transport in the short-term, e.g. next ten years. The current ten year network development plan of ENTSO-e envisages such lines between Italy and Tunisia and between Italy and Algeria with a total capacity of 1.5 GW. An interconnection of similar scale already exists between Spain and Morocco. Grid and renewable projects could facilitate closer cooperation between the EU and MENA regions to support their economic development, job prospects and reducing reliance on domestic subsidized gas purchases.

For the longer-term, large scale transmission between EU and MENA can lead to large cost savings, as it can enable an arbitrage in the daily and seasonal profiles of wind and solar plants and demand in the EU and MENA countries, and can allow to access some of the better resource potentials (DII, 2012). Such large scale energy cooperation requires early projects to develop trust, experience on institutional and technology sides and continuous dialog among all stakeholders involved. Therefore policy frameworks to support individual projects also need to be assessed with regard to their ability to contribute towards such a longer-term perspective.

II. Insights from interviews and literature survey

We first assessed issues associated with transmission investment in general and related to transmission in the context of desert power projects. The analysis was based on a review of existing literature and conducted interviews with 36 experts and stakeholders from Spain, Italy, UK, Morocco, Algeria and Tunisia. They were selected based on their experience with different business models for interconnection projects. These include regulated transmission investment with an example of Morocco-Spain interconnector, merchant investment with an example of Britned, and concession based transmission investment with an example of the UK offshore grid investments. Based on the stakeholders' experience with the current situation in Morocco, Algeria, Italy and Spain they provided us with insights relating to the EU-

MENA cooperation linked to desert power. The following summary reports on the issues that were identified most frequently by the experts and in literature with regard to desert power projects in general, interconnection projects related to desert power projects and in relation to three different business models for the construction of an interconnector.

Issues associated with desert power projects in general

Lack of national interest: For most countries, the goals of meeting their local demand, diversifying their supply, and building a local industry which generates revenues and employment are equally or more important than the profits which could be obtained from electricity exports. This can limit interest to advance interconnection projects.

Building trust between countries: Governments are cautious about electricity imports as they fear that this could introduce dependencies. In many instances a stronger basis for trust will have to be developed as basis for – and perhaps in the process of – increased interdependence of power supply. A possibility in interruption of electricity import-export activity due to political reasons may be a major concern for EU consumers and utilities. The Western Sahara conflict is still one of the major obstacles to necessary cooperation of Morocco and Algeria, hampering regional trade between them and with Tunisia.

The report discusses a set of policy responses to address these concerns including options to unlock full value of transmission to enhance the benefit of cooperation, enhancing and demonstrating the benefits of cooperation on an economy wide level and developing and demonstrating political commitment, in a domestic setting and through international cooperation.

Interconnection specific issues of international desert power projects

- *Opposition of selected stakeholders:* Transmission projects involve both government and utility actors, and in the case of interconnectors - also of several countries. Even if one of these stakeholders does not benefit from the project, this can create indefinite delays, therefore all stakeholders have to be supportive or at least neutral towards a new transmission project.
- *Co-ordination of generation and transmission investments:* Interdependencies in location, timing, contracting and financing aspects need to be considered, but can create challenges given different project durations, planning and permitting processes, and actors.

Interviewing partners and reviewing literature led to various approaches for how to address these issues. They can include coordination and integration of national responsibilities, transparent processes, compensating specific stakeholders and anticipatory investments in transmission.

The following three business models are applicable to investments in transmission:

In a regulated approach, a regulator typically approves construction of a line and, as result of this, new transmission assets become part of the regulatory asset base of a regulated transmission owner.

In a concession based approach, the government, regulator or some entity on their behalf tenders a long-term concession contract for a new transmission line.

In a merchant based approach, a company invests into a transmission line against the future revenue from selling transmission rights to market participants.

For more detailed description of each of the business model, see Chapter 2.

Issues with specific business model: regulated investments

In this case investments in interconnection capacity are pursued by transmission owners in neighbouring countries and included in their regulatory asset base. They are financed against revenues that will be determined by respective national regulatory authority. The three most prominent issues reported were:

- *Limited motivation for TOs to invest in new interconnectors:* Ownership structure and history may imply that TOs have limited focus on growing their business with new investments, an effect reinforced in case of complex and more risky interconnectors.
- *Access to capital:* European TOs might have to raise additional equity which can be challenging where they are government-owned, as this either requires cash from budget constrained governments or acceptance from the government that private investors co-invest. In MENA countries, tariff deficits create dependency on government support undermining credibility with financial markets.
- *Difficulty to decide on cost allocation:* The capital and operational costs for the lines to the extent that they are not recovered from transmission fees are added to usage fees for customers of the investing Transmission Owners. Regulators and governments thus need to agree on how to share these costs. In addition to the difficulty of

negotiating the cost allocation ex-ante the distribution of costs and benefits may change over time – an effect that needs to be addressed at the design stage to avoid risks to regulatory and thus investment certainty.

Several solutions are being applied to address these issues. They include granting higher and additional revenue to encourage TOs to advance projects and linking the allocation of benefits for a line to the cost-sharing principles.

Issues with specific business model: concession based investment

In this case the authorities of neighbouring countries initiate a tender for the construction of a new line and grant the winner of the tender a long-term guaranteed remuneration in exchange for the provision of the interconnection. This approach again faces, like regulated investments, the difficulty of *cost allocation between countries*, and in addition challenges in the:

- *Specification of quality requirements*: Repair of sub-sea interconnectors is expensive and can imply long and thus costly interruptions. Hence careful construction and suitable technology are necessary, and need to be suitably specified in the concession process.
- *Operation and expansion flexibility*: Concession holders want to ensure a stable and predictable operation of their asset to avoid risks. But also system benefits of a flexible operation and options for future development need to be considered.

Options to address these concerns involve inclusion of third party technical expertise and development of generic norms and standard provisions for concession contracts.

Issues with specific business model: merchant based investment

The concept of merchant based transmission investment envisages that private investors develop and implement a transmission project in expectation of the revenue they achieve by selling transmission capacity in the market. The separate ownership and contracting structure again raises concerns with regard to the *operation and expansion flexibility* in addition to concerns on:

- *Under-sizing*: The scarcity value of transmission assets declines with the available transmission capacity. Thus merchant investors face incentives to under-size capacity so as to maximize profitability.
- *High cost of capital*: The value of transmission, and thus revenue for merchant investors, depends primarily on the price difference between markets which tends to be difficult to predict and inherently uncertain. Returns can therefore be highly uncertain and require investors that accept large risks but typically require high returns.

The most prominent approach to mitigate these concerns is an Open Season during which merchant investors offer transmission capacity on long-term contracts to interested parties. This does however require a market and regulatory environment for long-term transmission contracts.

<i>Frequency of concerns mentioned</i>	Regulated investment	Concession-based invest.	Merchant investment
Desert power related concerns			
Lack of national interest	High		
Building trust between countries	High		
Interconnection specific concerns			
Selected stakeholders oppose	High (MENA) / Medium (EU)		
Co-ordination	Medium		
Permitting	Medium (MENA) / High (EU)		
Business model related concerns			
TO not motivated	High	-	-
Access to capital	Medium	-	-
Cost allocation between countries	High	High	-
Define quality for T line	-	Medium	-
Operation and expansion flexibility	-	Medium	Medium
Under-sizing	-	-	High
High cost of capital	-	-	High

Table 1: Summary of most frequently mentioned concerns by interviewees and in literature.

Table 1 summarizes the most prominent issues that need to be addressed to facilitate transmission investment and allows for a set of conclusions.

Merchant based transmission investments are often presented as a way to bypass blockages from transmission owners or regulators in neighboring countries. However, Table 1 illustrates that for the success of merchant based investments, the generic desert power and interconnection specific concerns need to be addressed. Indeed, transmission lines cannot be delivered without support of regulator and transmission owner who needs to integrate the line into the existing network. This might explain why merchant based transmission investments, while very prominently represented in the literature and studies, in practice remain very rare (e.g. one line in Europe between UK and Netherlands, one line in Australia, several - in the USA).

Concession based approaches for transmission investment offer an opportunity to engage resources of multiple competing project developers while creating contractual arrangements that can make the long-term value of transmission infrastructure accessible for financial investors and thus can allow for access of low-cost finance. While so far rarely applied, this approach should be considered more actively as an alternative to a regulated transmission investment, as the analysis points out at its value.

Irrespective of the business model, the successful implementation of an interconnection project requires a comprehensive set of actions by governments, regulators and project developers to address difficulties. In the detailed discussion of the report we describe various options for how these issues can in principle be successfully addressed. Their implementation will however require sufficient political support to ensure that public authorities (government, regulator etc) pursue them in a timely manner.

III. Comprehensive approach to unlock transmission investments

In order to unlock the potential of the desert power projects, renewable energy remuneration schemes and the rules for transmission investment need to be coherently designed to create a clear-cut business case for investors.

In the course of this study we held four meetings with the regulatory expert group of Dii comprising of EU and MENA stakeholders from generation and transmission companies, project developers and finance institutions. In the course of these meetings we have developed three options for potential EU-MENA energy cooperation combining transmission related aspects with a broader perspective on renewable remuneration mechanisms developed in a parallel study by ISI-Fraunhofer. The options were then discussed at an international expert workshop hosted at DIW Berlin. The summary presented in this report reflects the perspective of the authors of the study informed by these discussions.

Option 1: Regional RE tender with regulated/concession based transmission

Illustration: Italy and Germany run joint tender for import from Algeria to Italian border. Italian TSO builds an interconnector to Algeria as part of its regulated asset base. Winners of the tender can purchase transmission rights on the interconnector.

Option 2: EU RE tender with merchant based transmission

Illustration: Group of EU countries tenders for import from any MENA country to the EU. Project developers plan and build interconnectors. Participating EU countries are

responsible for the power once landed to the EU system, and need to acquire transmission rights to deliver it to their consumers.

Option 3: EU premium/ certificates with merchant based transmission

Illustration: EU adopts a premium or certificate scheme for import from any MENA country. Project developers plan and build interconnectors and acquire transmission rights within the EU so as to sell the energy to their consumers.

These three options presented for a renewable remuneration and transmission investment framework illustrate how risks, benefits, profits and responsibility for coordination can be differently allocated between public and private actors. They inherently offer different advantages and disadvantages that we evaluated against the following four criteria.

Criteria A: Coordination

Successful RE projects with export component in a MENA country need to off-take and transmission access within the country, develop an interconnector, link up with RE remuneration mechanisms in EU countries and deliver energy across the EU network to final customers. All these activities depend on strong abilities to sequence and align processes of transmission permitting, generation investment, local political engagement, transmission construction timeline, etc. In option 3 the project investor has to coordinate all these dimensions and needs to put them in place simultaneously to secure financial closure. Coordination requirements for private investors are reduced if governments or regulators take responsibility for energy transmission and off-take in the EU (option 1 and 2) and responsibility for the development of the interconnector (option 1). This can help project developers to gather experience in the still challenging commercial and technological environment. As experience and scale of activity increases, the additional coordination requirements of option 2 and 3 will be easier to tackle while option 1 remains viable.

Criteria B: Initiative

Multiple challenges have been identified in this study for international exchange and local use of renewable energy in the EU-MENA region. This raises the question: which of the discussed options is most likely to encourage actors to take the necessary initiative to address these challenges. We find that both public and private initiatives are essential and in all options – therefore this criteria does not allow for much differentiation between options..

Criteria C: Competition

Many actors are involved in EU-MENA energy projects, and will aim to capture some rent for the services provided. Thus competition can be essential to balance these interests and avoid excessive costs for consumers. Option 1 might offer the highest level of competition for RE project while the overall number of projects is still low. In the longer-term, as the scale of the EU-MENA energy cooperation and the number of RE and transmission projects increases, the matching between generation and transmission projects is less challenging, and therefore also options 2 and 3 can offer for a competitive environment.

Criteria D: Access to finance and financing costs

The economics of wind and solar projects are dominated by up-front investment costs. Therefore access to capital to finance the investments, and the associated cost of capital are essential for the execution and competitive operation of RE projects. They are determined by the risk associated with the investment. In the current market environment, options 1 and 2 provide long-term stable revenue streams and thus facilitate access to lower cost finance which translates to lower costs for consumers. The differences will reduce as energy technology mix stabilizes and thus the value of energy delivered can be better projected.

We thus find that for the initial RE projects with EU export component, a transmission and renewable remuneration framework as outlined in option 1 is most effective in addressing coordination requirements, ensuring competition, and facilitating access to low cost finance. In the longer-term, this choice will have to be re-evaluated. In principle, option 1 can remain a viable option. If the number and scale of export oriented RE project increases in the MENA region and continues to be closely linked to interconnection projects, option 2 could also become a viable option. If the state of energy markets in EU and MENA increase predictability of future power prices, option 3 can also become viable.

In all cases, the efficient utilization of interconnection assets is possible. Currently, this requires appropriate administrative procedures but if markets on both sides are liberalized, the line needs to be integrated in the market arrangements. This should be anticipated in regulatory approval process for merchant lines and contracts with concession projects.

IV. Concluding remarks

Our approach allows for the development of a perspective extending beyond the discussion of individual concerns and for an initial prioritization of issues that need to be addressed and options to tackle them. However, we would like to point out that the number of interviews that we could pursue per country and stakeholder group is too small to allow for a discussion of country specific solutions. We hope that our analysis can instead help to provide a structured basis to facilitate the more detailed technical analysis and political process to advance thus cooperation on the regional level.

A theme that was emphasized across our interviews and stakeholder workshops was the importance of the overarching policy framework. Issues common across all business models can only be addressed if participating countries are committed to the desert power strategy and to interlinking electricity networks. To this extent the analysis, design and communication of specific policy choices to enable the EU-MENA transmission and RE projects needs to be embedded in the energy- and economic policy strategies of the participating countries.

2 Introduction

The European objectives to reduce CO₂ emissions by 80-95% until 2050 require a decarbonisation of the power sector based on a portfolio of technologies exploited across many different regions. The renewable energy portfolio in North Africa is complementary to the resources in Europe. According to (Dii, 2012), an integrated approach could therefore lead to cost savings of up to €33bn p.a. by 2050.

However, a key requirement for this would be significant extensions and re-enforcements of the transmission grids within and between the EU and MENA region. Currently, the extent of interconnectivity between the two regions is rather low with only one interconnector of 1.4GW thermal capacity between Morocco and Spain.

As an initial milestone, the current Ten Year Network Development Plan of European TSOs (ENTSO-E, 2012) foresees the construction of two new interconnectors with a total net transfer capacity of 1.5 GW between Tunisia and Italy.

A co-operation in the electricity sector needs to respect the different market and regulatory structures persisting between countries in the European and MENA regions. In European countries generation and transmission have been unbundled and are now owned by different companies. In most EU countries several generation companies are competing. In the MENA region usually one incumbent utility owns generation and transmission assets, and the few generation assets owned by third parties sell power on long-term power purchasing agreements to the incumbent utility. With the absence of a competitive wholesale power market there is no short-term power price as basis for international power trade. Instead incumbent utilities negotiate with neighbouring utilities. In the case of the Morocco-Spain interconnector, the Morocco's state-owned utility l'Office National de l'Electricité (ONE) uses the transmission capacity to buy and sell power on the Spanish power exchange.

Both European and most MENA countries have established regulators for the energy sector. The text book objective of energy regulators is to independently decide on tariffs so as to ensure fair remuneration of grid investments while limiting costs for consumers. In practice the level of independence and resourcing of regulatory agencies varies across EU countries. This impacts the confidence of investors in the future remuneration for their investments. In the MENA region independence from the political process and resourcing of regulators is lower, and hence investments are only pursued by either incumbent state owned utilities or third parties that have a long-term contractual guarantee.

Both European and MENA countries have set national renewable energy targets. RES targets, however among the surveyed countries, only Algeria has a remuneration mechanism to incentivise investments in generation, while Tunisia and Morocco rely on indirect incentives, e.g. tax and tariff arrangements. Neither of the countries has established a comprehensive transmission framework which is necessary to guide investments in interconnectors. E.g. Algerian and Tunisian international connections frameworks are lacking rules for allocation of capacity and congestion management and furthermore the regulation does not allow merchant lines. Similarly, Morocco does not have capacity allocation rules nor common congestion management rules, however under Loi 13-09-IPP Moroccan regulation allows merchant lines for export subject to a concession regime.

The Department of Climate Policy at the German Institute for Economic Research (DIW Berlin) explored in a project with Dii whether and what regulatory developments are required to support the investments in transmission grids which are required to unlock the renewable energy portfolio of North Africa - for local use and for international exchange.

In the first phase of the project, literature was reviewed and in the period July till October 2012 thirty six interviews were conducted with experts from transmission companies, regulatory agencies, project developers and financial institutions and independent advisors. They interview partners had been selected to capture experience with different business models for interconnection projects, including regulated transmission investment at the example Morocco-Spain, merchant investment at the example of Britt-net, and concession based transmission investment at the example of UK offshore investment and based on their experience with the current situation in Morocco, Algeria, Italy and Spain to provide insights relating to EU-MENA cooperation linked to desert power.

The results are presented in chapters two and three. Chapter two focuses on issues of interconnection investment specific to the three main business models: Regulated, concession based and merchant based transmission investment. Chapter three characterises issues that are related to desert power projects in general and issues that are associated with interconnection specific issues not specific to individual business models.

Both of these chapters first describe the issues that have been most frequently mentioned in interviews and literature, and then discuss for each of the issue the solutions options. Solutions are typically accompanied by a set of enabling components, e.g. specific administrative or regulatory actions to implement a solution that are then described. Often enabling components are part of a solution for several issues, and are in this case discussed in detail at their first occurrence.

The analysis showed, that irrespective of the business model, the successful implementation of an interconnection project requires a comprehensive set of actions by government (national, EU), government agencies (regulator and possibly public banks like EIB and KfW) and project developer to address difficulties.

In the second phase of the project, three options for a potential EU-MENA energy cooperation were developed, combining transmission related aspects with a broader perspective on renewable remuneration mechanisms. They were informed by and discussed at four meetings with the regulatory expert group of Dii comprising EU and MENA stakeholders from generation and transmission companies, project developers and finance institutions. The options were also tested at an international expert workshop hosted at DIW Berlin. The summary presented in this report reflects the perspective of the authors of the study informed by these discussions.

The results are presented in chapter four. It describes the three options in detail and develops criteria for their assessment. The chapter also discusses a set of cross-cutting aspects relevant for all options: the role of long-term contracts, the framework for efficient operation of the concern of carbon leakage.

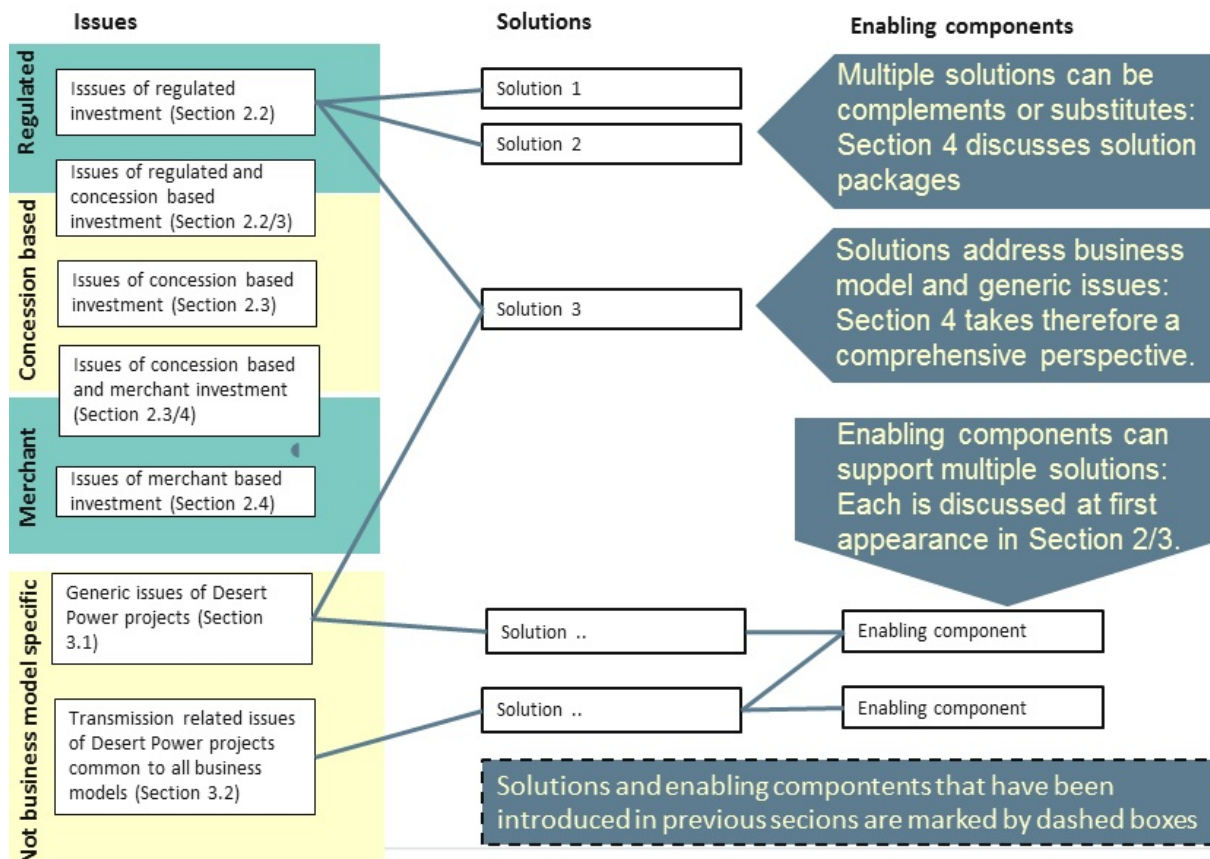


Figure 1: Structure of analysis of issues, solutions and their enabling components.

3 Aspects for interconnection investment specific to business model

As mentioned in the introduction, several existing business models are applicable for developing and operating transmission interconnection lines. The most widely used approach is the investment by regulated transmission owners. In the EU and in some MENA countries (e.g. Morocco) also third parties can construct an interconnector. This can involve a merchant investor that recovers investment costs by selling the right to use the interconnector to market participants, or it can be concession holder that participates in a tender to provide an interconnector and receives a contractually guaranteed remuneration for e.g. 20 years.

The business models differ in terms of motivating actors to invest into a line, access to and cost of capital, the allocation of cost, and the flexibility of future network operation and investment.

Within the following sections we will describe the main challenges and opportunities linked to each business model along with suggestions and concrete examples how the shortcomings can, and indeed have been, overcome in the past.

3.1 Existing business models

Depending on rules about the ownership of and revenues from transmission lines we can distinguish three generic business models. We classify them as regulated, concession-based or merchant models.

In a regulated approach, the regulator typically approves the investment in a line and, as result of this, new transmission assets become part of the regulatory asset base of a regulated transmission owner (TO). The regulator determines the allowed revenue to meet operational and capital costs of TO in periodic (usually 4-5 year) price review. The transmission owner can recover the allowed revenue from transmission users through usage fees.

In a concession based approach, the government, regulator or some entity on their behalf tenders for a new transmission line. Several companies compete to offer the line at the lowest annual price. The winning company then obtains a license agreement securing the revenue stream for 20-30 years.

In a merchant based approach, a company invests into a transmission line and against the future revenue from selling transmission rights to market participants. The line typically requires regulatory and planning approval, but does not obtain regulatory guarantee securing future revenue. As a result, merchant TOs are exposed, both to the cost recovery risk due to under-utilisation and some risks of regulatory changes.

All models have been extensively discussed and compared in the literature. (Biggar, 2009; Brunekreeft et al., 2005; Frontier Economics, 2009a, 2009b; Glachant and Pignon, 2005; Green, 1997; Hogan et al., 2010; Pérez-Arriaga and Olmos, 2005; Rious et al., 2008; Vazquez et al., 2002).

In practice, some aspects of these clear theoretical models can be combined. In particular, we observe that during the regulatory approval process for merchant lines profit- and loss sharing agreements have been negotiated that shift both downside risk and some up-side profit opportunities from the merchant investor to consumers (Britned, Text Box 3).

The connection of interconnection lines to national transmission systems typically also requires some reinforcements of the national system. Therefore also some provisions have to secure that the national Transmission Owner can pursue necessary investment. To accommodate the different needs it is therefore proposed in the case of the Serbia-Montenegro-Bosnia-and-Herzegovina interconnector, that the capacity is split up in shares that are subject to different business models (Vujasinovic and Illiceto, 2012). This is argued to help to reach an agreement between the neighbouring regulators, but also increases the complexity of the project.

Both regulated and merchant based approaches are institutionalised in the EU region, with some exceptions, e.g. Spanish regulation does not allow merchant line investments. On the contrary, most of countries in the MENA region are still lacking the legal basis for merchant line investments (except Morocco).

- Following subsections will focus on the assessment of pure business models. Questions of their practical implementation will be addressed in the section 4.

3.2 Regulated investment

Within the EU, regulated investment by regional Transmission Owners (TO) is clearly the dominant business model. In Europe, except for Scotland, the regional transmission owners are also responsible for the operation of the system, and therefore commonly referred to Transmission System Operators (TSO).

In our interviews and in literature we have identified a set of challenges for a regulated approach to investment, along with the potential solutions which are listed in Figure 1.

For each of the issues on the left hand side, the importance attributed to the issue has been assessed through a combination of literature review, stakeholder interviews and expert assessment. It is reflected in the share of the circle that has been filled. The estimated effort required to address each issue is indicated by the colour of the circles.

We will describe the issues in section 3.2.1 and provide a detailed description for each of the solutions along with their enabling components in section 3.2.2

The transmission links connecting the Spanish transmission grid with the transmission grid in Morocco between Puerto de la Cruz (Tarifa) and Melloussa (Fardiuoa).

The process of building a first link of 700 MW was initiated as early as 1986 and led to a first contract between Red Electrica Espanola (REE) and the Office Nationale d'Électricité (ONE) in July 1993 for delivery starting in 1996 (F. Mossadeq, 1998a). The link was completed in 1997.

However, the project faced local opposition, in particular by fishermen in Tarifa, which led to significant delays in the construction and triggered the renegotiation of the contract by ONE. The terms of the new contract which was signed in 1998 were more favourable for Morocco, reducing the contract price for energy imports from Spain below the price of power production at the most expensive Moroccan plant at Jerrada (F. Mossadeq, 1998b). The renegotiation of the contract was allegedly influenced by the interest of Spanish companies to participate in the construction of a power plant at Tahhadart (F. Mossadeq, 1998b). A second circuit of 700MW was added in 2006.

The commercial flows on the interconnector are a result of ONE's purchases and sales of electricity in the Spanish spot market (MIBEL) and adjustments by REE in case of grid constraints within Spain. Depending on the direction and resulting flows, ONE pays a transmission access tariff (per MWh) to REE which is passed on to consumers. The sum of these payments plus the capital expenditures is passed on the consumers of both countries on the cost-sharing basis.

Box 1: Spain-Morocco interconnector as an example of regulated based investment.

3.2.1 Issues associated with regulated investments

The set of issues for the construction of regulated investment are depicted in Figure 2. Based on the interviews particular importance was attributed to concerns that TOs might not be sufficiently motivated to advance the interconnector and difficulties on allocating the costs between countries. Concerns about access to capital for TOs to pursue extensive investment programs were also mentioned, and the literature frequently lists concerns that TOs might overinvest in capacity.

Limited motivation for TOs to invest in new interconnectors

TOs may only have a limited incentive to investing in large interconnector projects, as their specific situation discourages them from realising large growth opportunities for their business for two reasons. First, they have been asked in recent years (after market liberalization/unbundling) to focus their effort on minimising costs while securing system stability. Therefore the organization might not be set up to deliver large investment projects. Secondly, private shareholders usually have decided to invest in TOs to obtain stable and low-risk revenue streams and might thus not support the CEO in shifting the company towards a growth strategy that might offer higher returns, but also involves higher risks for example from large scale investment projects.

TOs face furthermore incentives to prioritise domestic transmission projects over international interconnectors for two reasons. First, TOs are operating within the national legislation frameworks which inherently are focused on national transmission system. Thus TOs are expected to prioritize investment projects to alleviate domestic transmission constraints over alleviation of international bottlenecks. In the UK, for example, the TO was operating for many years under a regime where costs of domestic congestion was shared between consumers and the TOs, thus creating strong incentives to alleviate domestic bottlenecks.

In the case of Norway, additional interconnections with EU countries would increase North-South congestions within the country. The reinforcement of the internal network has therefore been a priority for the Norwegian TSO prior to expanding interconnections with the EU. Also in Italy transmission constraints within the country are frequently binding – as can easily be observed by the different zones for wholesale price levels defined within Italy. As a result, dependent on the landing point of an interconnector to Italy, significant domestic grid reinforcement would be necessary to avoid situations where the interconnector contributes to additional congestion within the country.

A second reason for the prioritisation of domestic transmission lines is that implementation of interconnection projects requires co-ordination across more partners and is exposed to political uncertainties in multiple jurisdictions, and thus increase the effort required and the risk of delays and failures that could create costs for the TO and negative reputation for the involved managers. These risks are further increased by less established technology uncertainties, e.g. in the case of using high-voltage substations for offshore installations. Thirdly, once an interconnector has been implemented, it can increase the complexity of operating the power system due to the need to anticipate, coordinate and manage flows from outside of the domestic grid. This can create additional risks for system operation that is often integrated with transmission ownership (TSO) (Frontier Economics, 2008).

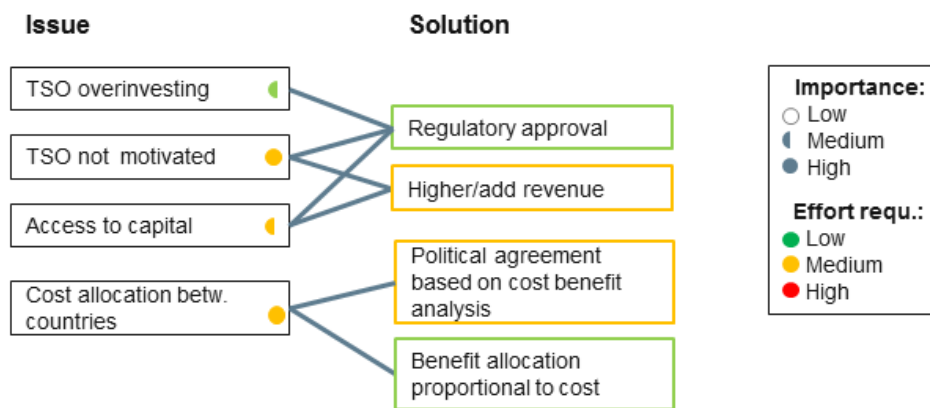


Figure 2: Issues and solutions for regulated investment.

Difficulty to decide on cost allocation between countries

In the case of regulated investment, the costs for the lines are included into the regulated asset base of the participating national transmission systems. Regulatory authorities in both countries need to agree about cost sharing principles between the TOs, and thus ultimately between the customers connected to the entire network which paying usage fees for the transmission network that allow the TOs to recover the investment costs over the lifetime of the asset (Frontier Economics, 2008; PJM, 2010).

According to the standard approach for cost sharing in the case of regulated or concession based investment for short-distance cross-border lines, each country constructs and bears the costs for that part of the interconnector which is on its own territory, while the revenues from the interconnector are split in half. In cases where the main part of costs occur in one

country and/or the line is long, the TOs and regulating agencies in the neighbouring countries may negotiate individual splitting rules. However, these individual cost-agreements are difficult to establish and have in many cases not been solved (Hou and Pfeifenberger, 2011). Hence the EU Infrastructure package (EC, 2011) proposes the use of a cost-benefit analysis to inform the negotiation of cost allocation between countries involved in and benefiting from projects of common interests, e.g. internationally relevant transmission expansion projects. However, these calculations are complex yet and due to dynamic change of European energy system (e.g. due to RES-E) may not be stable over time and could thus trigger subsequent renegotiations of provisions.

In the case of the Cobra cable between the Netherlands and Denmark, according to the standard approach, the construction costs would have to be borne by the Netherlands and Denmark, while a large part of the benefits occur on the German territory, because the cable would offer a bypass to the congested link between Denmark and Germany. As the investment has been shown to create benefits to the European society it was offered EU support of 86.5Mio EUR (through European Energy Programme for Recovery). Currently the Cobra project is awaiting a reassessment of the business case and discussions on the preferred route of the cable between the Dutch and German authorities (European Commission (EC), 2012).

The allocation of costs to regulatory asset base of a TO can be further complicated where the investment is pursued on the territory of a third country without necessary benefiting this third country (CEER, 2006).

Access to capital

In several countries of the MENA region power prices are set below the full cost of the system and as a result the utilities incur losses that need to be covered by transfers from the national government. This dependence on discretionary financial support from the national government reduces the credibility of the utilities and their ability to access private debt markets.

In the EU TOs are both publicly owned like TenneT and privately owned like National Grid. In principle TOs can offer an attractive investment opportunity for investors of which many are looking for stable and long-term returns. However, in practice TOs can only raise 2 units of debt for one unit of equity. If they would raise more debt, then rating agencies and investors consider the investment more risky and would downgrade or reassess investing in the TO.

Thus for TOs – if they are to engage in large scale investment projects – can not only raise debt but also have to issue additional equity.

Again, TOs should in principle not face difficulties in raising additional equity – given their strong and stable track record and business model. In practice, a public owner of a TO might be reluctant to accept that raising additional equity requires either providing cash to acquire the newly issued equity or accepting a dilution of ownership if private investors acquire the newly issued equity (Neuhoff et al., 2012).

One of the most recent examples of such difficulties is TenneT's inability to timely access the capital that would be required for the connection of offshore wind-parks to the grid since 2011, despite the applications and efforts spent by the developers and urge placed on the TSO by the national authorities.

Concerns that TSOs might be overinvesting

In the past we have observed that European utilities could pass all cost to consumers with limited incentives to reduce their costs. For investment projects that were approved, utilities often would recover all costs from consumers and in addition obtain a regulated premium. Thus TSOs had an incentive to build lines even if they would not be needed (Cambini and Rondi, 2010; Littlechild, 2011). As inclusion of lines into the regulatory asset base requires regulatory approval and additional incentives to limit costs are provided in countries with incentive based regulation, overinvestment is currently not considered to be a major concern.

3.2.2 Solutions for regulated investments

To address the issues discussed in the above we propose the following solutions (as graphically shown on Figure 3 together with their corresponding enabling components):

- Regulatory approval
- Higher/additional revenue
- Political agreement based on cost benefit analysis
- Benefit allocation proportional to cost.

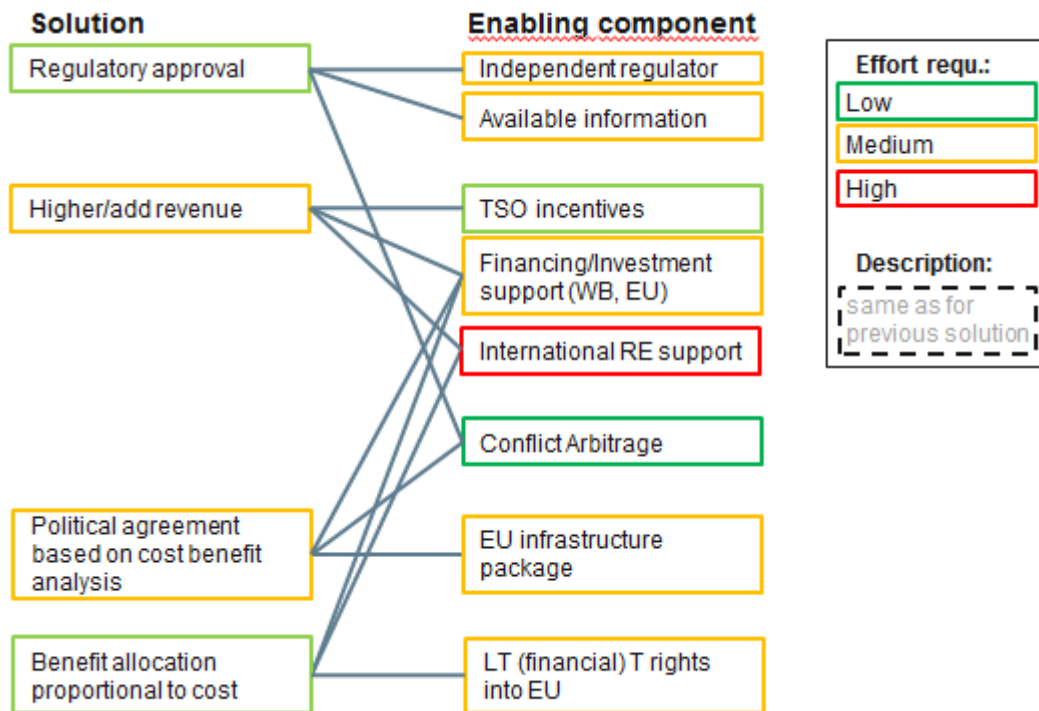


Figure 3: Solutions and enabling components for regulated investment.

I. Regulatory approval

The requirement of regulatory approval for the inclusion of investments into the regulatory asset base and in some countries for the investment budgets of new transmission lines can help to address the problem of TO's incentives. The regulator may decline the construction of lines for which the costs exceed the benefits – and the problem of TO motivation – because regulators can take a broader perspective and recommend the construction of interconnectors that would not have been considered by the TO. The detailed design of regulatory control has been discussed extensively in articles such as (Borrmann and Brunekreeft, 2011; Cambini and Rondi, 2010; Joskow, 2008; Petrov et al., n.d.; Rammerstorfer, 2009; Vogelsang, 2006). Currently transmission regulation regimes are very different across the EU. Thus definition and eligibility of cost components differs, increasing complexity, transaction costs and ultimately risks for international investors.

Within our case studies, Morocco is the only country where the investment in a new lines does currently not require the explicit authorisation by a regulator.

Increasing the (perceived) credibility of the regulator reduces uncertainty attributed to future TO revenue streams and can thus facilitate easier access to capital. Both European and MENA regions in principle have an interest to enhance their overall regulatory credibility. When assessed by international investors as one group of countries, a serious regulatory failure in one country affects the perceived regulatory credibility of all countries in the respective region. In addition, the heterogeneity of the regulatory regimes within Europe complicates the assessment of investment options in new transmission lines or transmission owners potentially limiting the interest of investors because of the resources and time that would be necessary to inform an investment decision.

The following enabling components can help to increase the effectiveness of the regulatory approval process and credibility of the regulator:

Independent regulator

A dedicated and independent national authority can increase effectiveness of the regulatory approval. Contributing to the regulator's independence are a stable source of funding, usually on the basis of fees that are paid by utilities, an irrevocable appointment of the regulator for a fixed term, appointment procedures involving the parliament, and clearly defined legal powers, including the right to impose sanctions (Larsen et al., 2006). Independence from the regulated industry increases if the regulator neither has a financial nor other personal interest in the industry, for example by prohibiting the employment of regulatory personnel by the industry or restricting the type of information that may be shared on pending decisions (Larsen et al., 2006).

There have been various consultations and studies on the design of a regulatory agency in Morocco since 2002. A new consultation has been launched in November 2012 and at the present the introduction of a regulator is planned for 2014. However, so far the institutional design has not been decided and further consultations could be launched in the future. In the case of Algeria on the other hand, a regulatory agency has been established, however, with limited powers as evident from the fact that the transmission system operator (SONELGAZ) can still ask the Ministry of Energy to subsidize projects in excess of the regulatory allowance.

Conflict Arbitrage

The credibility of regulation could further be increased by an independent agency that can be called upon in the case of dispute about allowed revenue or tariff levels. Of particular value could be guiding principles and political support if they can avoid the need for a lengthy and expensive legal process. It will be interesting to observe how the newly established agency for cooperation of European Energy Regulators, ACER, can play this part.

Alternatively, the European Energy Community might serve as an example of an international framework that also facilitates conflict arbitrage for its contracting parties including Balkan countries, Moldova and Ukraine. Since 2008, infringement processes may also be started by a complaint by any public or private party to the secretariat of the European Energy Community, and may be escalated from a so called 'opening letter' to a 'reasoned opinion' and a 'reasoned request' to the Ministerial Council (see Box 4). Furthermore, Mediterranean Regulators for Electricity and Gas association have announced to create a Mediterranean Energy Community by 2020 in its action plan (MEDREG, 2012). Establishing a similar or extending the existing framework may be arguably relevant for strengthening the interconnectedness between the EU and MENA regions.

Available information

Current discussion on the method for determining the costs and benefits of the transmission lines as part of the EU infrastructure package illustrate the scope of information necessary for regulatory approval of, and cost sharing agreements for transmission expansion. For the multi-criteria cost-benefit analysis the following seven benefit categories need to be considered: market integration, competition, system flexibility, sustainability, interoperability and secure system operation (EC, 2011).

For such an analysis, asymmetry of information is of major concern for regulators. Without independent modelling of the transmission and energy system, the regulators struggle to make a robust assessment of the need for and benefit of an additional transmission line. This remains a challenge in the EU and in the MENA region.

This can be illustrated by the example of the 400kV line between Algeria and Morocco. Due to transmission constraints within the countries, only a fraction of the 2800 MW (at 400kV) and 480 MW (at 220kV) thermal interconnection capacity can be used for commercial transactions. However, the link also reduces the need to operate power stations at part load which can provide responsiveness to maintain grid stability within the countries. This is due to the fact that the interconnection

can be shared between the countries. Arguably, this was one of the main reasons for constructing the 400kV interconnector (Bouchahdane et al., 2011).

II. Higher or additional revenues for TOs

Transmission projects comprise of high up-front capital costs that provide benefits over many decades. Therefore the focus of any solution towards higher and additional revenue is typically on the revenue stream over the live time of the project, as this avoids the difficulty to impose large on-off costs on rate-payers or public budgets.

Allowing higher revenues for interconnection lines increases the motivation to pursue investment projects and to overcome the bias towards investment in less risky, onshore transmission lines within each country (Frontier Economics, 2008). However, also the risks inherent in such an approach need to be considered. It could result in a bias towards international interconnectors, or necessitates a subsequent increase of revenues for domestic investments.

Creating additional revenue streams (besides the revenues from the transmission tariffs) to recover the costs for the investment reduces need to increase in the future transmission tariffs for domestic consumers (that traditionally cover the costs of an interconnector). This will therefore reduce the concerns of TOs that regulators will cut the allowed revenue for existing lines to balance increases of allowed revenue for new lines.

Increasing revenue on interconnection projects (TO incentives)

In order to increase the attractiveness of investments regulators can pursue a set of options. First, to reflect the additional effort necessary to initiative, plan, permit, construct and finance new transmission lines, the weighted cost of capital that determines the allowed revenue relative to the existing capital base can be increased. For example Swissgrid has been granted an increase in allowed revenue to allow for higher weighted cost of capital from January 2013 and the UK regulator Ofgem granted higher weighted costs of capital for new transmission lines. Second, investment budgets can be defined by the regulator, ensuring that costs of new transmission can be directly included into the calculation of the tariff base (example Germany).

The complexity involved in agreeing on planning, permitting and execution across multiple jurisdictions or the additional technology uncertainty of under-sea cables could create incen-

tives for TSOs to prioritise other investment projects. This can be compensated with additional incentives. For example, the current regulation in Spain uses two different tariff regimes. For onshore or standard AC links, standard cost factors (per km, per MW) from yearly audits of REE by third parties are used. For offshore or newer technology/DC links on the other hand, special calculations are carried out, mainly based on international benchmarks or offers by manufacturers.

A final option could in theory be the use of incentive regulation. The total costs incurred by a transmission operator could be benchmarked against an optimal network design (envisaged in German regulation for future regulatory periods) or a set of comparable transmission networks. If the reference and comparison networks comprises beneficial interconnection lines, then the total costs for a TSO that fails to implement such lines would increase – hence Totex benchmarking could in theory provide incentives to advance beneficial grid projects. In practice the difficulty of defining optimal reference networks, finding sufficient comparable networks and the costs of financing investment projects against such uncertainty need to be considered.

Providing Financing or investment support

Inside the EU, the Connecting Europe Facility (CEF) of the European infrastructure fund has foreseen a total of €9.1bn for the improvement of energy grids of European interest (“Projects of common interest”, PCI) between 2014 and 2020 (European Commission (EC), 2011), during Council negotiations for the EU budget (multiannual financial framework) this has been reduced to 5.1 bn as per European Council conclusions from Council 8/9 in February 2013. Considering estimates of the required volume of electricity transmission investment for this period of up to 100bn (Roland Berger, 2011a), and the fact that this amount is shared across electricity, gas, oil and CCS infrastructure projects, this amount is relatively small. Hence the resources might be most effectively applied if targeted to innovative project types, or to early stage project costs (grants for studies) that might be difficult to cover otherwise.

TSOs in the MENA region on the other hand, often have access to preferential loans from public sources, such as the European Investment Bank (EIB) or the World Bank which can reduce financing costs. However, access to and utilisation of such funding has to date only been taking place at a very modest rate. In the case of Morocco, many investments in the electricity infrastructure are supported by loans from public sources with a WACC between 0.5% and 4%. The selection of projects by the funding organisations can therefore increase the motivation of TSOs to engage in cross border projects, such as in case of the Morocco

Spain interconnector, which was built with financial support among others by the French Development Agency (Afd) and the EIB.

Integration with international renewable energy remuneration mechanism

Where renewable energy investments in a country are dedicated to exports to be remunerated in another EU country (MENA-EU but possibly also Joint Projects within EU), the investors in a generation project will need to acquire long-term transmission rights to use the line at the time of their renewable energy production. Thus the price paid for the renewable energy delivered will not only remunerate the production of the renewable energy but also the use of transmission. Thus an additional revenue stream is created for a transmission line. This increases the total revenue for a transmission owner without the need to increase transmission tariffs charged to domestic consumers. Thus the additional revenue stream helps to avoid domestic concerns about increases of transmission fees. Thus also concerns are avoided that more stringent regulatory reviews could be triggered to limit costs for consumers. Ultimately the international revenue stream therefore can increase the preparedness of the TSO to take forward the investment project.

III. Political agreement based on cost-benefit analysis

An agreement about cost allocation/sharing among different countries is a key aspect of a solution to unlock international transmission investment. The benefits (access to lower-cost generation, higher revenue for generation, security of supply) of new interconnection capacity do not always coincide with the physical location of the infrastructure. For example a transmission expansion within a country could (i) alleviate constraints in neighbouring countries or (ii) allow for additional transfers between third countries. Therefore as part of the methodology for the design of [transmission] PCI the EU infrastructure package outlines a process (including model-based analysis of energy system) to determine the allocation of investment costs for transmission lines that are jointly proposed by several countries. The process also includes a cost benefit analysis – with more precise methodology yet to be proposed by ENTSO-e, but recognizes that it is ultimately a political agreement among the project proponents that is needed, and that might be mediated by the Agency for the Cooperation of Energy Regulators (ACER). For interconnectors between EU and MENA countries this points to the potential need for alternative bodies to mediate a process that can decide on a cost allocation approach.

IV. Cost allocation proportional to benefit

Several different cost sharing rules exist, e.g. according to benefits in terms of voltage levels and reliability or economic investments for achieving better electricity price from the import-export activities. Typically, the cost sharing principles are established ex ante the investment as a general rule (rather than on a case-by-case basis).

If the (revenues from) transmission rights are allocated in proportion to costs, then the cost net of benefit to be born is lower and therefore cost allocation simplified. A successful example for the result of such a negotiation is the interconnector between Italy and Montenegro, where governments of both countries agreed to share the capacity of the cable and thus potential revenues from its use in a ratio of 80:20 reflecting the costs borne by the Italian TSO for the interconnector and the cost born by Montenegro's TSO network reinforcement to accommodate the interconnector.

3.3 Concession based investment

Concession based investment has been used in the EU context predominantly in the recent past and therefore leads to a more limited set of understood challenges. Certain advantages however are noteworthy to highlight, e.g. faster access to financial capital and wider range of ownership structures, including those from the private sector.

The main difference between the TSO-based and concession-based regulated investments is that in the first case an interconnector is part of the regulated transmission network of the TSO while in the second - it allows for other forms of ownership, e.g. by private investors who contract the third entity to operate their assets subject to the same regulatory framework. By conducting interviews and literature review, we have identified a set of challenges for the concession based approach of interconnector investments. They are listed in Figure 4 together with a set of solutions to address them.

We are addressing these issues in section 2.3.1 and provide a detailed description for each of the solutions along with their enabling components in section 2.3.2.

3.3.1 Issues associated with concession based investments

The following issues have been identified as creating key obstacles for the concession based investment in transmission interconnections (as specified on Figure 4).

- Cost allocation between countries
- Specification of quality requirements
- Facilitation of operational flexibility
- Preference for an integrated TSO.

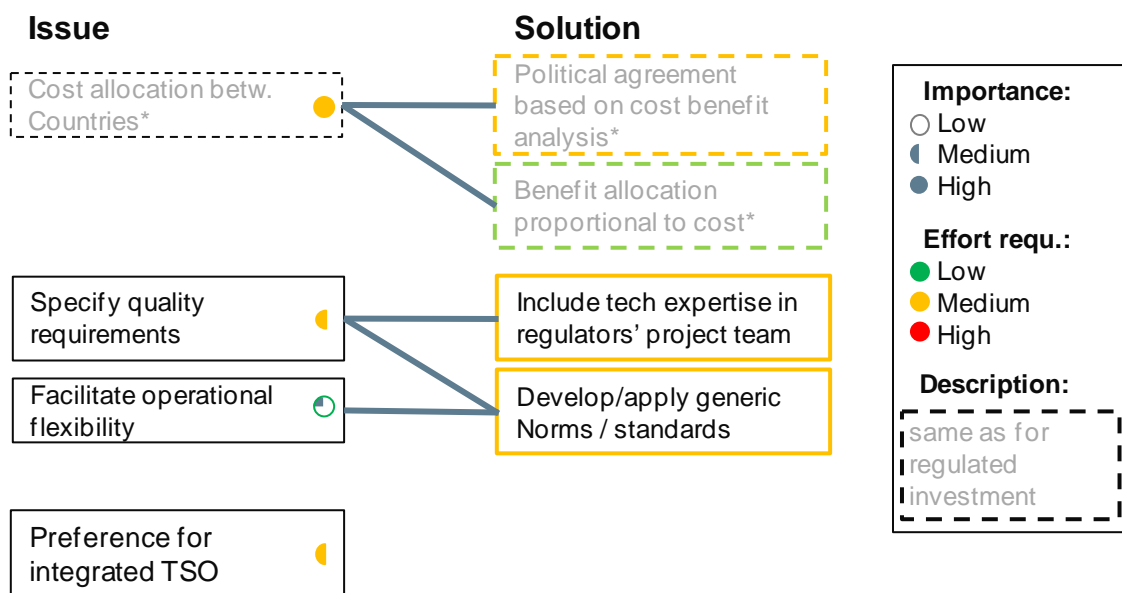


Figure 4: Issues, solutions and enabling components for concession based investment.

Cost allocation between countries

In the case of concession based investment, the concession fee to be paid to the transmission owner is recovered mainly from transmission fees on the line paid typically by transmission users as opposed to the charges passed on to the consumers in their bills as in the case in the TSO-based approach. If transmission users acquire long-term access rights, then the revenue for the line will be stable and likely to be close to the initial investment cost. If transmission users acquire access rights on shorter time frames, then revenues can exceed or fall short of the concession fee. Also, if the decision on the construction of the line precedes the issuance of long-term contracts for the entire capacity, a residual risk of under-recovery and opportunity of surplus recovery remains. The balance will then be passed on to transmission tariffs, in the same way as in the case of regulated investment. The problem of

cost allocation and the options to address these are then similar to that in case of regulated investments and have been discussed in section 2.2.

Specify quality requirements

Future repair of sub-sea interconnectors is expensive and can result in long, and therefore expensive, periods during which the cable is not operational. Hence careful construction and high quality materials are important which is typically addressed in the respective tendering processes. In principle, risks associated with the future operation could be fully allocated to the concession holder so as to create the incentives for appropriate technology choice and maintenance. In practice, it might be difficult to judge whether faults are related to operation, maintenance, third party influence or initial construction mistakes. Also, if liability is fully allocated to the concession holder, the unknown risk profile might preclude financing from pension funds or other financing sources that offer low cost capital for low risk investment opportunities. Hence, it might be necessary to specify the quality requirements prior to the tender so as to allow for some level of risk sharing between concession holder and the public counterparty.

An alternative approach to secure adequate quality in interconnector technology choice and construction process was pursued in the case of transmission links to UK offshore-wind turbines, by allowing the wind project developers to also build the transmission lines. The transmission assets were only auctioned to concession holders after they had been commissioned (See Box 2). Because each line was connecting a particular wind-farm, the project developer of that farm had an interest both to ensure the quality of the line – because he needed it to transfer electricity to the grid – and to keep the costs low – because he remains liable to pay connection charges that include the capital costs for the line.

The specification of quality requirements is also important in the case of regulated transmission investment. Typically the TO will as part of the investment process tender for technology and construction services, and at this stage as well as by monitoring the construction process will secure the quality of the assets. As the TO is subsequently responsible for the operation – and is a visible actor in the public discourse in case of failures of the assets – the TO is incentivised to ensure quality of the project. But in the case of regulated investment, the decisions are pursued within the TO organisation and thus require less regulatory supervision. Also, the risks of technical failures will be partially born by the TO and might dependent on the precise definition of the incentive regulation, passed to a smaller or larger share on to consumers. Large deployment of offshore wind-farms along the coast of GB in the recent years has required the construction of undersea cables connecting the wind-farms to the on-shore transmission grid. Between 2009 and 2011 alone, 1.9 GW of wind farms have been constructed and connected to the grid and it is expected that a total of up to 13GW will be developed by 2020.

- Under the current regime in the UK, the cables can either be built by the wind farm developers (generator build) or by independent offshore transmission owners (OFTO build).
- Under the *generator build option*, the generator will obtain the connection agreement from National Grid and take responsibility for all aspects of design, pre-construction, procurement and construction of the transmission infrastructure. After the generator has completed construction, the ownership of the line is transferred to an OFTO in a competitive tender. In addition to financing benefits, also European unbundling requirements on ownership of transmission and generation assets are addressed. The OFTO will operate, maintain and decommission the transmission assets.¹
- Under the current *OFTO build option*, the generator will obtain the connection agreement from National Grid and undertake high level design and pre-construction activities. Then the generator will run a tender for developing the connection that can be responded to by OFTOs. The OFTO will undertake detailed design work in accordance with the high level requirements that were specified by the generator in the tender document, undertake the procurement with suppliers, negotiate and finalise construction contracts, and will deliver the

¹ Ofgem 2012

build programme. The OFTO will operate, maintain and -decommission the transmission assets.² Although this option has been designed in more detail, so far no transmission line has been built by an OFTO.

both models the OFTO winning the tender receives a guaranteed revenue stream from the wind farm owner(s) at the level determined in the tender for a duration of 20-years in return for an up-front payment to cover the construction costs, and operating and maintaining the cable. At the same time, generators pay the transmission fee proportional to the costs of the line (concession). Therefore, they have an incentive to minimize the costs of the line from early on ensuring higher efficiency of the investment as seen both from financing (as access to transmission investment and operatorship is open to private entities), development (the design is being adequately made by the developer of the wind park to ensure sufficient quality of the line) and from the regulatory standpoint (optimisation of the transmission fees). It is however important to mention that bringing third party investors to own an OFTO may have effects on the operational flexibility of the line, as the former typically would prefer to not deviate from the initially contracted usage pattern so as to avoid transaction costs and potentially implied risks that are difficult to evaluate for investors that lag the in-house expertise of a TSO. Therefore, this may lead to inefficiencies in the OFTO line utilisation. The approach however has been successful at attracting additional low-cost finance into transmission development.

Box 2: UK Offshore Transmission Owners as an example of concession based investment.

Facilitate operational flexibility

Concession agreements envisage typically a very specific operational and maintenance schedule for the asset. The concession holder has no incentive to deviate from this schedule. Where the schedule had been the basis for risk assessments used by equity and debt investors, it is also complex to reconfigure the schedule. As a result, in the UK the lines operated by an OFTO could not be used to offer fast response that would technically be possible through short-term operation above nominal capacity. Some of the value which the asset could have provided for the system had therefore not been utilized. More generally, this illustrates the difficulties that might be incurred if separate transmission assets are to be effectively operated under evolving market arrangements.

² Ofgem 2012

Preference for an integrated TSO

Some countries prefer to allocate all responsibility for the development and operation of the transmission system to a single entity. This raises the question whether individual lines that are constructed and financed on a concession based approach could be integrated under the overarching responsibility of the TSO. The compatibility of the two models will both depend on the design of the concession contracts and on the expectations with regard to the TSO.

3.3.2 Solutions for concession based approach

The following solutions have been identified to address the main challenges with the concession based approach to transmission interconnection development (as depicted on Figure 5):

- Include technical expertise in regulator's project team
- Develop and apply generic norms and standards.

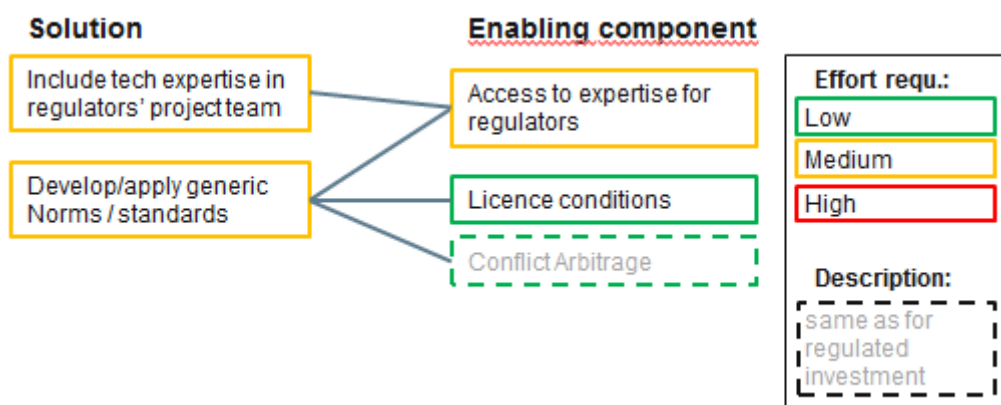


Figure 5: Solutions and enabling components for concession based investment.

In addition to various of the solutions that have been discussed and can be transferred from the discussion of regulated TSO investments, for concession based approaches the technical expertise of the regulator can be strengthened to execute the tenders for the concession,

and generic norms and standards can simplify both the tasks for the regulator and the participation of investors in the tender for the concession.

I. Include technical expertise in regulator's project team

If the technical specifications are too narrowly defined in the tender, then ultimately only one company can deliver the respective DC cable and converter stations. Therefore, to enhance competition, some flexibility has to be offered for the bids. In this case the regulator's project team which is running the tender will need the technical expertise to compare the bids.

A panel of experts that is recruited early in the process can provide independent advice to the regulatory bodies. This can include national actors and other TSOs not participating in the tender, international organizations or academia.

II. Develop/apply generic norms and standards

To ensure that new lines fulfil quality and flexibility requirements, it is important to develop and use standards and generic norms for cross-border transmission connections.

A panel of experts could support the design of suitable licence conditions. For example in the UK OFTO auctions, external advice on certain technical and financial aspects was provided by consultants.

Licence conditions for the concession based transmission project could include a standardised description of the different usage modes, e.g. conditions and additional remuneration possibilities for temporary usage of the line above its nominal capacity. The use of standardised term-sheets provides enhanced confidence to all parties involved in concession agreements and financing of investment. (See e.g. Kerf et al., 1997).

In the case of UK OFTO auctions, additional capacity above the Transmission Entry Capacity (TEC) is currently remunerated on the basis of additional capacity incentive adjustments (ACA) or incremental capacity utilisation adjustments (ICUA). ACA are case-by-case cost estimates and are used if major investments to the line are required. ICUA are fixed payments per kW of additional capacity and are used in case only minor capital expenditures are

required. Ofgem is currently considering to abolish the ICUA payments and is in favour of a case-by-case assessment of the cost for providing additional capacity in order to increase flexibility in the respective incentives (Ofgem, 2012).

3.4 Merchant based investment

Merchant based investment has been very prominently discussed in the academic literature but the number of projects realised under this business model have remained very low (one implemented (UK-Netherlands), four approved lines in Europe, one line in Australia, several - in the USA).

Merchant based investment provides flexibility in terms of the ownership structures, utilisation governance and capacity allocation methods. The main attraction attributed to the business model is the ability to allow third parties to advance investment projects that might have been ignored by incumbent TOs. For example if transmission and generation are vertically integrated, a vertical integrated utility might dislike an interconnection because the imports create competition and thus reduce profitability of generation. In principle, merchant investors would not be concerned about such impacts, and thus more willing to advance the project. In practice extensive regulatory support is necessary to ensure that such a merchant interconnection project can secure adequate access to grid, ensure its fair reflection in security assessments, and can sell its capacity for use in energy and ancillary service markets.

As some TOs might be privately owned such as in the UK, merchant interconnectors between France and the UK (IFA) and Netherlands and UK (BritNed) are constructed by the affiliates of regulated transmission owners in neighbouring countries.

The set of challenges with regard to the merchant approaches to transmission infrastructure investments we identified in literature and interviews are listed in Figure 6. To address these challenges, a number of regulatory solutions and enabling components can be used which are shown on the same graph and explained below.

The BritNed cable, which is connecting the Dutch transmission grid with the transmission grid in GB between Isle of Grain (GB) and Maasvlakte (NL), started operating on 1 April 2011 with a capacity of 1GW. The cable is owned by BritNed Development Limited³, which is a 50:50 joint venture of National Grid Holdings One PLC (GB) and TenneT Holding B.V. (NL).

Initial talks about the cable were started by the system operators in 1999 on the basis of the joint economic interests between the two countries, leading to the planning phase in 2004. As the TSO in the UK is not allowed to invest in interconnectors as to increase its regulated asset base, this led to a merchant approach being chosen for BritNed. Initial pre-construction activities begun in early 2007. The regulators in NL and GB provided an exemption for the line from tariff regulation. This allows the owners of the cable to sell transmission capacity on a commercial basis on da-ahead implicit auctions and longer-term explicit auctions (annual and monthly), subject to the following conditions:

a. Obtain prior approval for auction design and capacity products

BritNed is free to develop suitable products and design the auctions for selling explicit transmission rights, but needs to obtain permission from regulatory authorities prior to implementing changes.

b. Use it or sell it clause

Transmission rights which are not used need to be auctioned during implicit day ahead auctions to avoid capacity withholding.

c. Firmness of the transmission rights

Transmission rights which are sold during implicit day ahead and intraday auctions are by definition firm.

d. Auction Reserve price

BritNed is granted a reserve price during explicit auctions to cover the cost of the auctions. Reserve prices are changed by BritNed on cost base. Current reserve prices are increase from 1EUR /MWh to 2.5Euro/MWh with the share of the capacity sold.

e. Operate independently from NG and Tenet holding

In their role as system operators, NG and Tenet are not allowed to re-dispatch the

³ Company website: www.britned.com.

system in a way that maximises the un-regulated revenues of the BritNed interconnector.

f. Observe congestion management guidelines

Current congestion management guidelines do not allow the adjustment of interconnection flows in order to balance the national system.

Subsequent to the national authorities, the EU commission also had to approve the exemption of the line from tariff regulation. The EU Commission was concerned that the cable may be undersized. As part of this approval decision on 18 October 2007 it therefore required that if the average revenues by 2017 exceed the revenues that were projected by BritNed in their application for exemption by more than 1%, BritNed will be given the choice to return the additional revenues or increase the transmission capacity⁴.

Currently, BritNed cable has been in use almost 2 years with high availability (95%) and most power flows in the direction from the Netherlands to the UK.

Box 3: BritNed interconnector as an example of merchant investment.

3.4.1 Issues associated with merchant investments

The main concerns associated with merchant investments relate to the high cost of capital for investors to pursue merchant investments and the tendency to undersize the capacity of the transmission link relative to welfare optimal choices. In addition, concerns were voiced that incumbent TOs from neighbouring countries have information and other advantages allowing them to pre-empt the participation of third party investors thus leading to monopolistic situations with only limited regulation.

Undersizing

If a merchant investor constructs a line to be financed from future congestion revenue, then commercial interests are to size the transmission so as to maximise future congestion revenue. As typical for monopoly situations, less capacity than socially optimal is provided so as to maximise profits (DeVries et al., 2009; Léautier and Thelen, 2009; Levêque and Brune-

⁴ Glachant, Pignon, 2005

kreeft, 2007; Paul Joskow and Jean Tirole, 2005). The effect can be avoided if at the time of construction contracts for the future use of the line are issued in an ‘open season.’ All demand for contracts is collected and the total demand is used to set the capacity to be constructed. Such contracts could be used by investors to make the export of power from renewable energy projects credible “bankable”.

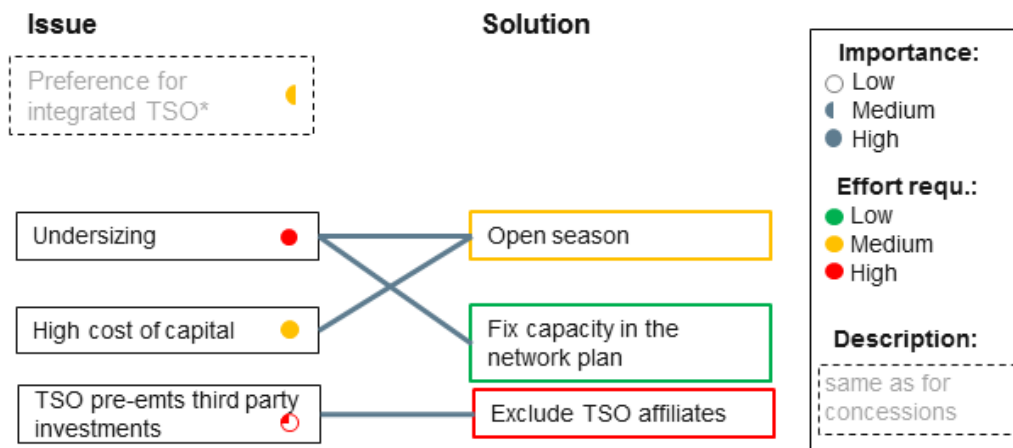


Figure 6: Issues and solutions for merchant investment.

High cost of capital

In principle the revenue of merchant investors depends on the price difference between the markets connected by the interconnector. Prices in both markets are volatile and subject to various drivers that are difficult to predict including regulatory developments. Therefore revenue uncertainty for a merchant investor is in principle very high (De Jong et al., 2007). As a result, higher shares of expensive equity are required in the financing structure increasing the overall cost of capital (Léautier and Thelen, 2009). There is an additional risk for future revenue streams, for example if parallel to the merchant line a regulated line is being built and reduces the scarcity value of the line, as took place in Australia.

In practice merchant investors will aim to sell access to the transmission line on long-term contracts. To the extent that they succeed in signing such contracts they can secure future revenue streams and reduce the uncertainty about future revenues. However, in the current European environment power contracts rarely extend for more than four years, so it would be difficult to find counterparties that would acquire access to transmission beyond this horizon.

In case the cross-border interconnection is built between one or more non-liberalised markets, the merchant investor of the interconnector will need to negotiate grid usage and payment prior to construction. This is because without a competitive market there is no reference power price for a market, and therefore there is also no price difference between the two ends of the interconnector that determines the value of the interconnector. Hence the construction of an interconnector to one, or between two, markets that are not liberalised can only be initiated once a long-term agreement secures the future revenue for the interconnector.

TSO pre-empts third party investments

TSOs are typically much better informed about power flows and potential future bottlenecks on lines linked to their network. If they are allowed to undertake merchant projects, they could therefore pre-empt third party investors or select the most profitable opportunities. This increases the risk for third parties of winning the tender only in the case if the project is not profitable (winners curse) or of incurring early project development costs with very low probability of succeeding in delivering a project.

Furthermore, the revenues of a merchant TO depend on the dispatch of the system. If the dispatch is controlled by an integrated incumbent TSO, independent merchant investors may be discouraged to construct additional lines, because the dispatch of the incumbent TSO will influence whether congestion rents are accrued within the system, or on specific interconnectors (De Hauteclocque and Rious, 2009; Glachant and Pignon, 2005).

3.4.2 Solutions for merchant investments

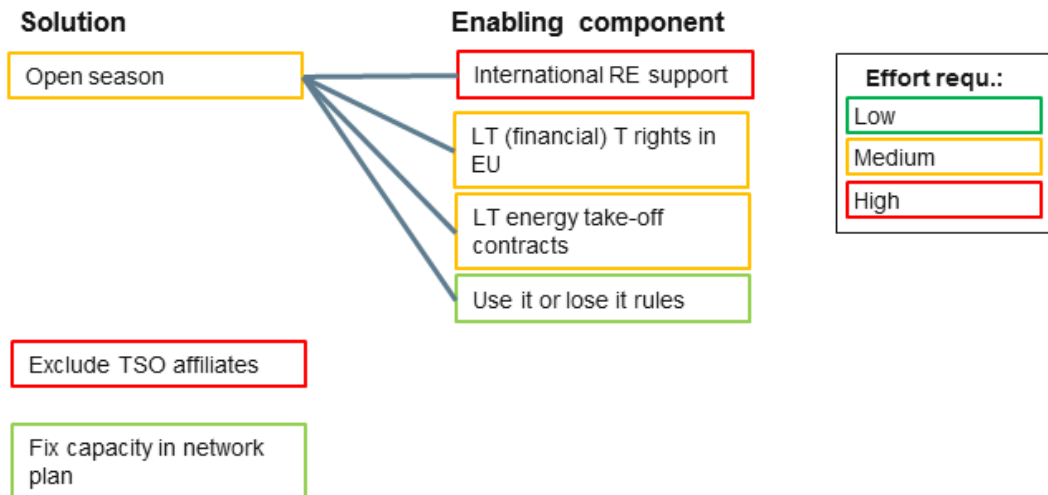


Figure 7: Solutions and enabling components for merchant investment.

Three primary options have been proposed to reduce concerns associated with merchant investment. Open seasons to issue long-term contracts prior to the construction, exclusion of TOs of neighbouring countries with their affiliates, and fixing the capacity that a line needs to reach in network development plan.

Beyond this, a suitable regulatory framework for merchant transmission projects is essential. In Italy, for example, the debate about the creation of a regulatory framework concerning interconnections has started with the Reg. CE n. 1228/2003, and (Art. 32, Law 23/07/2009) which set out conditions for accessing the network for cross-border exchanges in electricity, however, many details are still missing within its implementation. E.g. until recently Italy has been under an infringement procedure from the EU for not having established congestion management mechanism that is necessary for both an efficient cross-border trading and providing incentives for merchant interconnector investments.

I. Open season

During an open season, merchant investors sell long-term contracts for the capacity which they intend to provide. This has two advantages. First it provides long-term contracts that secure the revenue for the merchant investor. Second, the market demand for transmission capacity influences the capacity of the transmission line. Holding an open season before the

construction of the transmission can thus help to reduce the problem of under-sizing, because additional market participants might sign a long-term contract.

Open seasons comprise two phases. During the first phase, the sponsor assesses market needs and during the second - offers capacity to the participants and completes deals with those who offer best bids. Open season is publicised by the sponsor to attract higher interest from third parties and provides as much information about the needs as possible. Different methods may be used to allocate the capacity, however NRAs must assure that the chosen one is transparent and non-discriminatory. Once binding agreements are signed and the investment is decided, all non-sensitive information about the investment is made publicly available (ERGEG, 2007).

If market participants exist that can sign long-term contracts in the open season to secure transmission for energy they own or have contracted, then this can in principle stabilize revenue streams and thus reduce the risk for the merchant investor. However, in practice the counter-party risk involved in such long-term contracts remains a concern that complicates financing and is somewhat lower in cases when RES remuneration mechanisms are driving investments.

Historic long-term contracts had been an obstacle for a competitive European energy market. Therefore the Directorate General for Competition of the European Commission is only granting exemptions to allow for the use of long-term contracts in narrowly defined situations. In cases such as the merchant East-West interconnector between the British and Irish electricity with the commissioning date in 2019, European Commission granted the allocation of long-term contracts over more than 20 years in an open season. One of the key arguments for their decision was the existence of the regulated EirGrid interconnector which is running in parallel to the merchant lines and has been commissioned in late 2012 (European Commission (EC), 2008).

To create the demand for long-term transmission contracts to facilitate open seasons for transmission access the following enabling components are necessary.

International RE remuneration

In case of transmission lines which are built in order to import renewable energy, renewable power generators will only buy a long-term transmission right if there is an international RE remuneration mechanism that provides sufficient confidence that renewable imports will be sufficiently remunerated for the duration of the energy imports.

Long-term energy take-off contracts

Beyond the delivery point of the renewable energy remuneration mechanism, generators will only buy long-term transmission rights for the amount of energy sold on long-term contracts to consumers in Europe.

Long-term financial transmission rights within the EU

If power is to be sold by the project developer to users outside of the EU country which harbours the interconnector, then hedging against any congestion (cost) is necessary and requires that transmission contracts match the length of energy off-take contracts. Currently however such contracts are typically restricted to one year, and as long as EU congestion management approaches are not consistent with the physical nature of the networks and do thus not provide a credible long-term perspective, the opportunities for long-term transmission contracts remain restricted.

"Use-it-or-lose-it" rules

Long-term physical transmission contracts raise concerns that owners of the transmission contracts strategically or accidentally withhold transmission capacity that they are not utilizing. "Use-it-or-lose-it" provisions aim to secure in such instances that transmission capacity that will not be utilized has to be returned to the system operator so that it can be made available to other market participants.

In the case of the East-West interconnector between UK and Ireland, the European Commission highlighted that one of the conditions for the exemption was the introduction of use it or lose it rules for the long-term transmission rights (European Commission (EC), 2008). In absence of "Use-it-or-lose-it" requirements, strategic actors could buy long-term transmission rights in order to shield themselves against competition from the neighbouring markets. In order to obtain an exemption from the European Commission, other merchant interconnectors will need to comply with the "Use-It-Or-Lose-It" rules.

II. Exclude TO affiliates

If the national TO and its subsidiaries of a country linked to the interconnector would be precluded from pursuing a merchant transmission line, this would reduce information

asymmetry and could thus attract additional project developers. This could increase the level of interest in the development of a merchant line. Obviously this would be at the expense of losing the incumbent TO or its affiliate as a merchant investor.

Excluding the TO and its affiliate from the pursuit of a merchant transmission line could create a second advantage. It could increase the motivation of the TO to pursue the same line as a regulated transmission investment, as (i) potential additional revenues that might be obtained due to a merchant line are no longer dis-incentivizing regulated investments and (ii) the TO could be further motivated to take forward the regulated investment to avoid the prospect of third parties owning and operating adjacent asset.

III. Fix capacity in the network plan

Another solution to the concern that there may be strategic undersizing of transmission capacity in a merchant based model is fixing the capacity in the network plan. Therefore, if the investor would build the line, it needs to meet the envisaged capacity. This however raises a question as to how to allocate the right to build the merchant line if it is already pre-specified. E.g. is the line granted to the investor who has best links to the regulator and TSO so as to early participate in the process and to be the first in submitting the proposal?

3.5 Summary of interconnection aspects specific to business model

Table 2 summarizes the most prominent issues that need to be addressed to facilitate transmission investment under the different business models discussed in this section.

<i>Frequency of concerns mentioned</i>	Regulated investment	Concession-based invest.	Merchant investment
Business model related concerns			
TO not motivated	High	-	-
Access to capital	Medium	-	-
Cost allocation between countries	High	High	-
Define quality for T line	-	Medium	-
Operation and expansion flexibility	-	Medium	Medium
Under-sizing	-	-	High
High cost of capital	-	-	High

Table 2: Summary of most frequently mentioned concerns by interviewees and in literature.

Given the limited attention that was to date dedicated to concession based business models, it might be worthwhile to further explore their advantages. Namely, they provide for opportunities to attract and facilitate use of the private financial capital to develop the transmission infrastructure projects and could thus also avoid bottlenecks in financing or project development and execution faced by incumbent TSOs. Should an increasing number of lines be built on a concession base, then underpinning contractual arrangements need to be carefully designed so as to create flexibility for efficient operation and further development of the network. Otherwise the interests of concession takers for protection from regulatory and other risks could dominate the structure of such contracts.

The formulation of concession agreements and execution of the tender requires trusted technology expertise that might typically be concentrated within the incumbent TOs. This raises the question on the role of incumbent TOs. One might consider a process in which the incumbent TO would first be consulted on its interest and capacity for a quick implementation of a project in a regulated approach. In case of agreement the TO would be requested to commit to a firm delivery schedule. If this is not obtained, then a concession could be tendered. Given the additional information available to the incumbent TSO, its participation will increase the risk of a winners curse for third parties participating in such a tender. Hence it should be considered to then exclude the incumbent TSO from a tender for a concession and instead built on its expertise in the design and execution of the tender, thus also ensuring that the concession line can be effectively integrated in the transmission system.

4 Aspects of interconnections investments beyond specific business models

Having discussed the challenges with the existing business models for investment in cross-border transmission capacity in Chapter 2, we further turn to address generic issues in relation to developing power projects in the MENA region.

Within the following sections we discuss issues that apply to both transmission and non-transmission investments.

4.1 Desert power in general

International desert power projects are faced by a number of problems that are not only relevant for the construction of transmission lines but also for the implementation of an international renewable energy remuneration mechanism. An overview of the problems as well as potential solutions and their enabling components is given on Figure 8 and explained below.

4.1.1 Issues associated with desert power projects in general

The (perceived) lack of national interest in an export oriented desert power strategy is according to our interviews the strongest obstacle for desert power projects in general, but also some level of distrust between countries can inhibit the implementation of the strategy.

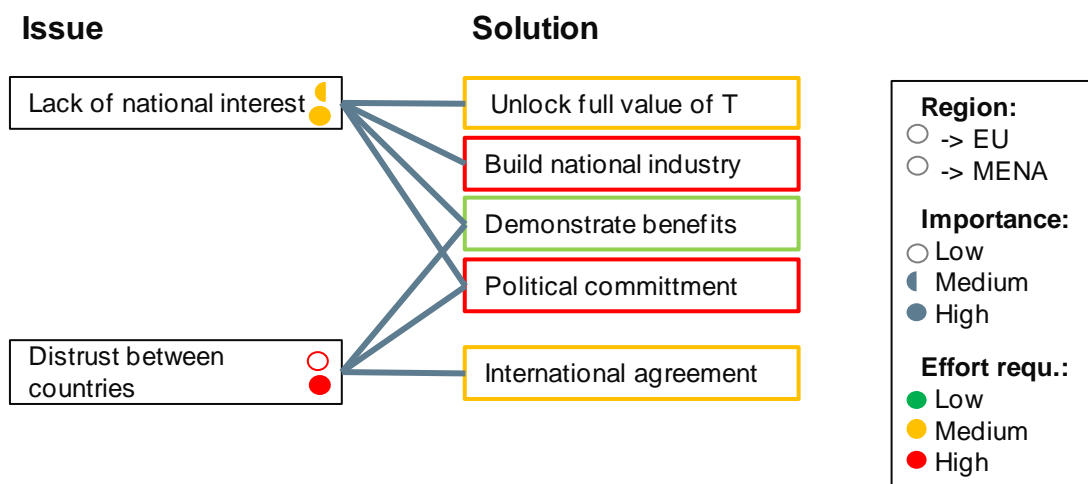


Figure 8: Generic Issues and solutions for international desert power projects.

Lack of national interest

For most countries, the goals of meeting their local demand, diversifying their supply and building a local industry which generates revenues and employment are equally or more important than the profits which could be obtained from electricity exports or transit (Brunekreeft, 2004). Unless desert power projects address these policy dimensions, the governments of potential export countries may therefore not be interested in collaboration.

For example Supersberger and Abderrahmane argue in 2010 that in order to stimulate interest in export oriented renewable projects in Algeria it is necessary to demonstrate local benefits (Supersberger and Abderrahmane, 2010).

The situation in some of the potential transit countries is similar: the renewable energy from the deserts is competing with the energy they could produce locally and export. Such an incentive could for example explain why recent negotiations on exporting renewable energy from Morocco to Northern Europe through Spain failed. They did not envisage the construction of additional interconnection and thus limited export capacity from Spanish generation to Northern Europe.

Distrust between countries

If the relationship between neighbouring countries is influenced by unresolved historical disputes, governments are often very cautious about engaging in joint projects or opening up their borders for electricity trade relations because they fear that this could introduce dependencies or lead to a re-negotiation of historical disputes in other areas. To a large extent national borders within MENA are still characterised by a significantly depressed effect on electricity trade. This is even more evident in the South-South route (direction) connection, where physical connection is already in place, but the rate of utilization of the existing capacity is extremely low. This does not take into consideration yet, due to its scarce volume, the effects of deployment of RES power generation.

In two interviews mutual dependency was stated as a reason for difficulty to better utilize the interconnector between Algeria and Morocco. Historically, these countries have been close to going to war with one another and the border between them is still closed. As a consequence of these historical tensions in most recent years Maghreb countries have separately sought to develop their exports to their main partner, the EU. The intra-Maghreb trade represents only 3% of foreign trade in the area (CIDOB, 2010).

4.1.2 Solutions for desert power project in general

In address of the issues described in the above, we have developed the following set of solutions (as illustrated on Figure 9):

- Unlock full value of transmission
- Build national industry
- Demonstrate benefits
- Political commitment
- International agreement

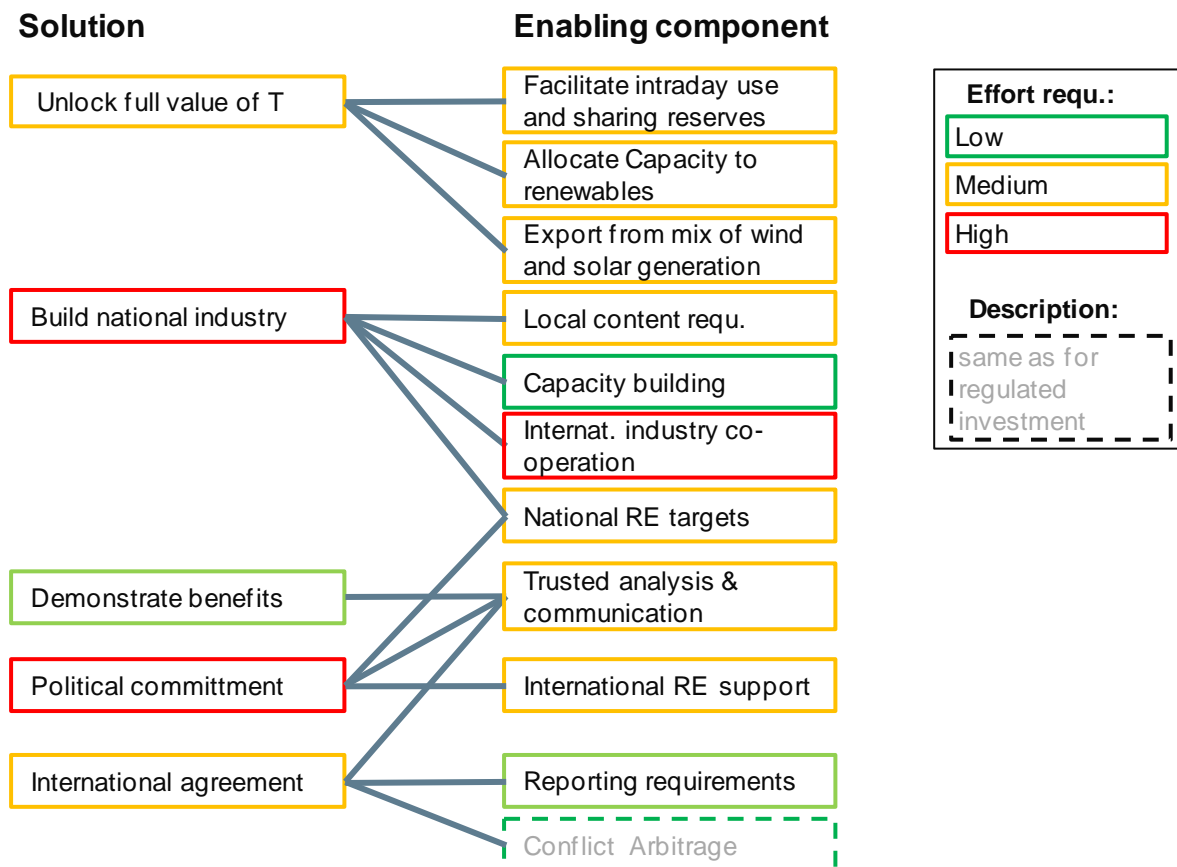


Figure 9: Solutions and enabling components for international desert power projects.

I. Unlock full value of transmission

If transmission lines are regulated in a way that allows for a more efficient sharing of balancing energy and reserves across countries, this could reduce the required total generation capacity and thus increase the attractiveness of further interconnections for local govern-

ments by increasing the supply security and reducing the cost for their consumers. Benefits from co-ordinating balancing markets have been observed as quite significant in the literature (Van der Weijde and Hobbs, 2011). A set of policy options exist to unlock the full value of transmission:

Facilitate intraday use and sharing reserves/responsiveness

The effective use of interconnectors requires frameworks to allow for commercial or administrative co-operation at intraday and balancing stage. This could include alignment of intraday and real time market clearing and dispatch algorithms. In the absence of competitive markets, administrative arrangements could determine the remuneration of services delivered across the interconnector on the basis of transparent international cost benchmarks.

Allocate all long-term capacity to renewables

Long-term transmission contracts can be issued for a line, and can allow investors to sign long-term contracts for power from new generation plants in a MENA country to European consumers or public entities. Thus they could secure stable revenue streams to facilitate lower-cost financing of the investment. To their advantage, such contracts do not have impact on the short-term operation, if capacity is to be returned to the market in short-term auctions. Alternatively, such long-term contracts may be of financial nature and referenced to the result of the short-term transmission auction or – if spot prices are available in both countries – to the difference of the spot prices in the markets adjacent to the interconnector).

Export from a mix of wind and solar generation

The utilisation of the interconnector can be increased if power from a mix of generation technologies is exported. In this case the size of the interconnector would be significantly smaller than the total renewable capacity. During a certain percentage of the time, this would mean that not all the renewable energy from all the associated generation assets can be transferred to the EU. As remuneration of the excess production in the MENA markets can be expected to be lower, this will have an impact on the ability to finance renewable investment projects. Technically, however the host country for RES projects would in fact benefit from fuel savings. For example the following two options could be used to reduce the impact on ability to finance new RES generation.

First, renewable technologies could be allocated transmission rights for different time windows. With the provision of firm capacity, the share of generation output that can be exported can be accurately calculated as a basis for financing decisions.

Second, renewable technologies could be allocated transmission rights with different priorities. Thus technologies with higher investment costs (e.g. solar thermal) could obtain rights with higher priority for the share of power not stored, followed by solar PV and wind plants with lowest priority to the share of power that produced from stored solar thermal storage.

In either case, the sale of the power not exported needs to be agreed. In the example of Morocco, local off-take contracts can both be signed with the state owned electricity utility (ONE) or directly with end-consumers (MEM, 2010). In absence of a liberalized market, the price for local off-take of energy needs to be determined prior to construction, as subsequently the generator has very limited power to negotiate an attractive price.

The price can be determined for the individual plant, for example as part of a tender for the plant. Alternatively, the power price in a liberalized market or of a reference power plant could be used as reference point (for example longer-term gas contracts in continental Europe had sometimes been paid at the gas price in the more liquid UK market).

II. Build national industry

A clear strategy to unlock the opportunities for local industry to contribute to and develop with the renewable energy investment as well as a quantification and communication of the resulting benefits could greatly increase the attractiveness of investments in export oriented projects.

This can involve a set of enabling components mentioned below. They are assessed and quantified in more detail in associated studies by DII (DII, 2012):

Local content requirements

Renewable energy projects could be subject to local content requirements in terms of a minimum local ownership, minimum share of local employment, and minimum share of locally manufactured equipment or other. However, such local content requirements might be challenged under WTO rule. Furthermore, in order to deliver the scale of investments that justify local investment in the supply chain it would be very beneficial to develop a common market across several MENA countries. Local content requirements would need to accommodate this.

Capacity building

Renewable energy projects could be accompanied by local capacity building measures in the form of exchange programs, technical training, apprentice-ships, university courses or the formation of local research centres and others. Capacity building measures may help to prevent a shortage of the skilled labour which is needed to facilitate local provision of inputs.

International industry co-operation

Co-operation between companies in different countries, e.g. in the form of joint ventures or shared research centres can be an effective way to transfer knowledge between them. On the TO level, an industry co-operation has already been set up in the form of the Med-TSO, which is sharing information about best practices and transmission standards in the Mediterranean region. Med-TSO was born in 2011, among France, Spain, Portugal, Morocco, Algeria, Tunisia, Libya, Egypt, Jordan, Turkey, Greece, Albania, Montenegro, Slovenia and Italy, and aims to develop common perspective on the institutional and regulatory frameworks required for a better integration of the systems.

National Renewable energy targets

In addition to the demand for capacity resulting from exports, national renewable energy targets can increase the credibility of signals to the local and the international supply chain.

III. Demonstrate local benefits

Ensuring that initial activities are deliver local benefits and allowing for effective communication of these and future benefits can help to increase interest in co-operation. This can comprise several enabling components:

Producing for local use

Domestic renewable energy projects are firstly beneficial for securing energy supplies locally. Typically, renewable generation is relying on the resource which is cheaper than imported fossil fuels and its development also contributes to economic growth in the country.

Trusted analysis and communication

A trusted analysis about the local benefits and its communication to governments can help to create national interest. In order to be effective, the analysis would have to be perceived as qualified and impartial and needs to illustrate the whole package of cost and benefits for each country not only in terms of the revenues from selling electricity and transmission but also in terms of the impacts along all the other dimensions which matter for policy makers.

IV. Political commitment

The political commitment to renewable energy targets is an important building block that can help to solve a variety of different issues by sending a credible signal of future demand. For potential exporters of desert power, this will also signal national interest in such a strategy and reduces distrust about future deviations. For the supply chain, an increased level of confidence increases the case for development of local capacity that would not be warranted for one-off projects. An increased confidence in growing future demand also increases the case for additional investment in RD&D throughout the supply chain and can thus contribute to lowering the technology costs and increase the national interest.

A credible political commitment to renewable energy targets and trajectories also provides a helpful framing for discussions of individual components of a renewable strategy – to motivate the policies and programs necessary to facilitate grid expansion and project development. The target is thus a reference point for many individual decisions of different government agencies. Binding targets at the national level provide a benchmark against which future governments can be held accountable.

The effectiveness and credibility of such a target can be strengthened with trusted analysis and communication (see previous discussion) and can be enhanced through international renewable remuneration mechanisms.

V. International Agreement

An international agreement can provide a basis for effective cooperation between participating countries, as well as provide a platform for the co-ordination of policies and investment projects between the participating countries. Again there is an important role for

trusted analysis and communication of the underlying benefits for the participating countries.

In order to be effective, an international agreement requires some form of moderation process or an independent mediator for conflict arbitration. Some options had been discussed in section 2.2.2.

Indeed, it is in every partner’s interest to avoid legal confrontation, and as such - one of the key risk mitigating measures is to foster more dialogue and participation among stakeholders.

Legal enforcement of international agreements is challenging – therefore reporting requirements can play an important part in its success. Timely reporting on the process, output and outcome of such an agreement allows stakeholders and the public to track the progress, and can enhance the public commitment to such an agreement.

4.2 Interconnection specific aspects

Transmission projects are faced by a number of problems that arise independently of the business model and are also relevant for projects outside EU-MENA. An overview of these transmission specific problems as well as potential solutions and their enabling components is given in Figure 5 and explained below.

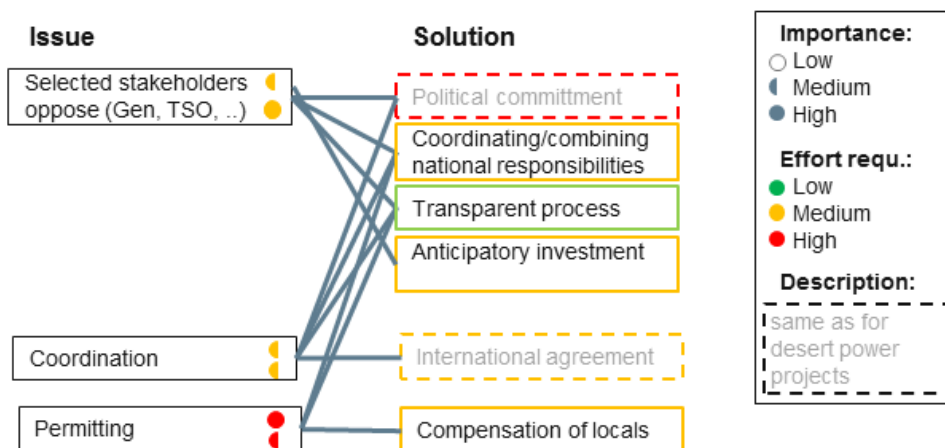


Figure 10: Generic Issues and solutions for transmission projects.

4.2.1 Issues specific to interconnections

Selected stakeholders opposition

In the case of liberalised neighbouring markets, the re-enforcement of interconnections between them leads to a price convergence for consumers and increases the competition between the generators as well as the need for co-ordination between TSOs. This is less of the case in the MENA region as its markets are not fully liberalised, however we will expect gradual price convergence as a result of connecting MENA electricity sectors with European markets. Convergence typically goes along with price increases in some countries – not welcome by respective consumers – and price reductions in other countries – not welcome by respective generators. If overall efficiency gains and cost reductions are not sufficient or not well enough communicated, selected consumers or producers may therefore oppose the expansion of transmission grids in order to protect their specific interests.

Co-ordination

The simultaneous expansion of generation and transmission assets requires some form of co-ordination in order to ensure a timely delivery of the appropriate scale of transmission capacity. In the past this co-ordination could often be achieved through an approach often described as transmission follows generation. As traditional, large scale, generation projects took several years to develop, it was possible to initiate the necessary transmission investment once generation investment plans had firmed up. Provision of early and credible information to guide the transmission investment was further facilitated through vertical integration between generation and transmission.

For renewable generation projects this approach is less suitable, because they tend to be characterized by shorter project cycles – e.g. can be executed within one to two years, and would then have to wait several years until also the transmission is in place. Due to such temporal dependencies, transmission planning needs to precede respective renewable generation being built.

In the case of larger scale transmission corridors and in particular international interconnectors, the planning and permitting period for transmission is particularly lengthy, and therefore it seems particularly relevant to revisit the paradigm of transmission follows generation

In addition to the co-ordination between transmission and generation capacity, future transmission expansion also needs to be co-ordinated with the supply chain. For example

the market for under-sea HVDC cables is still relatively small. Bottlenecks in the supply chain – e.g. because ships for installing the cables are booked out – may lead to significant delays that can risk the success of the project. For some of the MENA countries bottlenecks in the supply chain may create a significant risk, as most of the components that are needed for the construction will either require the prior development of local production facilities or will need to be imported. MENA countries will need to be as attractive marketplaces for the technology suppliers as their primary focus markets therefore.

Permitting

The difficulty of obtaining permits for the construction of transmission lines, which is often referred to as the NIMBY (not in my back yard) problem, is one of the major obstacles for grid expansion. Within the EU, this problem has already been studied in detail and a number of suitable solutions have been suggested, e.g. involvement of an consultation with local communities and/or making local public a financial partner in projects (Ragwitz et al., 2007; Roland Berger, 2011b). The EU energy infrastructure guidelines (EC, 2011) provide guidelines for the permitting process and its timelines where applied by EU member states to projects of common interest.

Several transmission projects in our case study were significantly affected by delays in the permitting process due to local opposition. In the most positive case, a recent interconnection between Spain and Portugal was delayed for three years. In other instances the opposition of local communities or limited interests of neighbouring TSOs in advancing cross-border transmission links significantly delayed investments, e.g. the expansion of interconnection capacity between France and Spain took thirty years to build.

4.2.2 Solutions for interconnection specific issues

The following solutions have been identified to address these issues (see Figure 11):

- Coordinating/combining (national) responsibilities
- Transparent process
- Compensation of local communities
- Anticipatory investment

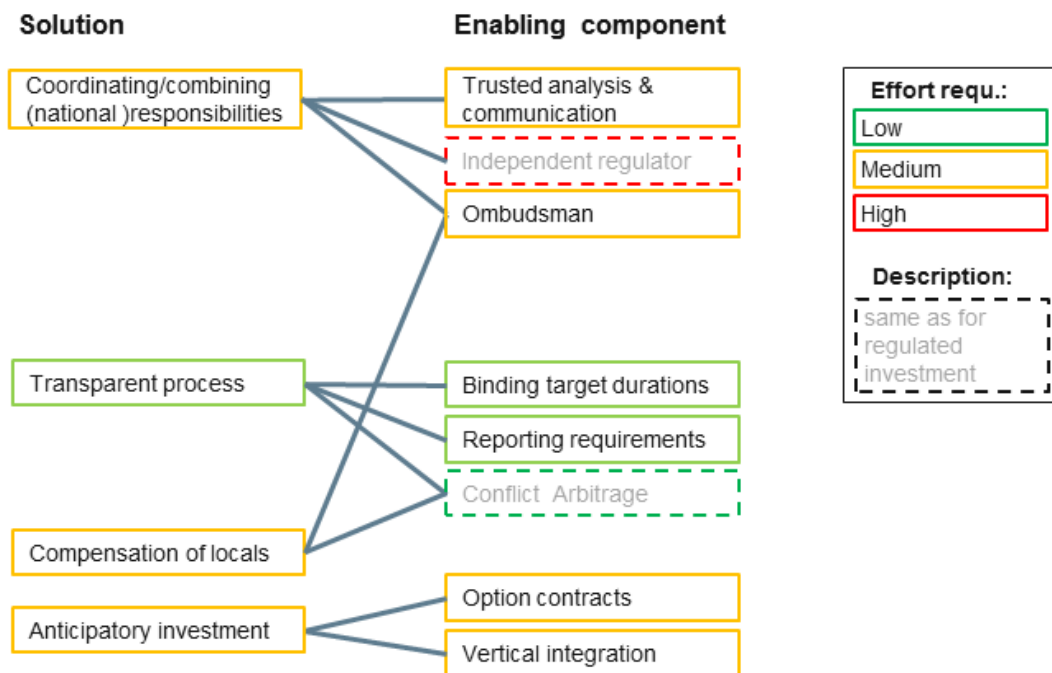


Figure 11: Solutions and enabling components for generic issues of transmission projects.

I. Coordinating/combining national responsibilities

The designation of one competent authority which “shall be responsible for facilitating and coordinating the permit granting process for projects of common interest” is required by the EU Infrastructure package (Art. 9EC, 2011). Furthermore, where projects are at risk of delay, there is a possibility to “designate a European coordinator for a period of up to one year renewable twice” so as to facilitate also the international coordination (Art. 6 EC, 2011).

Such a designated authority might be more effective in addressing the problems of stakeholder opposition and permitting by providing a platform for the co-ordinated integration of individual stakeholder concerns into the planning process. It can also help to solve co-ordination problems by providing a single point of contact for the regulators and project developers in neighbouring countries.

The Mediterranean Energy Regulators Group MEDREG aims to contribute to such a process by facilitating a transparent dialogue among the regulators from the participating countries⁵. The history of regulatory cooperation among EU countries illustrates that it may be challenging to build on a bottom up approach of regulators if there is insufficient political support. E.g. Germany was very late to implement an independent regulatory authority and thus was less engaged in the regulatory cooperation under e.g. the Florence Forum. In Federal states the creation of a single agency faces the additional challenge to integrate responsibilities from sub-national bodies (e.g. Belgium, Germany). In the light that currently several MENA countries have no regulatory authorities or have formed regulatory bodies only with limited powers, future cooperation between MENA regulators will be lengthy in its establishment.

Within individual countries, such a one-stop shop for regulation and permitting has been established in England and Wales, where the Infrastructure Planning Commission is responsible for the whole permitting process, or in the Netherlands, where the Ministry of Economic Affairs, Agriculture and Innovation is a single contact point responsible for the co-ordination of all the other authorities that are involved in the process (Roland Berger, 2011c).

Within the EU, a co-ordination between individual member states is achieved through the EIP and the Ten Year Network Development Plan by ENTSO-E, which is compiled from the grid expansion plans by individual national transmission owners and is non-binding in its nature. Following the principles outlined in, EIP, an ad hoc working group composed of the Commission, member states, TSOs and project promoters, regulators, ENTSO-E, ACER and – on ad hoc basis – third countries or external experts (Nabi Siefken, 2012) will select a number of Projects of Common Interest (PCI) which will receive additional funding from the Connecting Europe Facility (CEF). One condition for these projects is that they have to obtain construction permits by national agencies in no longer than 3.5 years (EC, 2011).

Trusted analysis and communication

A set of initiatives can help to improve coordination. Trusted analysis and communication can contribute to a shared vision that can become a reference for all parties. An independent regulator can help to balance individual stakeholder concerns and defend the interest of

⁵ http://www.medreg-regulators.org/portal/page/portal/MEDREG_HOME/ABOUT

consumers. While these two points had already been introduced before, additional opportunities created by an Ombudsman and Transparent processes are now discussed.

Ombudsman

An ombudsman is an authorised central contact point that can help to streamline the decision process by channelling stakeholder requests. This can improve co-ordination between different stakeholders, both in the phase of designing regulation and during the planning and permitting processes for individual projects.

In the case of the Connecting Europe Facility, the ad-hoc group is offering such a centralized contact point for the concerns and suggestions of independent project developers or other stakeholders. A similar procedure has also been used with some success in the case of the North Sea grids initiative. In the past, the centralized contact point has been successful in facilitating the dialogue and focussing discussions on a technical level.

II. Transparent process

A transparent process can be built on a set of enabling components that will be discussed in detail, including reporting requirements and stakeholder involvement, and requires clear timelines for credibility to all parties. Again clear provisions for mediation or conflict arbitration that has been previously discussed can strengthen the credibility of a transparent process.

Reporting Requirements

In order to ensure the adherence to target durations for the permitting process, national authorities need to report the duration of permitting decisions which effectively enables early indication of problems. For example in case of the Connecting Europe Facility, developers of all projects of common interest need to submit an annual report regardless of the project status. As another example, in the UK, the chair of the Infrastructure Planning Commission needs to report to Parliament if the permitting procedure for nationally significant infrastructure projects exceeds target duration.

Binding target durations

In order to ensure the uncertainty for project developers and increase the incentives for regulatory authorities to speed up procedures, clear target durations for each of the planning stages can be defined. (Roland Berger, 2011b).

While the agreement of target durations for projects involving many steps and unknowns is difficult, where this is possible, a process which only requires reporting in case of deviations from the schedule could be more efficient because it is saving the need for regular project updates while increasing the dis-incentive to fall behind the schedule.

III. Compensation of local communities

In some cases, the compensation of communities can help to gain the approval of local authorities. Compensations often involve the construction of public infrastructure such as schools, sport centres or others but could also consist of environmental benefits such as natural reserves. In the case of the interconnection between Morocco and Spain, local authorities agreed to the construction of the interconnector after a total of 3.000 EUR per inhabitant of Tarifa were invested in compensation projects.

Additionally, the MENA region has an experience of formal environmental and social framework assessments by World Bank (World Bank, 2011), which further formalises the process of land acquisition and use with respect to the local communities. Eg. Moroccan Agency for Solar Energy (MASEN) had commissioned such an assessment for the Quarzazate I CSP project. The assessment showed that in this case although land acquisition was a voluntary process, it triggered the "Involuntary Resettlement Policy" which led to a preparation of the Land Acquisition Plan describing the acquisition process and to monitoring of the proceeds to the benefit of the local population.

Apart from compensation through public infrastructure, compensation can be provided through environmental actions, such as re-forestation measures or the establishment of a natural reserve in the respective community. In the case of the France-Spain interconnection, for example, the permit was granted in return for the guarantee that other than for supply local consumption in the Eastern Pyrenees, no further interconnectors would pass through that department (Zapatero and Sarkozy, 2008).

The issue with the compensation however is related to the underlying process for its determination, e.g. is it a "closed doors" decision by government and TSO(s) or an open forum or a voting process among stakeholders for different ways of allocating the funds. The effectiveness of such compensation can be increased, if it is seen to be fair, e.g. negotiated according to the rules of a transparent process, perhaps by a

credible independent party (Ombudsman), and linked to accepted conflict arbitrage mechanisms.

The Energy Community has been established in 2005 and entered into force in 2006 following two memorandums of understanding: in 2002 and in 2004. It currently comprises the EU and the states of Albania, Bosnia and Herzegovina, Croatia, Macedonia, Moldova, Montenegro, Serbia, Ukraine and Kosovo as contracting parties, and Armenia, Georgia, Norway and Turkey as observers.

The original purpose of the energy community has been to implement EU regulation in the areas of electricity, gas, environment, competition, renewables, energy efficiency, oil and statistics.

Its organisation is divided into the following five organs:⁶

The Ministerial Council, which is the key decision making organ that meets once per year to decide about the rules and regulations for the Energy Community.

The Permanent High Level Group, composed of senior officials from contracting parties and two representatives of the EU community which is following up on work from the Ministerial council.

The Regulatory Board composed of regulators and EU officials advising the ministerial council in case of technical questions and cross-border disputes.

The fora, where stakeholders from all relevant sectors come together to discuss current questions which will feed into the analysis of the Permanent High Level Group.

The secretariat, which is co-ordinating the day-to-day activities of the Energy Community and monitoring whether contracting parties fulfil their obligations.

Particular factors for the success which have been highlighted by respondents was the permanence and independence of institutions, the enforcement of rules through an arbitration process, the interest of the governments in member countries, the public backing by the EU commission and multi-lateral nature of the treaties.

Since its foundation, the Energy Community has evolved and increasingly started to adapt regulations or develop its own rules in order to accommodate specific circumstances of member countries.

Box 4: Energy Community as an example of an institutional umbrella.

⁶ <http://www.energy-community.org>

IV. Anticipatory investments

To avoid delays or failure of renewable projects due to lack of timely transmission access, regulators or governments can approve and back transmission investment prior to a firm investment decision for a specific generation asset. (Van der Weijde and Hobbs, 2012).

In cases of on-shore wind farms, where the lines are not dedicated to individual projects, national regulators are increasingly approving anticipatory grid expansion to ensure the network expansion can advance in anticipation of future generation projects (see Ofgem, 2012 and German Network Development Plan).

Anticipatory planning could be seen as a 'light' version of anticipatory investment. In the case of the connections for the first two rounds of UK offshore wind projects, the co-ordination was achieved by initiating planning prior to the tender, and by then allowing developers that were successful in the tender to build the lines which connected their wind-farms to the grid.

In absence of a co-ordination by the regulatory framework, approaches which are used by private actors in order to solve co-ordination problems include option contracts and vertical integration

Option type contracts were used in the in the case of UK offshore wind-farms: The licences for land use needed for connecting the farms to the onshore grid provide an opportunity, but not the obligation, for the developers to build an onshore connection to the offshore wind-park during the time required for its in-depth feasibility studies. Thus if feasibility of the project or financing cannot be secured, the developer is not left with expensive land lease contracts. Such optionality in the land license contracts enables developers to minimize their financial risks of failed or delayed project construction.

Vertical integration can offer another mechanism to allow for anticipatory grid investment, as a vertical integrated entity might initiate the grid investment prior to the generation investment based on internal information about the full project status and internal commitment to the overall delivery. Thus co-ordination between the construction of wind-turbines and off-shore transmission in the UK has been achieved as both assets were developed within the same consortium. In order to comply with unbundling requirements stemming from the EU Third Energy Market Directive, such consortium has to divest the line to independent transmission owners after commissioning of line and generation project.

4.3 Summary of issues relating to transmission

Table 3 summarizes the most prominent issues with regard to desert power in general and interconnection specific.

<i>Frequency of concerns mentioned</i>	Regulated investment	Concession-based invest.	Merchant investment
Desert power related concerns			
Lack of national interest	High		
Building trust between countries	High		
Interconnection specific concerns			
Selected stakeholders oppose	High (MENA) / Medium (EU)		
Co-ordination	Medium		
Permitting	Medium (MENA) / High (EU)		

Table 3: Summary of most frequently mentioned concerns by interviewees and in literature.

It is interesting to observe that a set of concerns need to be addressed that are independent of the business model that is used and in particular also apply to merchant based investments. Thus the advantage that merchant investment models might offer – avoiding potential obstruction of projects by allowing independent commercial parties to initiate and advance a project, is constrained by a set of concerns that need to be addressed by transmission owners in neighboring jurisdictions and regulators or governments. After all, an interconnector needs to be integrated with the existing network at both ends of the line. Even where project proponents fund initial grid impact studies, the ultimate configuration of the network will remain responsibility of the TSOs. This might explain why merchant based transmission investments, while very prominently represented in the literature and studies, in practice remain very rare.

The summary also shows the importance of a public commitment to a desert power strategy and to network expansion for the export-oriented share has repeatedly emerged in this analysis. This requires that all participating countries need to see benefits of such projects matching their priority objectives like jobs, energy security, or emission mitigation. This can provide confidence to all that the multiple issues will be addressed by public and private actors.

5 Options to match approach to renewable energy remuneration and transmission regulation

In the previous chapters, we have identified a large number of issues and regulatory solutions. However, the importance of these issues is strongly dependent on the design of the renewable energy remuneration mechanisms. In order to unlock the potential of desert power projects, renewable energy remuneration schemes and the rules for transmission investment thus need to be coherently designed to create a clear-cut business case for investors.

In this section, we will provide an in-depth description of three comprehensive packages of renewable energy remuneration and transmission regulation that can be used for this purpose.

In principle, we can classify the policy packages according to the following criteria:

Coverage of RE remuneration: renewable energy or premium

Renewable remuneration schemes can be the only revenue stream for power produced from a renewable plant, in the form of a Feed-in-Tariff (FIT) or a contract awarded in a tender. Alternatively, renewable remuneration mechanisms can provide a complementary revenue stream in addition to the revenues which renewable projects obtain from selling their output in electricity markets. Renewable certificate schemes and Feed-in premium provide such additional revenue streams.

Delivery point: landing point in EU, EU country, or EU consumer

Renewable remuneration schemes typically only pay the generators for the energy that is physically delivered to the importing region. The delivery point for the renewable energy remuneration mechanism can either be a specified EU border country, any EU country, or European electricity consumers⁷ This will also impact the responsibility for contracting for (potentially new) transmission capacity within Europe.

⁷ In principle one could also envisage renewable remuneration premiums granted to generation that is not exporting power to EU consumers. However, this would be incompatible with the EU RE directive, which requires physical imports to ensure that generation that is supported contributes to an increased renewables share in the EU power mix.

Additional policy instruments exist and are further developed to support renewable power projects for local use in the MENA region. (NAMA cooperation, financing remuneration through public banks).

Qualifying location: one specific or several potential MENA countries

Renewable remuneration mechanisms in Europe can be open to projects in only one specific MENA export country or can allow for competition between projects exporting from different MENA countries.

Development of interconnector – responsibility of project developer?

European renewable remuneration mechanisms had traditionally relieved the project developer from the responsibility for securing grid access, and there is some move to a system of expanding grid capacity in expectation of future RE projects. In this spirit, governments could take the initiative of developing interconnecting capacity to be provided to RE project developers. In contrast, the UK off-shore wind regime allocated the responsibility for the construction of the (relatively short) cable from off-shore turbines to the landing point to the project developer. Equally one could envisage that a developer for an export oriented RE project in the MENA region also has to take responsibility for development or contracting of the necessary MENA-EU interconnector.

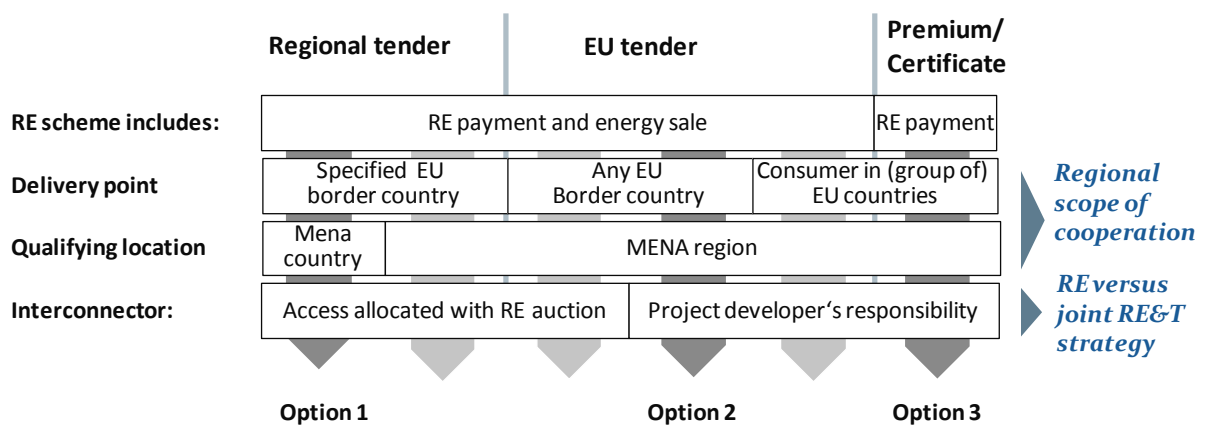


Figure 12: Arrangements for combining renewable remuneration mechanisms and transmission rights.

From the various combinations possible, we select three for a detailed discussion. They are selected as they represent different dimensions of the scope of the cooperation as well as the RE-only versus joint RE- and Transmission strategy:

Option 1: Regional tender - interconnector constructed by EU and MENA countries

An EU country or a group of EU countries run a tender for imports of RE from a specific MENA country to a Mediterranean EU country, which is in alignment with the Art. 9 (EC, 2009). Winning bidders commit to deliver RE from a new project e.g. by a specified technology (wind, solar, concentrated solar) in the MENA region and will obtain a specified price per MWh delivered. In parallel, the participating EU and MENA countries coordinate on the construction of an interconnector typically in either a regulated TSO- or concession-based approach. Long-term transmission rights for the interconnector are allocated to the winning bidders of the RE tender on a cost basis.

Option 2: EU tender – project developer responsibility for constructing or contracting interconnector

A group of, or all EU countries, run a tender for imports of RE from the MENA region. The winning bidders commit to deliver RE from a specified technology to one of the participating Mediterranean EU countries and will receive a price that has been determined in the tender for every MWh delivered. It is in the responsibility of winning bidders to secure or develop transmission to deliver the energy to the EU shore. Without a priory government commitment to such an interconnector this would likely involve a merchant based approach.

Option 3: EU premium – project developer responsibility for constructing or contracting interconnector

We assume that EU countries jointly implement a system that grants a premium payment for all renewable energy. Such a premium would also require delivery of the renewable energy to the shore of an EU country and thus allocate responsibility for securing transmission to project developers. In contrast to the EU tender, the premium system allocates responsibility of selling the produced power to the project developer. This will likely require that the project developer finds a counter party that signs a long-term power purchasing agreement of sufficient duration to facilitate financing of the RE project. If the counter-party is not located next to the landing point, it will also require that the RE project developer acquires corresponding transmission contracts. Without a priory government commitment to such an interconnector this would likely involve a merchant based approach.

For each of the packages there are a number of critical points that need to be addressed by transmission regulation which will be described in the following sections.

5.1 Cross-cutting topics for all options

All of the three options which we discuss will need to address the role of long-term contracts to back the transmission and generation investment, the framework for an efficient use of the interconnector beyond the flows anticipated for exports from contracted plants and the issues relating to concerns on carbon leakage.

5.1.1 Long-term contracts

Merchant generation investments outside liberalized markets (and frequently - RE generation investments in liberalised markets) are usually backed by long-term energy off-take contracts, so called power purchasing agreements. Similarly, interview partners in the MENA region also reported that they anticipate new RE plant investments expect RE plant investment to take place with such contracts (## cross reference to ISI-Fraunhofer).

Long-term contracts for the interconnection provide RE project developers with the confidence that they can access the interconnector to deliver to the EU and capture both energy and renewable remuneration payments. Similarly, the stability of revenue is attractive for investors in the interconnector. Thus, in the case of regulated or concession based investment, the costs for consumers of regulated TSO in neighbouring countries are avoided. In the case of merchant interconnections the investor benefits from more stable revenue streams.

Arguably, if a RE plant in the MENA region could secure firm transmission access to the EU market, it could sell power on shorter-term arrangements. However, given uncertain developments on fuel and carbon prices as well as deployment volumes both within Europe and from imports, power price projections are very uncertain. Project investors therefore have to anticipate low energy prices for the calculations of revenue streams they need to secure debt financing. As a result, investors can use only a small share of debt and need to primarily rely on equity to finance their investment. In the presence of technology, regulatory and sovereign risks, the return requirements and therefore cost of equity is very high. Thus, financing costs would be extremely high, increasing the level of necessary renewable support to ensure break even. Both the high returns observed and the high costs put the sustainability of political support at risk and thus further increasing their risk profile.

Hence, we assume as base case across all options presented in this chapter, that RE projects are backed by long-term energy off-take contracts. For options 1 and 2, the contracts are of

similar nature to the provisions offered for RE energy projects under tender or feed-in approaches across most European countries. In option 3, the long-term contract is assumed to be signed directly with power consumers, similar to the contractual provisions between large industrial users and the investor group into the Finnish nuclear plant. In the Finnish case the counter party risk inherent in such a long-term contract is reduced as the industrial consumers that anticipate acquiring power from the nuclear power station also own shares in the project.

We equally assume that for all the options presented in this chapter, there will need to be some form of arrangement to provide long-term guarantees to transmission access matching the energy off-take contracts. However, the design of these guarantees will deviate across different options and is therefore discussed in the corresponding sections.

If all generation assets require individually firm access to the interconnector, then the diversification effect of the portfolio is not captured. The time profile of wind production varies across locations and differs significantly with the production profile of solar energy. Thus investors might consider the development of a portfolio of wind and solar plants exceeding the capacity for which they can secure access to the interconnector with the perspective of also selling to the national market.

The central role of long-term contracts did raise some concerns in discussions with stakeholders. After all, prevailing long-term contracts were one of the main obstacles for the introduction of competition in Europe. In particular long-term contracts of small generators with incumbent utilities strengthened the dominant position of incumbent utilities and long-term physical access rights to international interconnectors restricted the interconnector capacity available to increase competition between countries.

Hence, the use of long-term contracts requires a case by case approval of the EU commission. The prevailing case law offers some comfort that such exemption will be granted. Additional support for such an exemption can be linked to the energy strategy nature of the project. In a resolution from 12 June 2012, the European Parliament “considers the conclusion with our strategic trade partners of long-term energy and raw materials supply contracts at fair prices to be one of the top priorities; calls, therefore, for the EU to adopt a coherent strategy with regard to energy supply contracts with these partners” (European Parliament, 2012).

5.1.2 Efficient use of interconnector

The contribution of interconnectors to total welfare increases with the efficiency of their use. Therefore, within the EU, merchant TOs are subject to regulated third party access to enhance competition (Cuomo and Glachant, 2012). However, merchant transmission projects will only be pursued, if the merchant investor can capture a sufficient share of the value created by the interconnector. Thus, in certain circumstances the EU commission can grant merchant investors an exemption from third party access in order to increase the possibility of rent extraction. Such exemptions from the duty to provide access to third parties have been granted to EstLink (FI/EST), BritNED (UK/NL), East-West Cable (UK-IE) and Arnoldstein/Tarvisio(AT/IT)

http://ec.europa.eu/energy/infrastructure/exemptions/doc/exemption_decisions.pdf). The exemptions may also apply to the situation with the EU-MENA interconnectors. RE project developers, acquiring the long-term transmission contracts, have the primary interest to deliver power to the EU markets and to secure the ability to do so. Hence it is not against their interest to implement effective use-it-or-lose it provisions for the transmission capacity.

On an efficiently operated interconnector the flow pattern can vary from the long-term contractual position. For example, if current generation capacity shortages prevail, MENA countries might use the additional interconnection capacity to import power from EU countries. In this case, flows might be scheduled to export RE energy to the EU, while simultaneously flows are scheduled to import EU power into the MENA country. Thus, the physical net flow would be zero. If the RE energy exporters can make a firm commitment to their export flows, then this would allow to double the imports into the MENA country (once backed by the RE export, once by the physical capacity on the line).

This example illustrates a feature of energy markets: the physical flows implied by commercial transactions can cancel each other, such that the volume of commercial transactions can exceed the volume of physical flows. This is desirable in the specific case of an EU-MENA interconnector for at least two reasons:

First, the commercial transaction (the long-term energy export contract) facilitates financing of the RE plant. Furthermore the physical delivery of the energy to the EU has been required in the current EU RE Directive (Art. 9) to ensure the development of the overall system.

Second, the effective use of the interconnector can address short-term energy availability concerns in the MENA region. This might reduce the need to implement quick fixes with low-cost and inefficient fossil plants, and can thus provide time to implement longer-term solutions, preferably based on RE technologies at further reduced costs in the future.

Thus, the deviation of commercial and physical flows is in the interest of the EU, of MENA countries and of the environmental strategy and increases the value of the interconnector and the interest of all parties for cooperation. This also creates the basis for increasing the scale of cooperation in the longer-term.

The energy system scenarios developed by DII show that in the longer-term also physical flows will for much of the time deliver energy from the MENA region to Europe (Dii, 2012). The generation capacity invested in the MENA region with the expectation of exporting will however exceed a cost efficient choice of interconnection capacity.

Assuming a generation mix of wind, solar PV, and solar CSP, in the MENA region, every 1GW of additional export oriented generation capacity would be matched with 0.6GW of interconnection capacity. As a result, during 40% of the time some of the renewable production cannot be transferred to the EU because production exceeds the interconnection capacity. This will have to be reflected in the design of new transmission contracts (see section I).

5.1.3 Carbon leakage

The construction of interconnectors between MENA and EU raises concerns of carbon leakage: Assuming an increasing carbon price and thus increasing cost of fossil power generation within the EU, production from fossil power plants in the MENA region could be increased or even expanded for exports to the EU. We currently lack a detailed assessment to quantify the materiality of the concerns. Several options to address the concern could be explored in more detail.

First, approval for long-term contracts for transmission on the interconnector can be conditioned on their use to finance RE projects. Without access to such long-term contracts, it is difficult to finance the construction of new fossil plants in the MENA region.

Secondly, all importers of power into the EU could be requested to submit CO₂ allowances for the carbon emissions associated with power production. Such an approach has been implemented in California for power imports from neighbouring states. If importers do not

demonstrate evidence for the carbon intensity of the power plant where the power has been sourced, then a default emission rate of a coal power station is assumed (<http://arb.ca.gov/cc/capandtrade/capandtrade.htm>).

Third, it is suggested that renewable energy producers could obtain priority access to the interconnector. However, if renewable projects that were initially constructed to meet local demand, and potentially even obtained international support through CDM or finance from public banks, are encouraged to export their power based on preferential priority access conditions on the interconnector, then the local demand they would have otherwise served can be captured by fossil producers. Thus priority access provision for exports from a market might be less suitable to address carbon leakage concerns.

Obviously any such intervention has to be carefully designed and possibly agreed upon in international process, so as to ensure they avoid any undue discrimination and concerns about protectionism.

A recent example from Egypt cement production illustrates that a carefully designed intervention that addresses risks of leakage created by unilateral carbon prices can be of interest not only for the countries with the carbon price. With increasing European willingness to pay for cement - also linked to carbon prices - an increasing share of the Egyptian cement production had been exported prior to 2007. This in turn increased costs of cement for local construction with negative impact for Egyptian consumers. In response the Egyptian government implemented in early 2007 an export tax of 11 \$ per ton of cement which corresponds thus increasing the price of exported cement by about a third and thus scaled back the exports (Hourcade et al., 2007).

5.2 Option 1: Regional tender

In this section, we will provide a detailed description of the regulatory framework for transmission investment for the option of a regional tender for renewable energy.

An overview of the critical points along the transmission path that need to be addressed by the regulatory framework (grey boxes) or by private renewable investors (yellow boxes) is shown in Figure 13.

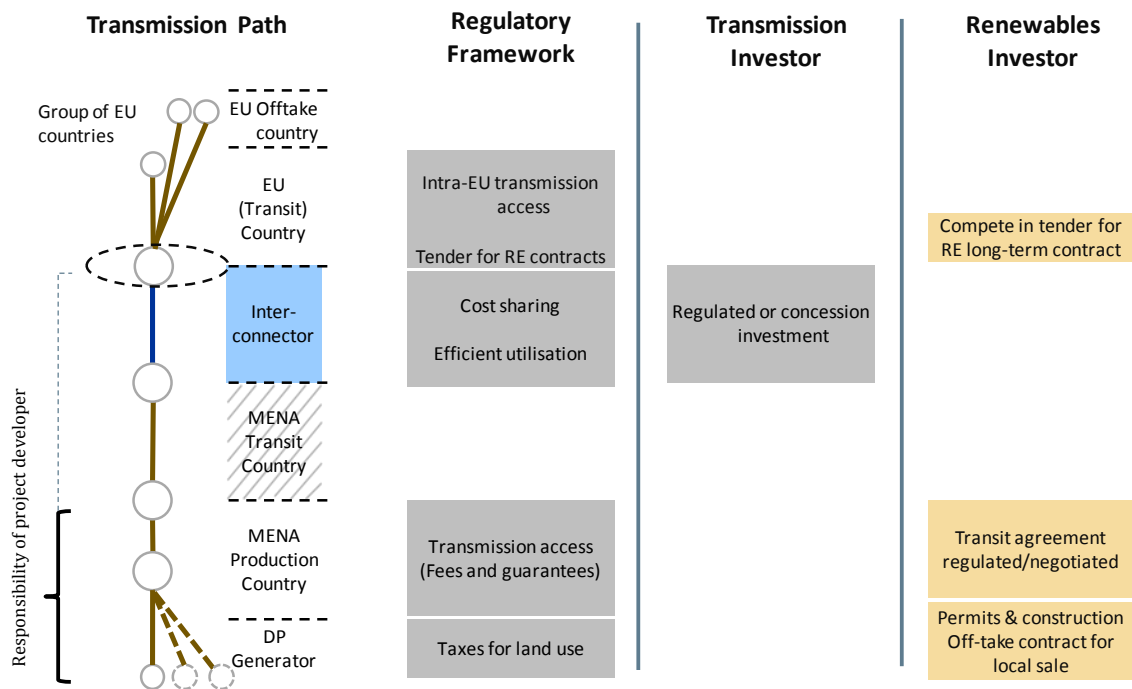


Figure 13: Critical points along the transmission path that need to be addressed by the regulatory framework, transmission investors or renewable investors in case of a regional tender.

Renewable Investors

Project developers are competing for projects in one MENA country. Prior to the regional tender they need to secure options for sites, technology, and financing and need to agree on transmission within the MENA country. The project developers that can offer the lowest price/MWh for energy delivered in the tender will obtain a twenty year energy off-take contract and transmission rights for the interconnector to deliver the power to EU shore. To ensure timely delivery, the project developers have to post collateral at the time of the tender and winning bidders are liable for penalties in case of project delays.

Where projects envisage delivering power both for local use and export, the project developers need to secure off-take contracts for local sale prior to the tender for international sales. If local and international sales are linked, the project developer might otherwise be in a weak negotiation position for the discussion of the local off-take contract.

Regulatory framework – Local taxes and transmission access MENA

All RE projects competing in the tender require grid access and are subject to the taxes and grid tariffs in a single MENA country. As all tender participants are subject to these provisions, they implied costs will be added by all tender participants to the bid and the respective MENA country faces no incentives to reduce the implied costs. Therefore they need to

be agreed prior to the tender between EU countries and the MENA country that will host the projects to balance the interests of EU and MENA consumers and citizens.

MEDREG has planned an initiative to promote and develop the regional tender approach (which is also referred to as "corridor approach" by MEDREG) which among other aspects will focus on harmonisation of national regulations for the access to the networks and power exchanges, including the possibility to develop merchant lines. It will also aim to develop a common approach and decision tools to assess profitability of transmission infrastructures.

With regard to the transmission tariff level within the MENA country, if they are set below long-run costs of transmission investment within the MENA country, then MENA consumers would subsidise power exports. This seems unfair, and could trigger future changes to the tariff level and thus create regulatory uncertainty complicating financing. If tariffs are set above long-run costs of transmission investments, then EU importers subsidise the MENA power system reducing attractiveness of such cooperation and public acceptance. It is therefore advisable that transmission tariff levels are linked to long-run marginal costs for transmission investment and fixed for e.g. 20 years. In the UK a methodology was developed to calculate transmission tariffs according to this principle (DC loadflow (DCLF) ICRP Transport Model, www.nationalgrid.com/uk/Electricity/Charges/transportmodel/).

With regard to national taxes and regulation, again a balance needs to be found and agreed between the MENA country and the EU countries organizing the tender prior to the tender process and grid construction. This will include a specification of the expectations on local input enabled with technology assistance or local labour or content requirements and taxes charged for the projects. This cooperation can be reinforced with clear transparency guidelines in leau with the regional or global transparency institution development as e.g. in (<http://www.publishwhatyoupay.org/>). Thus, project developers can develop robust proposals and MENA countries are confident about the local benefit and will advance the cooperation.

Regulatory framework for interconnector

The EU framework for such an interconnector is a project of common interest (PCI). A proposal is submitted to the Ten Year Network Development plan (TYNDP) and evaluated by ENTSO-e and ultimately the European Commission. The plans, and thus also the list of PCIs are updated every two years. In 2012 three EU-MENA interconnectors have been proposed as PCI, but at least one was not short-listed by the European Commission, arguably because the state of the project development had not been sufficiently advanced. However, without regulatory backing it might be difficult to further advance such a project proposal – pointing to the importance of public backing already at such an early stage.

As the PCI process builds on the the EU infrastructure package and the 3rd Energy Package initiating the TYNDP, it focuses on EU member states. Therefore, additional mechanisms need to be developed to ensure coordination with third countries. In principle they can be listed as project proponents. This raises the question of whether MENA countries would also accept that ACER, the agency of coordination of European Energy Regulators, acts as arbitrage body as envisaged in the infrastructure package, to resolve for example issues of cost allocation if they cannot be adequately addressed among the project proponents.

Once a project has been agreed, in principle the easiest approach for its implementation would be through the TSOs in neighbouring countries as a regulated investment. With the backing of national regulators and governments, national TSOs in the Mediterranean EU country and MENA country can plan and finance the interconnector. Typically the ownership is split according to the financing contributions. This can be modelled on existing examples, e.g. Spain-Morocco or the envisaged interconnector Italy-Montenegro. The revenue from transmission use (e.g. sale of long-term contracts) would also be allocated in proportion to the financing contribution.

If the national TSOs do not attribute sufficiently high priority to the project, given other demands on their project execution and financing capacity, then the project can instead be pursued in a concession based approach. There are several options that may be applicable that range from capital investments provided by the third parties to the construction, ownership and operatorship by the third party.

The regulators or administration of the countries adjacent to the interconnector would tender for the construction of the line in exchange of a long-term revenue guarantee (section 2.3). As the neighbouring TSOs have initially declined an interest in pursuing the line as a regulated investment, they and their affiliates could be excluded from the tender for the concession. This would reduce information asymmetry between the TSO and other participating bidders that might otherwise preclude participation or aggressive bidding by other project developers. It also reduces the potential disincentive for a TSO to pursue a line as regulated investment so as to take it forward under other contractual arrangements. The project of developing on-shore wind parks in Ireland for power export to the UK (<http://www.greenwire.ie>) envisages the development of transmission in such a concession based approach. If in the longer-term an independent ISO is evolving, then it could facilitate the coordination of planning and operation of network assets owned by multiple entities and the differences between regulated and concession based approach might be further reduced.

The inherently international nature of interconnectors could pose additional regulatory challenges – sometimes referred to as regulatory gap. It has been argued that some national regulatory frameworks do not allow TSOs to pursue regulated investment in transmission lines outside of their own and international territory. This applies according to ECRB (2010) e.g. to some EU countries and according to an interview comment to at least one MENA country. In this case the national TSO would have to pursue the transmission investment. If the investment is however only beneficial for third countries, then there seems little rational why a national regulator should approve such an investment. However, if instead projects are to be pursued by third parties, they would require access to information and decide on grid aspects, a prospect likely to be opposed by local utilities. Various options to address these potential problems seem in principle suitable, but would have to be explored for any specific instance, including (i) directly refining the relevant regulatory provision that limits such investment (ii) development of a joint project thus ensuring that joint ownership avoids concerns about territorial issues and cost sharing ensures the beneficiaries will also pay for the line (iii) use of alternative business models like concession based or merchant approaches.

Regulatory framework – Design of the regional tender

One, or a few EU countries, jointly tender for RE imports to Europe. Prior to the tender they specify the amount of energy, technology (mix), and contract duration for energy imports to be tendered.

The implementation of such a tender, suitable institutions and design details are discussed in the complementing study by ISI-Fraunhofer (###ref). The design needs to carefully consider the constraints imposed by EU state aid rules. (see state aid discussion in (Johnston et al., 2008)). Possibly the international energy security nature of the relationship (see section 4.1.1), or the specific innovation policy dimension of CSP could provide additional justifications and thus design flexibility.

The energy tendered for at EU shore then needs to be delivered to final consumers in EU countries. To the extent that power has been tendered in Northern European countries, it will likely require that the corresponding energy is delivered to consumers in the respective Northern European countries. This increases the value for these consumers with regard to energy price stability and energy security. At the same time it reduces concern in a country like Spain, that providing transit capacity reduces the ability to use available export on the Spanish- French interconnector to export power from Spanish renewable energy projects and thus reduces the ability to advance Spanish investment projects to create local jobs. In the longer-term, this requires linking larger scale import projects with corresponding trans-

mission expansions within the EU, for example within the 10 year network development plan of ENTSO-E.

The situation in Italy has been historically different. For the last decades significant power imports result in persistent transmission flows from the North to the South. Thus any power that is inserted into the system for export to the North, will initially help to balance this flow pattern and would thus not induce additional congestion or cost.

It is however currently difficult to secure access to intra-EU transmission for periods exceeding one year. If this continues to be the case, two options remain:

Firstly, governments could obtain the transmission rights at an uncertain price in annual auctions or shorter-term markets and socialize the risk and benefits through transmission tariffs. Secondly, governments could negotiate with the TSOs of the transit country that they would be receive part of the congestion revenues resulting from the renewable energy imports in exchange for a contribution to network costs.

Lastly, for international export, transmission access and fees are also negotiated by project developers but supported with a Letter of Understanding (LOU) or framework agreement between the MENA country and the EU countries tendering for RE imports. Public actors in EU-MENA take responsibility for both the interconnection investment and a tender for RE imports into the EU.

Summary

The approach does require a significant level of coordination to be delivered by public actors including the implementation of a regional tender, grid expansion, and some level of framework agreement between the importing EU countries and the MENA country hosting the RE projects. The coordination could in principle be embedded within the process of National Renewable Energy Action plans that are submitted by EU member states to the EU commission and comprise plans on RE deployment trajectories and the provision of enabling environments including grid and planning. Alternatively, a dedicated person or institution could be tasked with facilitating the coordination. As part of the North Seas Grid Initiative the EU Commission appointed an EU Coordinator to identify and address concerns for the successful development.

Thus the approach will likely depend on the initial success of semi-public initiatives to advance the project idea and framework with subsequent sign up at the political level in both EU and MENA countries. It has the benefit that requirements on the further development of coordination and local regulatory functions are comparatively limited and that the resulting

regulatory framework can support investments based on established business models with limited complexity.

5.3 Option 2: EU Tender

The case of an EU tender for RE energy imports differs from the regional tender described in option 1, as projects in multiple MENA can participate in the tender, and the power can be delivered to several EU landing points. This also implies that the responsibility of securing of the interconnection is shifted from the public to the RE investor and thus may be more adequately pursued according to the merchant based approach.

Figure 14 illustrates that, as a result, responsibility shifts from the regulatory framework towards the renewable investor. The following discussion in this section focuses on differences to the previously described regional tender.

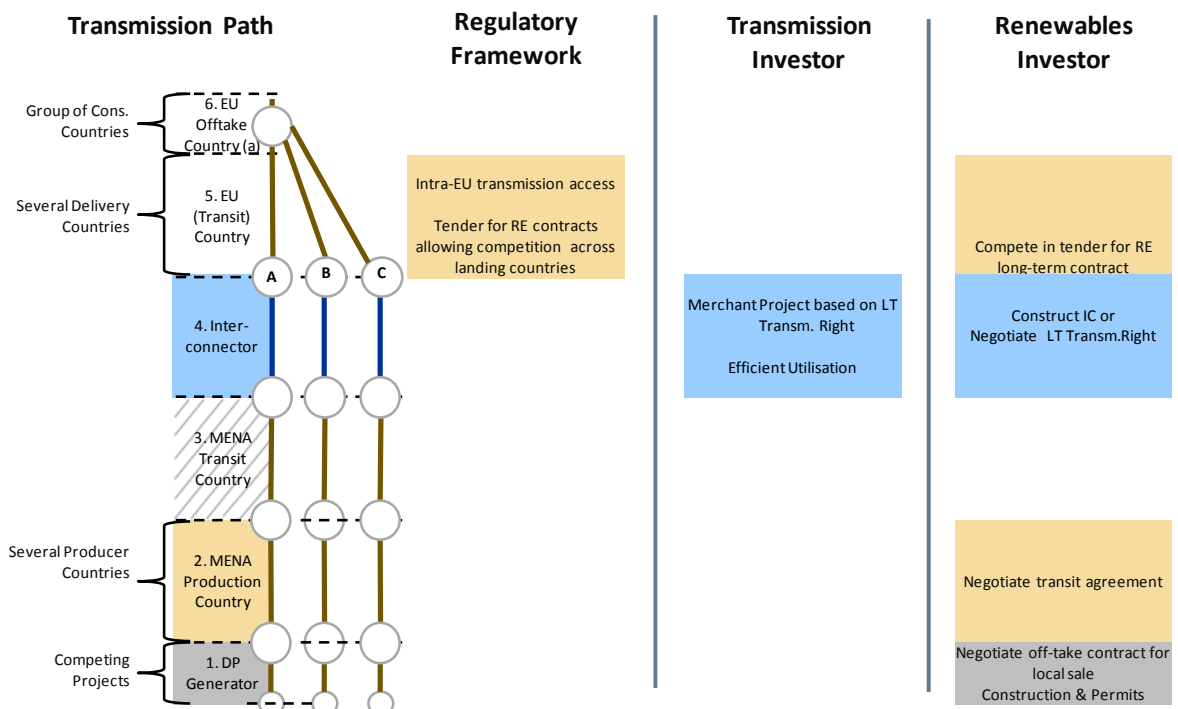


Figure 14: Critical points along the transmission path that need to be addressed by the regulatory framework, transmission investors or renewable investors in case of an EU tender.

In contrast to a regional tender, in the case of an EU tender a number of different export countries are eligible and might in principle be competing with each other on transmission tariffs and provisions for land-use they can offer RE project investors. If there is suitable regulation in place and sufficient experience with renewable export projects, the negotiation

of off-take contracts for local sale, taxes for land-use and transit agreements could thus be left to RE developers. Gobney (2012) points to the value of aligning regulatory and policy frameworks across the MENA regions through harmonisation of the arrangements for system operation and tariff methodologies and deepening energy sector reforms and establishing internal power markets.

In contrast to the regional tender, in case of an EU tender, the winning bidders need to secure access to interconnector. They either have to develop such an interconnector on their own, or secure capacity on a merchant interconnector developed by a third party. Approaches that had previously been used to facilitate the development of merchant interconnectors are described in section I.

A high level of coordination effort has to be shouldered by the RE project developer. Prior to the EU tender, the developer has to sign option contracts for RE technology, options on land use and transmission access in the MENA region and options for access to an interconnector. Therefore, a merchant transmission developer also needs to put in place contracts for grid access in the neighbouring countries, secure planning consent, secure options for the DC converters and line, and secure options for the financing of the project. The synchronicity that is required seems challenging, given the nature of the various public institutions that need to provide credible assurance for their approval, and given the scarcity in production capacity for DC cables and CSP plants.

The design of the EU tender varies in two aspects from the regional tender. Firstly, no transmission rights are allocated to the winning bidder. Secondly, project developers with offers to deliver power to different landing points are competing. And thirdly - the countries in the MENA region are also seen as competing for hosting projects that are participating. The clearing algorithm for the tender needs to correct for the different value of electricity delivered to different landing points. For example, if power is delivered to Southern Spain, then additional on-shore transmission expansion costs for delivery to Northern Europe are significantly higher than if the power is delivered to a landing point in Southern France and thus requires less transmission expansion within continental Europe. This suggests that the bids in the tender should be adjusted by an estimate of long-run marginal costs for grid expansion that would be required at each connection point (see <http://www.nationalgrid.com/uk/Electricity/Charges/transportmodel> for an example of the possible methodology).

In summary – the approach requires strong coordination across several EU and MENA countries to implement a regulatory framework that can support the broader tender and merchant based investment. This might be more suitable in a mid-term perspective as scale and

frequency of investments increases and the governments want to limit their involvement in decisions in transmission and generation strategies.

5.4 Option 3: EU premium or quota system

Option 3 involving a European premium or quota system to remunerate RE differs in two main aspects from an EU tender approach. First, the RE project developers do need to secure off-take contracts for the energy they will produce including transmission contracts if the counter party is in a different pricing area from the landing point of the interconnector. Second, the requirement to put in place all commercial and administrative arrangements prior to the EU tender is relaxed as qualification for the quota or premium is not linked to auction deadlines but to continued availability of the remuneration mechanism.

Figure 15 illustrates that by comparison to the other packages, an EU premium or quota system allocates most responsibility to renewable and transmission investors.

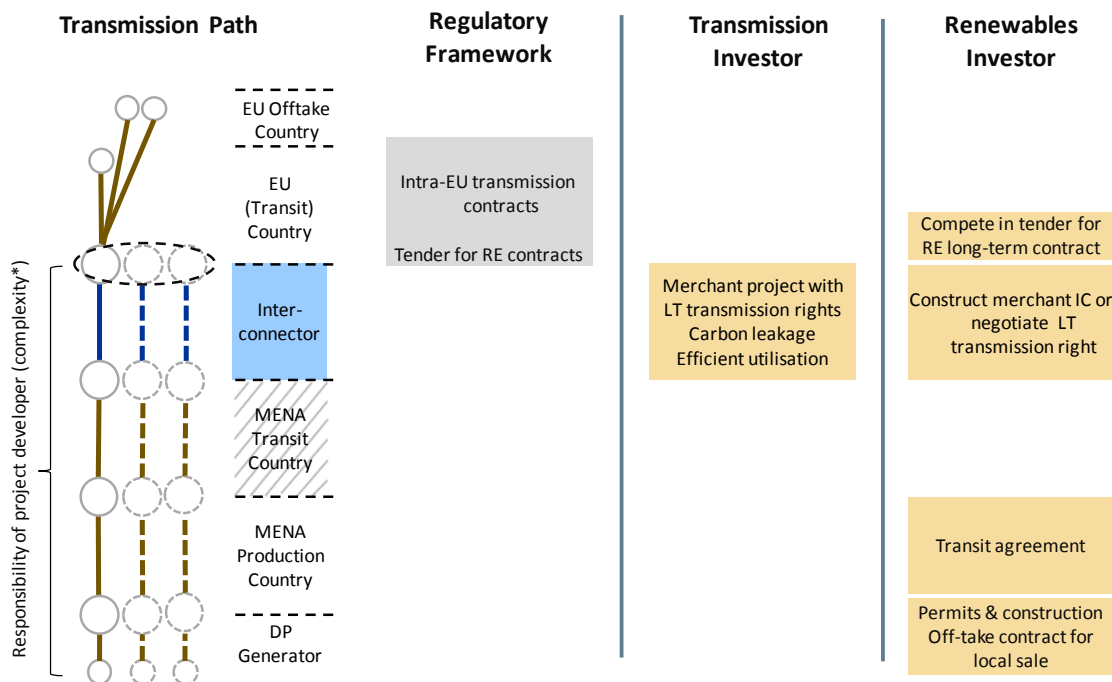


Figure 15: Critical points along the transmission path that need to be addressed by the regulatory framework, transmission investors or renewable investors in case of an EU premium.

In the same way as for an EU-wide tender, in the case of an EU premium or certificate system, a number of different export countries are eligible and competing with each other on

transmission tariffs and taxes for land-use. If there is an advanced regulatory framework and sufficient experience with renewable export projects, the negotiation of off-take contracts for local sale, taxes for land-use and transit agreements could thus be left to generators without further support by the regulatory framework.

Again, in the same way as for EU tenders, project developers could construct a merchant interconnector. Although the financial closure does not have to be aligned with an auction, the timing for the construction of interconnectors and power plant still needs to be aligned.

Different from a regional tender or the EU tender, an EU premium or certificate scheme would only pay for a top-up to energy market revenues. Project developers would thus still have to sign off-take contracts for their energy in the EU and obtain intra-EU transmission contracts from the landing point until the target destination. This would depend on significant further development of EU congestion management approaches. In absence of long-term transmission rights, RE project developers will have to find counter parties for the imported energy in the price zone of the landing point of the interconnector.

In summary, the approach requires the development of EU and MENA market framework and the development of trust in quality and continuity of decisions of the regulatory structures in participating countries that will determine the future revenue streams to remunerate the necessary investment. This suggests that option 3 is more suitable after experience and trust have been gathered with other, less ambitious, regulatory and market structures.

5.5 Criteria to compare options

In order to compare the policy packages, we will use the following criteria:

Criteria A: Coordination and timing

In option 1, public actors have to coordinate the cooperation between selected EU countries and a MENA country to advance and time both transmission investment and the RE tender. The allocation of costs for the interconnector can be particularly challenging but should be viable if linked to long-term contracts acquired by RE importers.

In option 2 and 3, private project developers have to coordinate planning, permitting for RE project and transmission line, and transmission access in addition to the investment in new generation and transmission technology across multiple jurisdictions. In option 2, the project development has to furthermore match the timing of the EU tender, while in option 3 additional coordination is required to ensure access to EU transmission rights and secure energy buyers.

The high level of coordination with multiple public agencies required in options 2 and 3 can be a challenge for project developers. If clear standards and procedures are established for the planning, permitting, transmission access etc., then options 2 and 3 offer to project developers the advantage of more control over the dimensions relevant for overall project success.

Conclusion: Coordination requirements for private investors are reduced if governments or regulators take responsibility for energy transmission and off-take in the EU (option 1 and 2) and responsibility for the development of the interconnector (option 1). This can help project developers to gather experience in the still challenging commercial and technological environment. As experience and scale of activity increases, the additional coordination requirements of option 2 and 3 will be easier to tackle.

Criteria B: Initiative

Multiple challenges have been identified in this study for international exchange and local use of renewable energy in EU-MENA. This raises the question which of the discussed options is most likely to encourage actors to take the necessary initiative to address the issues.

Often, public actors are argued to be less active than private actors that might be driven by social, environmental or profit motives. However, the social and environmental objectives can initiate action in each option. As the investment in RE generation is pursued by private, profit oriented, investors in all three options, this motive is also present in all three options.

Project developers responsible for most of the activities in option 3 might however respond stronger to the profit motive than a regulator, and thus might be more successful in advancing a transmission line. However, also a project developer with the ambition to advance a merchant line for the power transmission will have to engage with the same public actors to obtain support for planning, permitting and grid access.

Conclusion: Public and private initiatives are essential and not a strong differentiating factor between the options.

Criteria C: Competition

All options provide for competition between RE projects for the market. In option 1, projects in one MENA country compete in a RE tender, in option 2 projects from several MENA countries compete in one regional tender, and in option 3 renewable projects in MENA countries can compete with renewable projects in the EU.

All options also allow for competition in transmission investment. In option 1, the interconnector is either constructed based on a competitive tender for a concession, or if constructed by a regulated TSO typically the components are acquired in competitive procurement processes. In option 2 and 3, the interconnector is constructed by a merchant transmission investor.

As coordination requirements and risk exposure in option 1 are smaller, more project developers have the capacity to participate. The lower entry requirements are likely to translate into a higher level of competition.

As the number of RE export projects increases, the emphasis shifts from successfully delivering a project in the presence of challenging technology, financing, and regulatory environment to enhancing the efficiency of system design. Also, with increasing number and scale of projects, generation and interconnection projects might become increasingly decoupled.

In option 2 and 3, the number of eligible export countries increases, which is likely to increase the competition between them, resulting in a pressure on transit fees and land use charges.

Conclusion: Option 1 might offer the highest level of competition for RE project while the overall number of projects is still low. In the longer-term, if the scale of EU-MENA energy cooperation and number of RE and transmission projects increases, the matching between generation and transmission projects is less challenging, and therefore also options 2 and 3 may provide for a competitive environment.

Criteria D: Access to capital and financing costs

The dominant cost share of wind and solar projects are up-front investment costs. Therefore access to capital to finance the investments, and cost to access are central for execution and competitiveness of RE projects. They are primarily influenced by the investment risk.

Renewable Energy project development and operation risk remain under all three options with the project developer. Interruption of transmission access in the MENA region or unexpected tariff increases constitute a key risk in all three scenarios.

The risk profiles of the options differ at the EU end. In option 1 and 2 publicly secured off-take contract at the landing point should in principle eliminate all risks. In option 3 additional risks are embedded in the long-term sales contract to European consumers (counter party

risk) and the additional complexity created by the need to contract for transmission on EU network.

There might be additional differences with respect to the risk embedded in the long-term transmission contract for the interconnector that is assumed for all three cases. The recent discussion on German off-shore wind parks has demonstrated the importance of provisions for the case of interconnector failures. As the technology and delivery risks are still difficult to assess, risk sharing agreements for the case of long-term downtimes had been considered essential. Such guarantees could also be necessary where interconnection projects are an essential component of RE financing schemes and could be more easily integrated with option 1.

Conclusion: In the current market environment, options 1 and 2 provide long-term stable revenue streams and thus facilitate access to lower cost finance which translates to lower costs for consumers. The differences will reduce as energy technology mix stabilizes and thus the value of energy delivered can be better projected.

The analysis suggests, that for the initial RE projects with EU export component, a transmission and renewable remuneration framework as outlined in option 1 is most effective in addressing coordination requirements, ensuring competition, and facilitating access to low cost finance.

In the longer-term, this choice can be re-evaluated. In principle, option 1 can remain a viable option. If the number and scale of export oriented RE project increases in the MENA region and continues to be closely linked to interconnection projects, option 2 could also become a viable option. If the state of energy markets in EU and MENA increase predictability of future power prices, option 3 can also become viable. In all cases, the efficient utilisation of interconnection assets is possible. Currently, this requires appropriate administrative procedures but if markets on both sides are liberalized, the line needs to be integrated in the market arrangements. This needs to be anticipated in regulatory approval process for merchant lines and contracts with concession projects.

6 Conclusion

We have identified multiple issues that need to be addressed to enable transmission investment for international exchange and local use of renewable energy in EU-MENA. Such issues can be classified into general (eg lack of national interest, trust building between countries), specific to the interconnection in question (eg opposition of selected stakeholders, coordination between generation and transmission investments) and in relation to relevant business models (regulated, concession-based and merchant approaches). However, the importance of the issues and the suitability of different solutions depend on the design of the renewable energy remuneration mechanism. Three policy packages were presented that could be used to address the problems faced by renewable energy projects in a consistent manner. Figure 16 compares these three options, focusing on the respective role of private and public actors in coordinating the project delivery and the sharing of risks and opportunities between private and public actors.

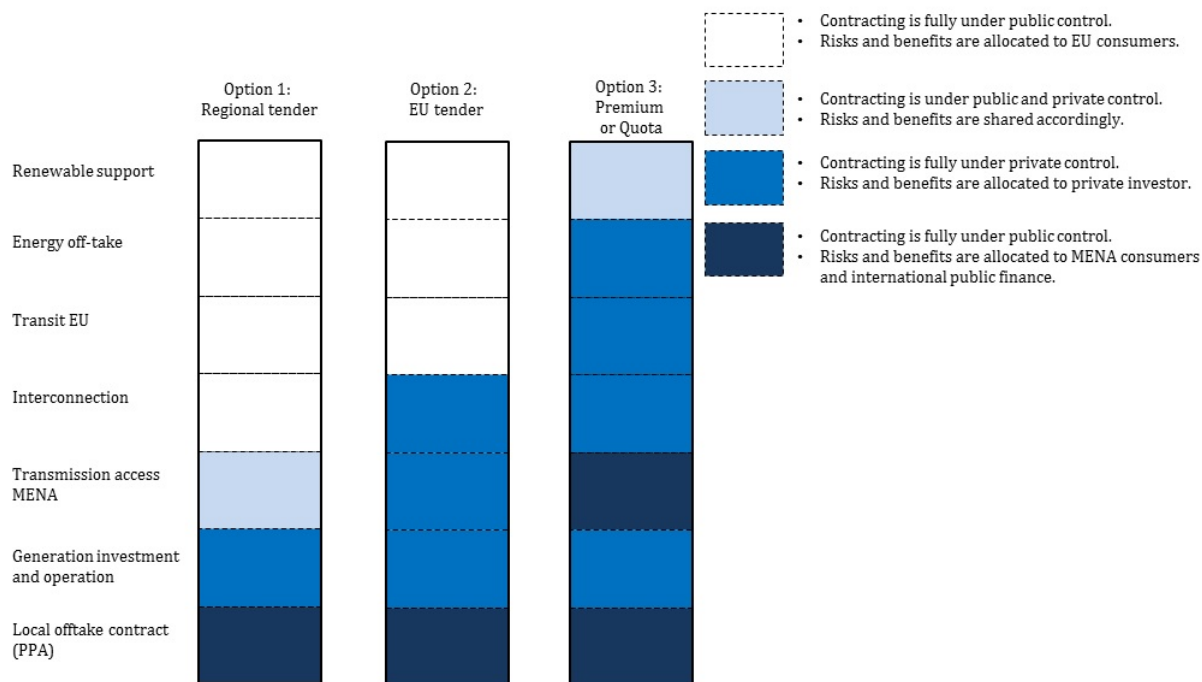


Figure 16: Contractual responsibilities, risks and benefits for different aspects of international export arrangements under the three options: Regional tender, EU tender and Premium/Quota.

In option 1 – a regional tender - project developers can focus on the planning, permitting, financing, implementation and operation of the RE project in the MENA region. For international export, transmission access and fees are also negotiated by project developers under

either a Letter of Understanding or a framework agreement arrangement between the two regions.

In option 2 – an EU tender – project developers can develop projects in several MENA regions and potentially deliver the energy to different Mediterranean EU countries. This, however, also imposes the additional requirement on the project developers to negotiate transmission access in the MENA country of their choice and secure interconnection capacity from the MENA country to an EU Mediterranean country, by either developing own interconnectors or contracting with third party transmission investors.

In option 3 – a European premium or quota system – project developers do not need to develop the entire project to the level of financial closure to an exogenously determined time frame of a tender auction – but can advance at the pace matching their needs and requirements for negotiation with third parties. However, this comes at the additional requirement to secure a counter party for their power sales and transmission contracts within Europe to deliver to this counter party. This requires new ways of recruiting buyers of such long-term contracts and addressing the counter party risk, and further development of EU regulation to enable and back transmission contracts of durations exceeding their maximum current length of one year.

In all three options it is assumed that national governments in the MENA region tender for power purchasing agreements (PPAs) to secure access to energy from RE plants for local use. Often, winning projects also obtain international support through preferential loans from public banks like World Bank, European Investment Bank, or KfW.

Figure 16 illustrates the differences in the allocation of responsibility between public and private actors regarding the options.

It is important to decide on one clear strategy, so that project developers can make a clear business case for their investors and the tasks to be executed by public entities are clearly defined.

For the initial RE projects with EU export component, a transmission and renewable remuneration framework as outlined in option 1 is most effective in addressing coordination requirements, ensuring competition, and facilitating access to low cost finance.

In the longer-term, this choice will have to be re-evaluated. In principle, option 1 can remain a viable and dominant option of choice. If the number and scale of export oriented RE project increases in the MENA region and continues to be closely linked to interconnection pro-

jects, option 2 could also become a viable option. If the state of energy markets in EU and MENA increase predictability of future power prices, option 3 can also become viable. In all cases, the efficient utilisation of interconnection assets is possible. Currently, this requires appropriate administrative procedures but if markets on both sides are liberalized, the line needs to be integrated in the market arrangements. This needs to be anticipated in regulatory approval process for merchant lines and contracts with concession projects.

We want to end on a theme that was emphasized across our interviews and stakeholder workshops: the importance of the overarching policy framework. Issues common across all business models can only be addressed if participating countries are committed to the desert power strategy and to interlinking electricity networks. To this extent the analysis, design and communication of specific policy choices to enable the EU-MENA transmission and RE projects needs to be embedded in the energy- and economic policy strategies of the participating countries.

References

- Biggar, D. (2009): A Framework for Analysing Transmission Policies in the Light of Climate Change.
- Borrmann, J., Brunekreeft, G. (2011): The Effect of Monopoly Regulation on the Timing of Investment (Bremen Energy Working Paper No. 0009). Bremer Energie Institut.
- Bouchahdane, M., Bouzid, A., Bouchareb, I. (2011): Electric Network Interconnection of Maghreb Arab Countries. Presented at the Environment and Electrical Engineering (EEEIC), 10th Conference.
- Brunekreeft, G. (2004): Market-based Investment in Electricity Transmission Networks: Controllable Flow. *Utilities Policy* 12, 269–281.
- Brunekreeft, G. (2005): Regulatory issues in merchant transmission investment. *Utilities Policy* 13, 175–186.
- Brunekreeft, G., Neuhoff, K., Newbery, D. (2005): Electricity transmission: An overview of the current debate. *Utilities Policy* 13, 73–93.
- Cambini, C., Rondi, L. (2010): Incentive regulation and investment: evidence from European energy utilities. *Journal of Regulatory Economics* 38, 1–26.
- CEER (2006): Response to the Energy Green Paper, REF C06-SEM-18-03.
- CIDOB (2010): Building trust can take the form of investment. Energy and regional integration in the Western Mediterranean.
- De Hauteclocque, A., Rious, V. (2009): Reconsidering the Regulation of Merchant Transmission Investment in the Light of the Third Energy Package: The Role of Dominant Generators [WWW Document]. URL <http://cadmus.eui.eu/handle/1814/12793> (accessed 12.7.12).
- De Jong, H.M., Van der Lippe, J.C., Knops, H.P.A. (2007): Investment in cross border transmission capacity: Economics or Politics?

- DeVries, L., DeJooode, J., Hakvoort, R. (2009): The regulation of electricity transmission networks and its impact on governance. *European Review of Energy Markets* 3.
- Dii (2012): *Desert Power 2050*.
- ECRB (2010): *Cooperation of Regulators with Regard to Cross Border Investment Projects*.
- ENTSO-E (2012): *Ten Year network Development Plan (TYNDP) 2012*.
- ERGEG (2007): *ERGEG Guidelines for Good Practice on Open Season Procedures*.
- European Commission (EC) (2008): *Exemption decision on the East-West Cable Project*.
- European Commission (EC) (2009): *Directive 2009/28/EC on the promotion of the use of energy from renewable sources*.
- European Commission (EC) (2011): *Proposal for a regulation on guidelines for trans-European energy infrastructure*.
- European Commission (EC) (2012): *Cobra Cable* [WWW Document]. URL http://ec.europa.eu/energy/eepr/projects/files/offshore-wind-energy/cobra-cable_en.pdf (accessed 11.30.12).
- European Parliament (2012): *European Parliament resolution on Engaging in energy policy cooperation with partners beyond our borders: A strategic approach to secure, sustainable and competitive energy supply*.
- Frontier Economics (2008): *Improving incentives for investment in electricity transmission infrastructure*. European Commission (EC).
- Frontier Economics (2009a): *Theory of Efficient Pricing of Electricity Transmission Services*. New Zealand Electricity Commission.
- Frontier Economics (2009b): *Identification of High-Level Options and Filtering Criteria*. New Zealand Electricity Commission.
- Glachant, J.-M., Pignon, V. (2005): *Nordic congestion's arrangement as a model for Europe? Physical constraints vs. economic incentives*. *Utilities Policy* 13, 153–162.

- Gobney (2012): Promoting the development of concentrated solar power in the MENA regions: policy and regulatory implications.
- Green, R. (1997): Electricity transmission pricing: an international comparison. *Utilities Policy* 6, 177–184.
- Hogan, W., Rosellón, J., Vogelsang, I. (2010): Toward a combined merchant-regulatory mechanism for electricity transmission expansion. *Journal of Regulatory Economics* 38, 113–143.
- Hou, D., Pfeifenberger, J. (2011): Financing Transmission Expansion: The Impact of Cost Allocation.
- Hourcade, J.-C., Damailly, D., Neuhoff, K., Sato, M. (2007): Differentiation and dynamics of EU ETS industrial competitiveness impacts: Final Report. *Climate Strategies*, Cambridge.
- Johnston, A., Kavali, A., Neuhoff, K. (2008): Take-or-pay contracts for renewables deployment. *Energy Policy* 36, 2481–2503.
- Joskow, P.L. (2008): Incentive Regulation and Its Application to Electricity Networks. *Review of Network Economics* 7, 547–560.
- Kerf, M., Gray, D.R., Irwin, T., Levesque, C., Taylor, R. (1997): Concessions for infrastructure, A guide to their design and award (No. World Bank Technical Paper 399). World Bank Publications.
- Larsen, A., Pedersen, L.H., Sørensen, E.M., Olsen, O.J. (2006): Independent regulatory authorities in European electricity markets. *Energy Policy* 34, 2858–2870.
- Léautier, T.-O., Thelen, V. (2009): Optimal expansion of the power transmission grid: why not? *J Regul Econ* 36, 127–153.
- Levêque, F., Brunekreeft, G. (2007): Investments in Generation and Transmission. *Competi* 2.
- Littlechild, S. (2011): Merchant and regulated transmission: theory, evidence and policy. *Journal of Regulatory Economics* 1–28.
- Littlechild, S.C., Ponzano, E.A. (2008): Transmission expansion in Argentina 5: The regional electricity forum of Buenos Aires province. *Energy Economics* 30, 1491–1526.

- Littlechild, S.C., Skerk, C.J. (2008): Transmission expansion in Argentina 4: A review of performance. *Energy Economics*, *Energy Economics* 30, 1462–1490.
- MEDREG. (2012): Action Plan 2012-2013-2014.
- Mossadeq, F. (1998a): Maghress : Electricité: le Maroc branché à l'Espagne. *L'Economiste*.
- Mossadeq, F. (1998b): Electricité: C'est parti pour l'interconnexion. *L'Economiste*.
- Nabi Siefken, N. (2012): The PCI identification process and implementing measures.
- Neuhoff, K., Boyd, R., Glachant, J.-M. (2012): European Electricity Infrastructure: Planning, Regulation, and Financing, CPI Workshop Report.
- Ofgem (2012): Offshore Electricity Transmission: Updated proposals for the enduring regime (Consultation No. Ofgem 72/12).
- Paul Joskow, Jean Tirole (2005): Merchant Transmission Investment. *Journal of Industrial Economics*, *Journal of Industrial Economics* 53, 233–264.
- Pérez-Arriaga, I.J., Olmos, L. (2005): A plausible congestion management scheme for the internal electricity market of the European Union. *Utilities Policy* 13, 117–134.
- Petrov, K., Ajodhia, V., Grote, D., Resnjanskij, D., n.d. Regulatory Incentives for Investments in Electricity Networks.
- PJM (2010): A Survey of Transmission Cost Allocation Issues, Methods and Practices.
- Ragwitz, M., Held, A., Resch, G., Faber, T., Haas, R., Huber, C. (2007): Assessment and optimisation of renewable energy support schemes in the European electricity market.
- Rammerstorfer, M. (2009): Risk Acceptance and Regulatory Risk. *Competition and Regulation in Network Industries* 10, 235–259.
- Rious, V., Dessante, P., Perez, Y. (2008): The efficiency of short run and long run locational signals to coordinate generation location with lumpy transmission investments. Presented at the 31st IAEE International Conference. Bridging Energy Supply and Demand: Logistics, Competition and Environment, Istanbul.

- Roland Berger (2011a): The structuring and financing of energy infrastructure projects, financing gaps and recommendations regarding the new TEN-E financial instrument.
- Roland Berger (2011b): Permitting procedures for energy infrastructure projects in the EU: evaluation and legal recommendations. European Commission (EC).
- Roland Berger (2011c): Permitting procedures for energy infrastructure projects in the EU: evaluation and legal recommendations - Selection of best practice examples. European Commission (EC).
- Supersberger, N., Abderrahmane, A. (2010): Algeria - A Future Supplier of Electricity from Renewable Energies for Europe. Wuppertal Institute and Centre de Recherche en Economie Appliquée pour le Développement (CREAD).
- Van der Weijde, A., Hobbs, B. (2011): Locational-based coupling of electricity markets: benefits from coordinating unit commitment and balancing markets. *Journal of Regulatory Economics* 39, 223–251.
- Van der Weijde, A.H., Hobbs, B.F. (2012): The economics of planning electricity transmission to accommodate renewables: Using two-stage optimisation to evaluate flexibility and the cost of disregarding uncertainty. *Energy Economics*.
- Vazquez, C., Olmos, L., Pérez-Arriaga, I. (2002): On the selection of the slack bus in mechanisms for transmission network cost allocation that are based on network utilization. Presented at the 14th PSCC, Sevilla.
- Vogelsang, I. (2006): Electricity Transmission Pricing and Performance-based Regulation. *Energy* 27, 97–126.
- Vujasinovic, Z., Illiceto, A. (2012): Business Models for new interconnections: allocation of costs, benefits and risks (No. C1-205).
- World Bank (2011): Project Appraisal Document for the Quarzazate I Concentrated Solar Plant Project.
- Zapatero, J.L., Sarkozy, N. (2008): Co-operation agreement on the electrical interconnection between the government of the French Republic and the government of the Kingdom of Spain.