Concepts and solutions tailored to increasing renewable energy shares – lessons learnt in Europe

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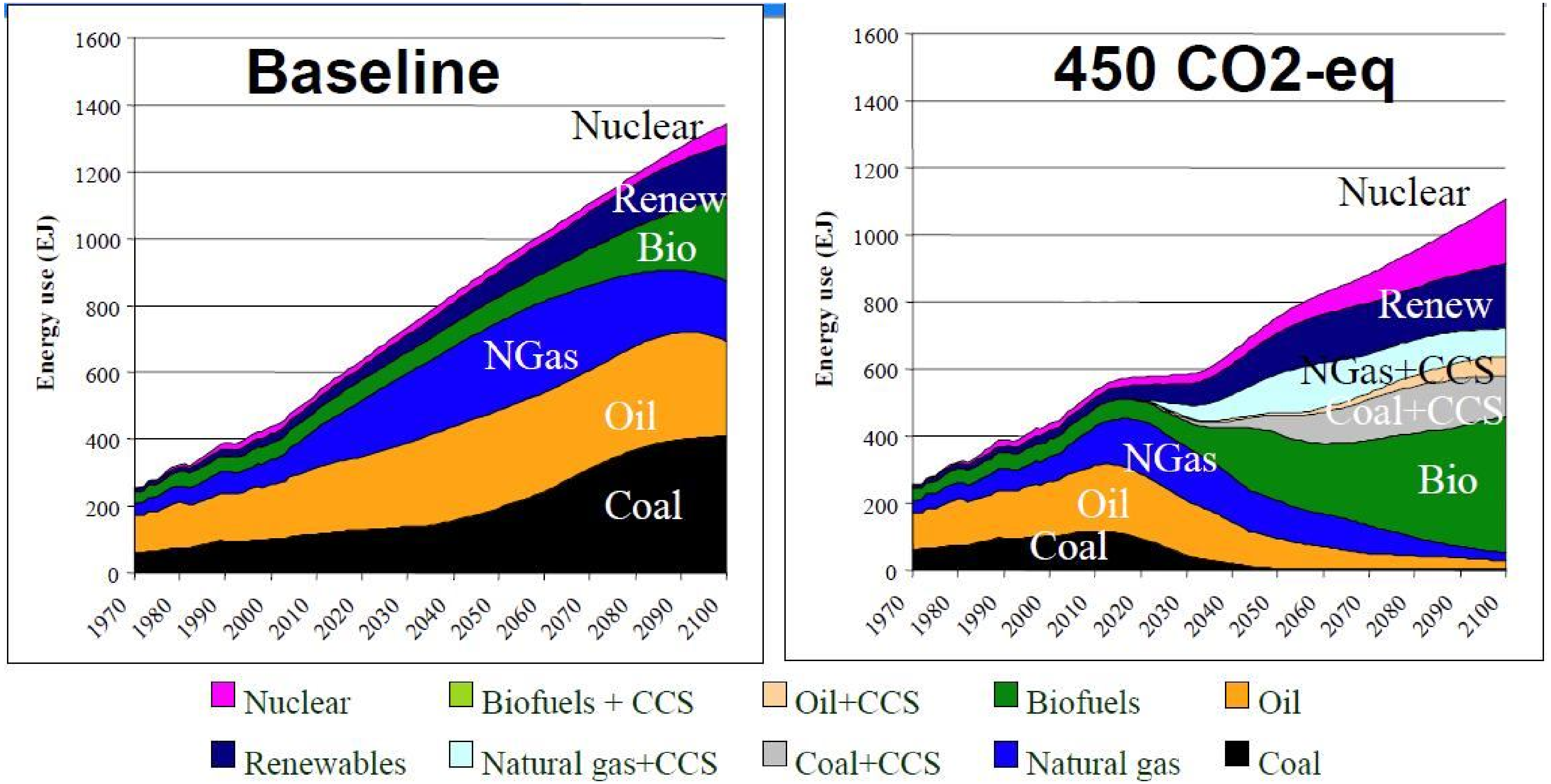
Security of European Energy Supplies:
Discussing the main Policy Recommendations
of the SECURE Project

Manama, November 10th, 2010

Motivation and background information



Source: IPCC SRES report 2000

<u>Time for decision – an energy world in transition holds two major challenges</u>

1. Reducing the overall energy demand
2. Shifting energy technologies towards a more sustainable portfolio

Administrative characteristics

- Historically strong regional differences (permissions, one stop-shop)
- Strongly depending on plant type (large scale hydro versus Photovoltaic)
- National RES targets (indicative versus binding)

Economical characteristics

- Energy generation costs depend on plant type – broad range
- Significant dynamic changes of generation costs over time
- Design of support option is key with respect to total money spent

Technological characteristics

- Volatile energy output requires fast responds of energy markets
- Supply and load location can differ strongly – grid infrastructure requirements
- High potential for R&D at novel technologies (tide and wave energy, etc.)

Spatial planning in Germany

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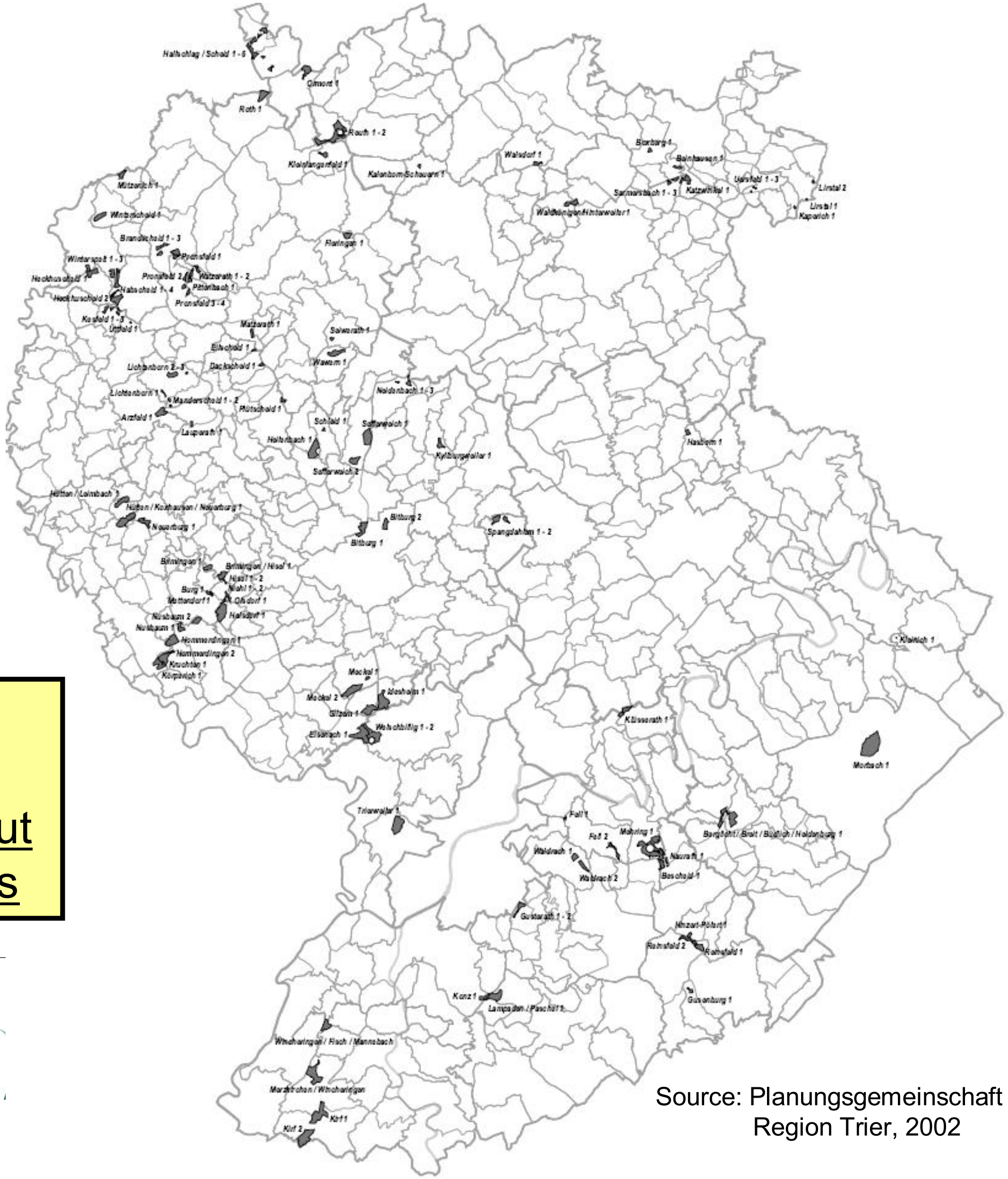
Common non-economic barriers for every plants:

- Environmental impacts (birds, current CO_2 emissions, etc..)
- Distance to cities, agricultural areas
- Visual impacts

In 2002 Germany undertook an **identification strategy** to define areas for RES technologies without additional administrative approvals



Source: Planungsgemeinschaft Region Trier, 2002

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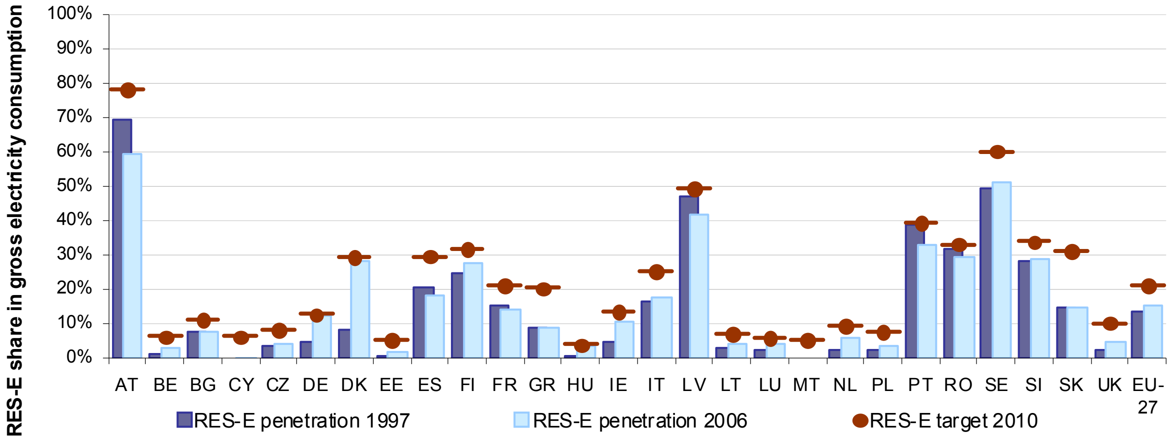
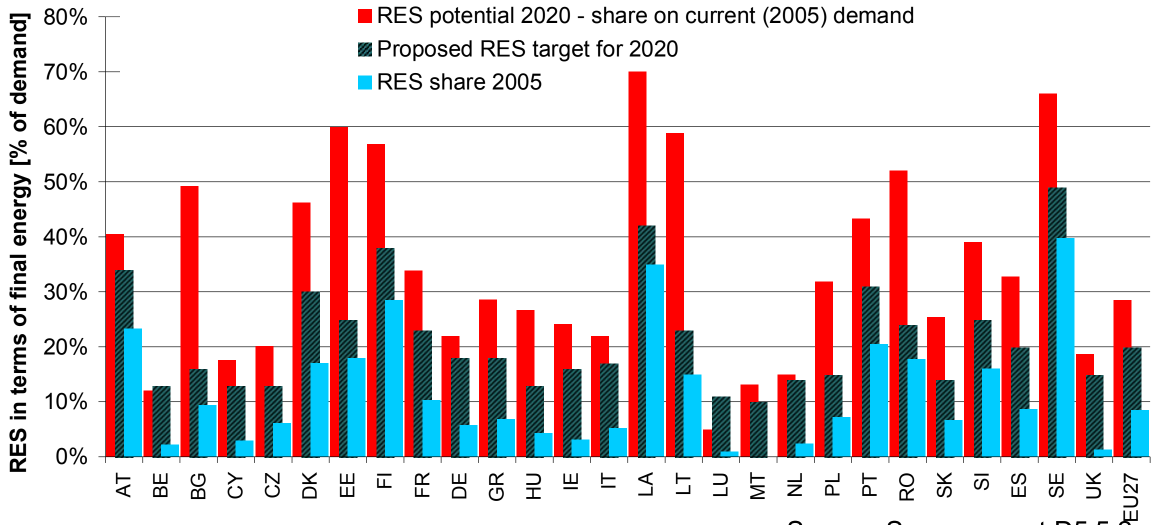
RES target setting in Europe



Source: futures-e review report

Indicative targets led to failing them, but nevertheless stimulate some early development in their regions

Binding targets are now set into force, with accompanied infringement processes in order to significantly increase the renewable energy share



Source: Secure report D5.5.2

RES generation costs

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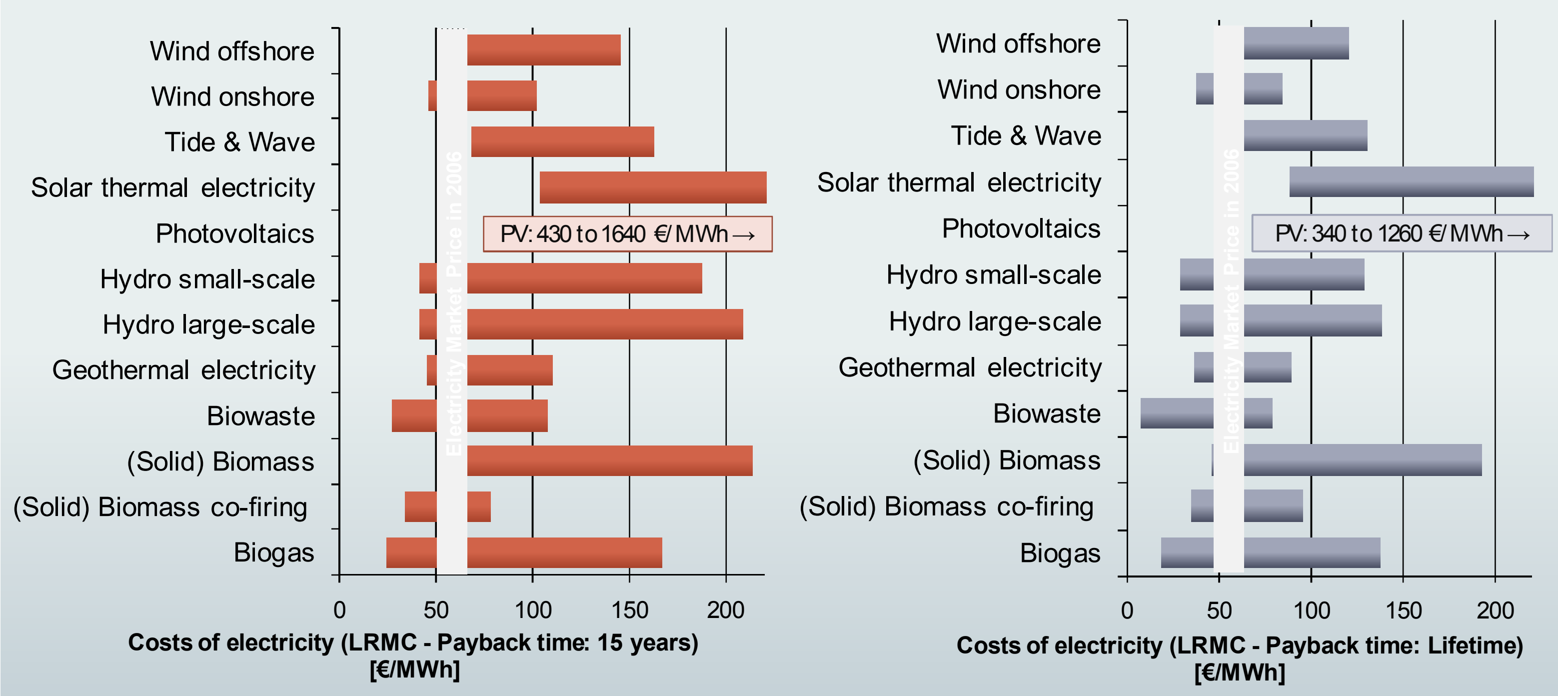

Source: Green-X model

Impact parameters:

- Plant size (small, medium large scale)
- Energy flow (full-load hours of energy generation plant)
- Raw material price impacts on investment costs
- Pay back time for investors

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RES generation costs – dynamic development

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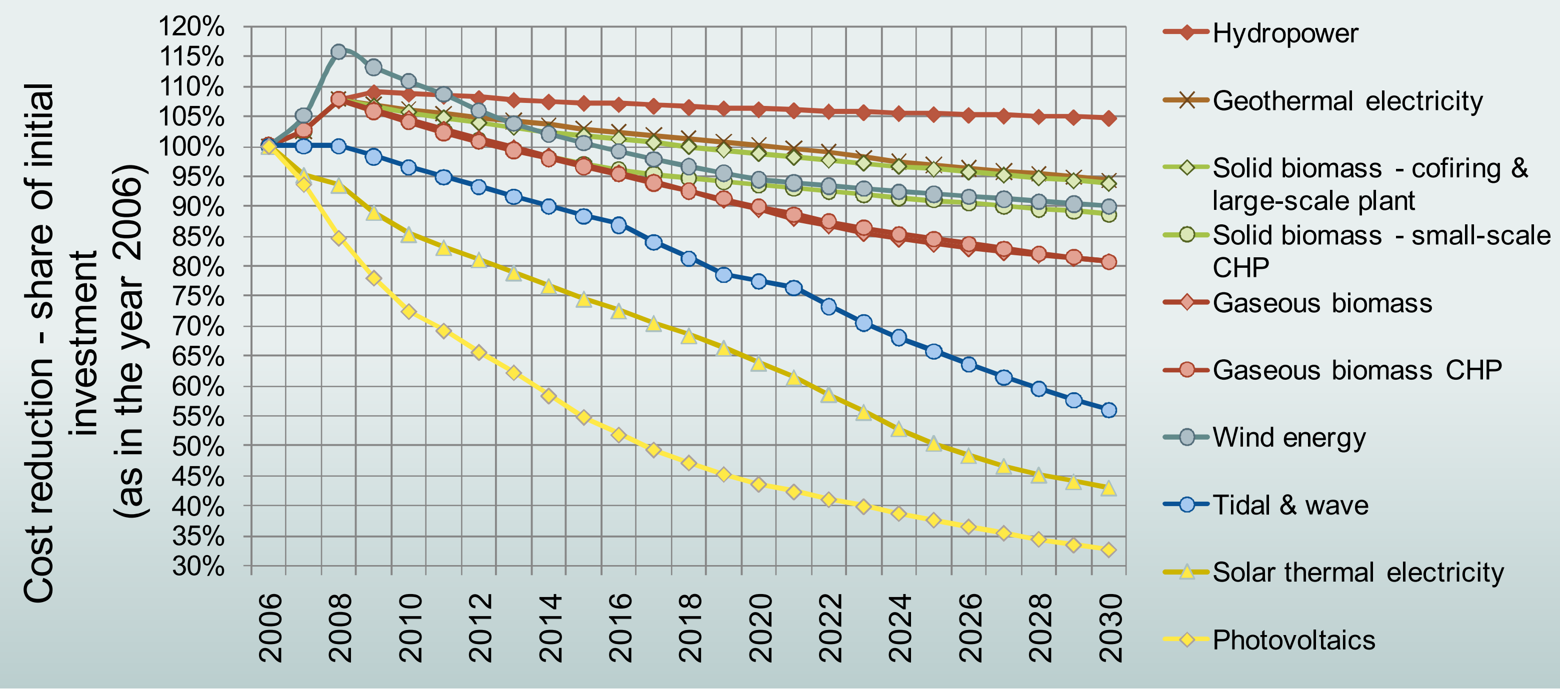


Source: Green-X model

Impact parameters:

- Technological learning based on cumulative production
- Raw material price impacts on investment costs
- Scale effects

RES promotion schemes - types

		Direct		Indirect
		Price-driven	Quantity-driven	
Regulatory	Investment focused	• Investment incentives • Tax credits • Low interest / Soft loans	• Tendering system for investment grant	• Environmental taxes • Simplification of • Connexion charges, balancing costs
	Generation based	• (Fixed) Feed-in tariffs • Fixed Premium system • Production tax incentives	• Tendering system for long term contracts • Tradable Green Certificate system	
Voluntary	Investment focused	• Shareholder Programs • Contribution Programs		• Voluntary agreements
	Generation based	• Green tariffs		

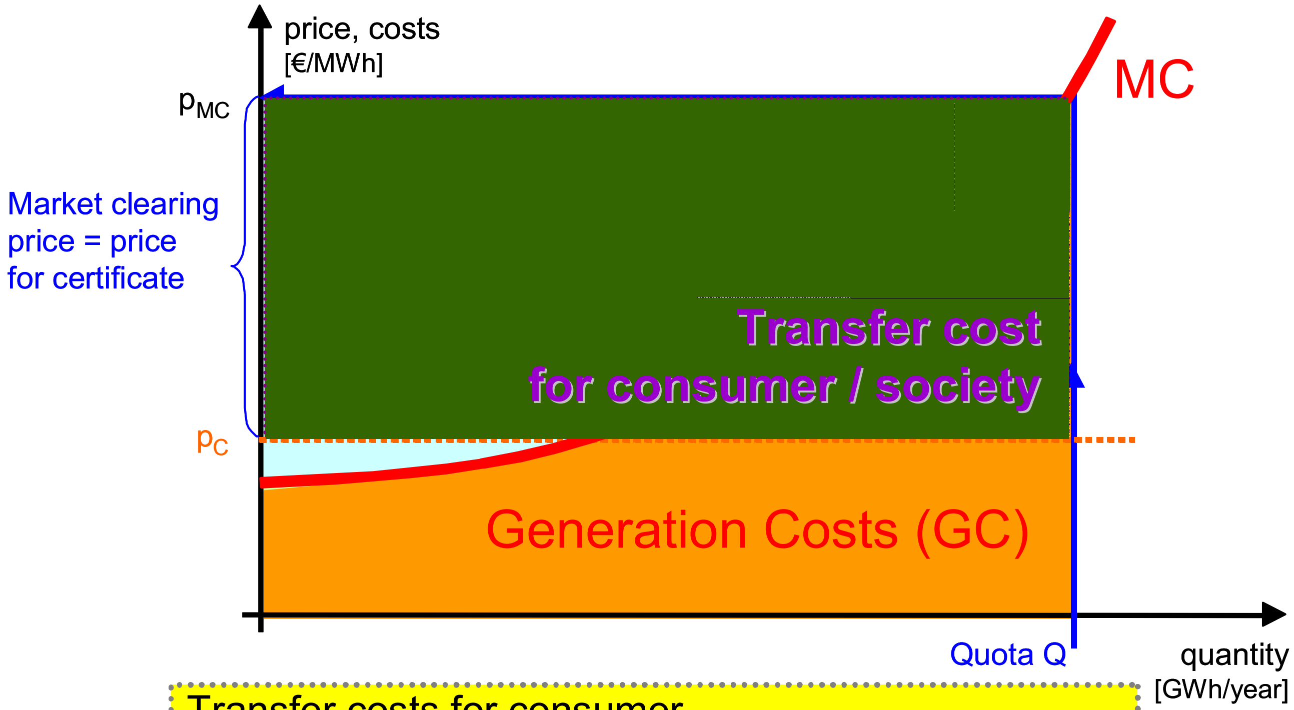
Motivation for support schemes:

- Stimulating future cost reductions
- Diversifying the energy supply portfolio
- Enhancing technology development
- Launching new jobs

RES promotion schemes – types (2)

The *criteria used for the evaluation of various instruments* are based on:

- ***Minimise generation costs***
- ***Lower producer profits***



Transfer costs for consumer (additional costs for society) $= PS + GC - p_C * Q$

p_C … market price for (conventional) electricity

p_{MC} … marginal price for RES-E (due to quota obligation)

MC … marginal generation costs

Source: Green-X model

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RES promotion schemes - implications

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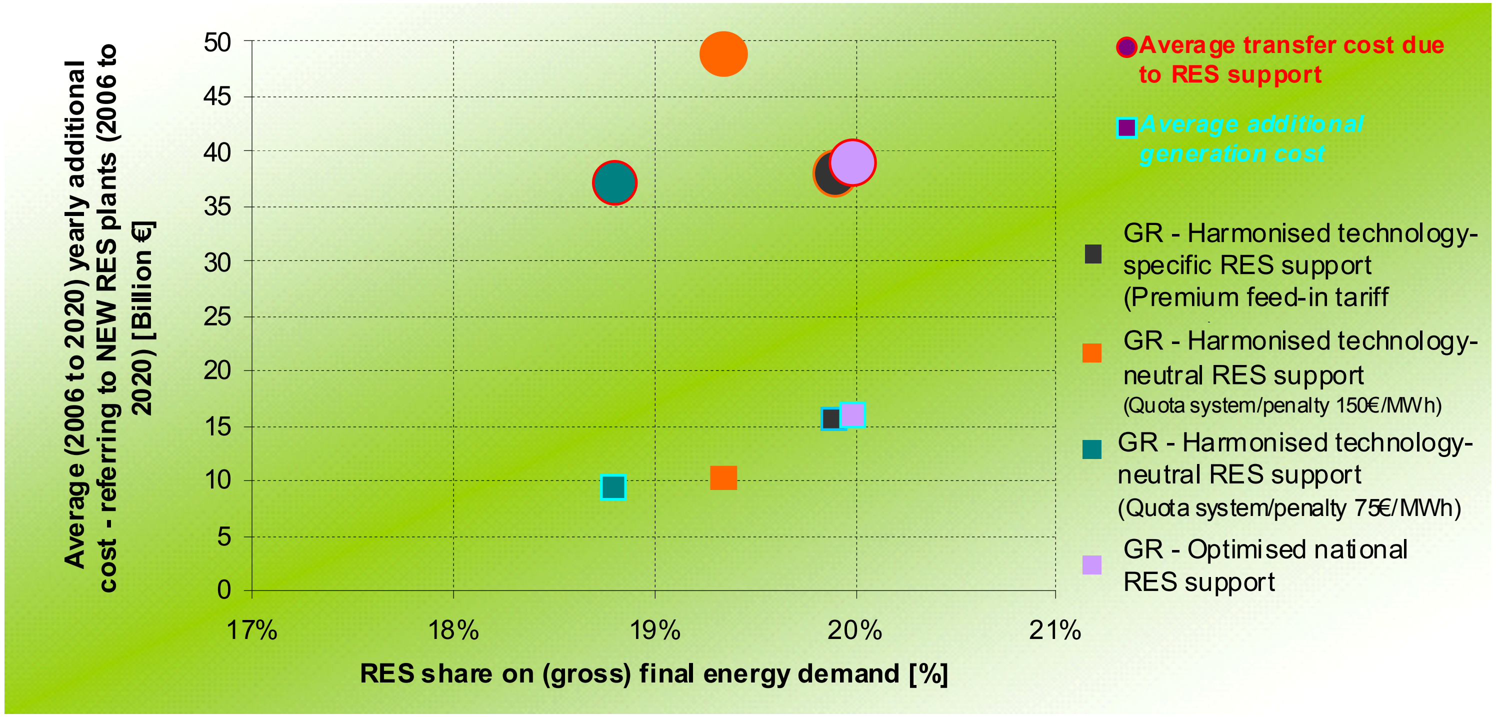

Source: Secure Deliverable D5.5.2

Implications of different support scheme designs:

- Technology neutral support fails to meet the target
- Technology neutral support results in significant higher consumer expenditures
- Technology neutral support enables least cost technologies only

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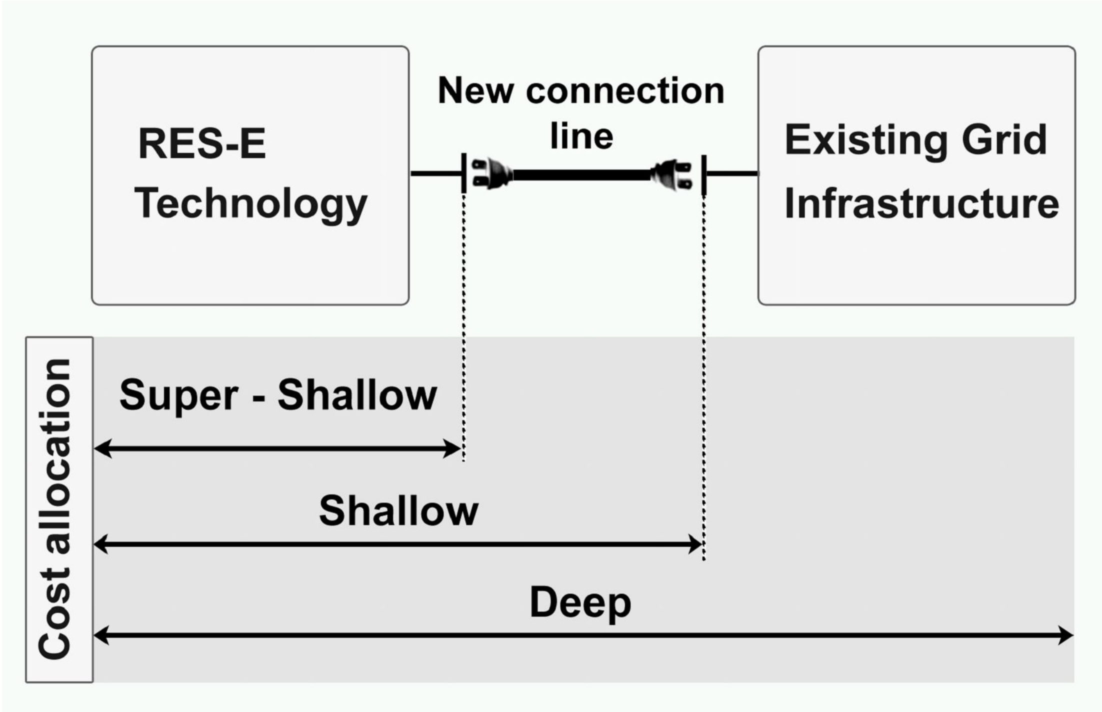
RES grid integration approach



Source: GreenNet model

Implications of different connection approaches:

- Shallow: Incentive for RES installations to site plants at best energy flow
- Shallow: Better cost competiveness for RES plants on energy market
- Deep: RES plants are sited at existing grid infrastructure but not at best energy flow
- Deep: First mover disadvantage for first RES plant

Energy variability – historic approach

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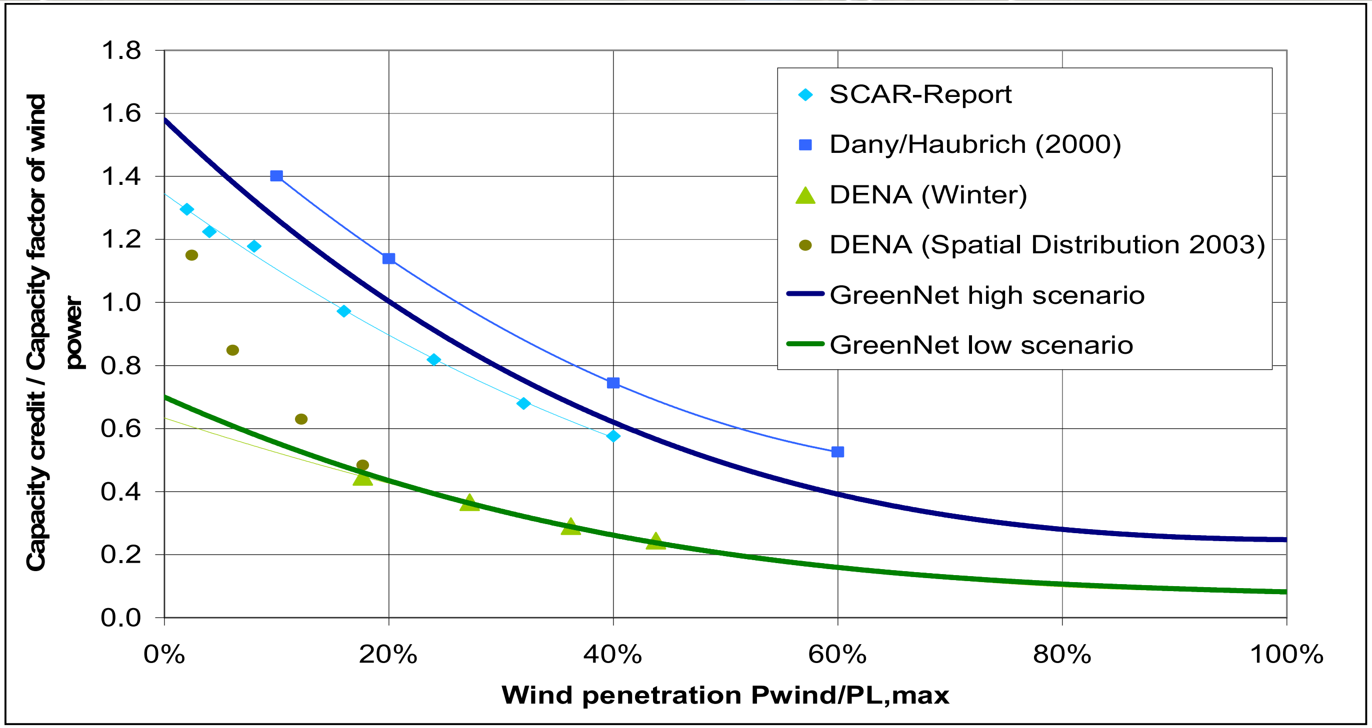
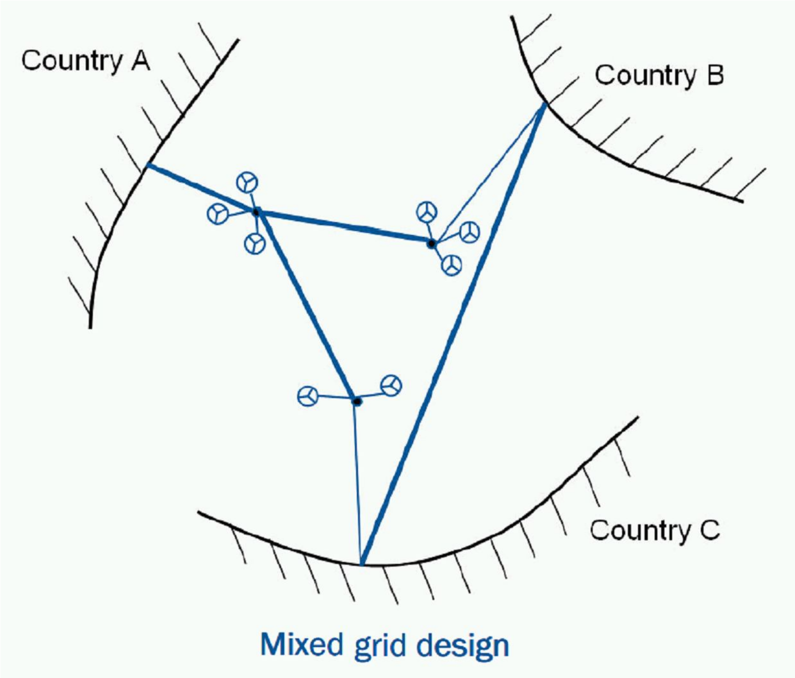


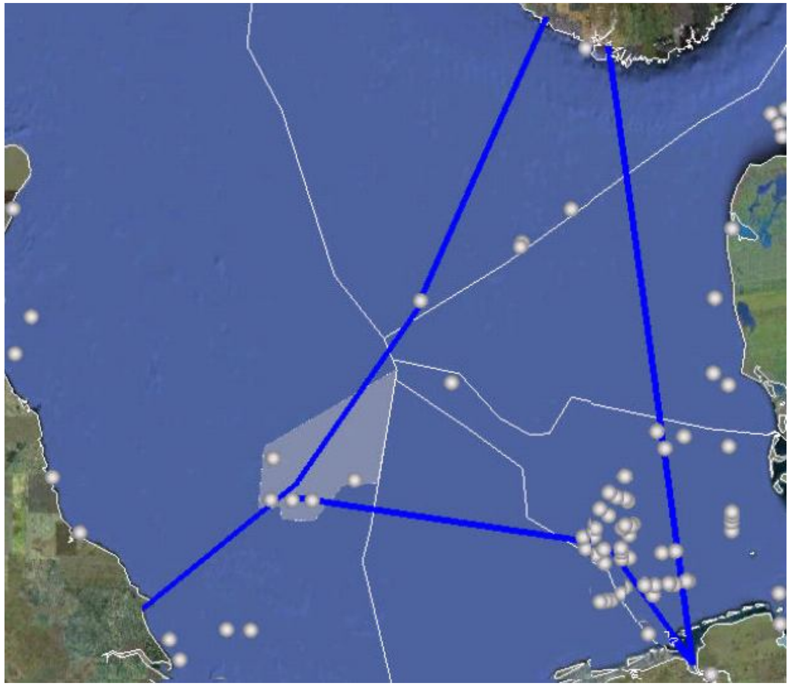
Source: GreenNET model

Implications of volatile energy output – the case of wind energy:

- Regional responsibility of balancing its energy supply and demand
- CC: Higher share of wind energy required relatively more backup power
- Requires high amount of fast backup power (hydro and gas-fired)
- Illiquid markets increase costs of balancing

Energy variability – future approach





Source: Decker/Woyte (2010)

Implications of volatile energy output – the case of wind energy:

- Transmission grid investments reduces grid-bottlenecks
- Enabling one single secondary reserve market – eliminate capacity credit discussion
- Incentivizing decentral storage systems for fast respond (hydro, natural gas)
- Establishing one liquid reserve market across borders to reduce balancing costs

Domestic RES supply in the Middle East

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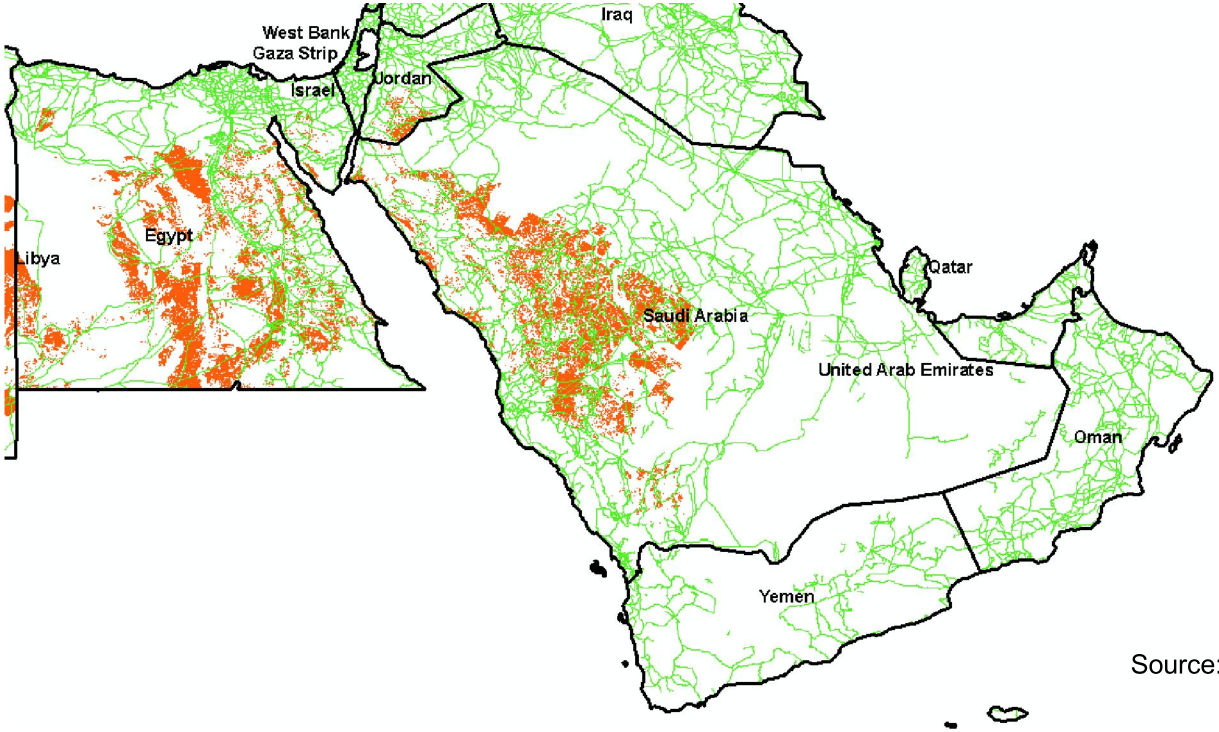

Source: Center for Global Development, 2008

Potential RES supply options in the Middle East:

- Highest potential for "Concentrated Solar Power" (CSP)
- Electricity generation during peak time, potentially shifting with storage systems
- Focus on electricity sector, redirecting oil to i.e. transport sector in EU
- Profitable transportable to Europe and for domestic use

Domestic RES supply in the Middle East

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The case of Saudi Arabia:

- Subsidy on fuel and generation of electricity keep electricity prices very low
- Potentials to substitute natural gas plants for CSP plants
- Allowing, redirecting the subsidies for natural gas plants, in order to keep electricity prices very low, to CSP plants could make CSP plants economical completive
- Currently, natural gas based electricity producers (mostly public) are operating at very low profit level
  - Assuming this approach for CSP plants would allow zero CO2 emission electricity plants without any additional subsidies
  - Natural gas could be sold to Europe, allowing for additional national tax revenues and even increasing the State budget

Source: Center for Global Development, 2008

Conclusion and policy recommendations

Reducing administrative barriers

- Introducing spatial planning
- Installation of only one responsible authority for permission (one-stop shop)
- Applying a transparent approach of permissions

Selecting appropriate support schemes

- Considering supply characteristic of RES technology (base vs. peak load)
- Technology specific support scheme
- Setting ambitious but realistic targets

Appropriate market integration

- RES technology integration without discrimination (market unbundling)
- Establishing a common, liquid reserve market

General RES policy recommendations

Policy support to increase the share of renewables should be efficient but sufficient

Considering dynamic investment developments of RES technologies when setting support levels in order to provide enough incentives to invest in RES, but avoiding overcompensating of investors

Apply technology-specific support instruments

Support a wide range of technologies to trigger learning effects and cost reductions. Associated costs vary largely between technologies and over time

Efforts are needed globally

Uneven distribution of RES potentials and costs emphasises the need for flexibility mechanisms in order to achieve a sustainable energy portfolio at moderate costs

Demand side management

Helps to integrate high shares of fluctuating electricity generation – enabling demand incentives at supply peak. But potentials for this option currently still appear restricted

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Thank you for your attention!

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