SOLID-DER Co-ordination Action to consolidate RTD activities for large-scale integration of DER into the European electricity market

Support policies and regulation for optimal DER integration in the EU

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National SOLID-DER Seminar - Vienna
May 16, 2008

ENVIROS TODAY'S BUSINESS TOMORROW'S WORLD

SOLID-DER

Outline of the presentation

- SOLID-DER objectives
- DER support mechanisms
  - DER costs and benefits
  - Support of DER in the EU MS (FIT & TGC)
  - Recommendations to improve DER support
- DER network regulation
  - DER perspective
    - DER connection to the network
    - Network access
  - DSO perspective
    - DSO regulation
    - Incremental OPEX and CAPEX
    - Impact on performance indicators
- Conclusions

Objectives

SOLID-DER **objectives** for enhancing the share of DER in distribution networks

- **Review the current state** of network regulation and DER support schemes in the EU-27, especially in NMS
- **Identify major topics** and constraints for improved network integration
- Propose specific **recommendations** for each topic to improve DER network integration

Proposed **approach**:

- **DER** perspective: Assess additional revenue possibilities for DER operators to further integration of DER
- **DSO** perspective: Assess additional possibilities to lower costs for DSOs in furthering DER

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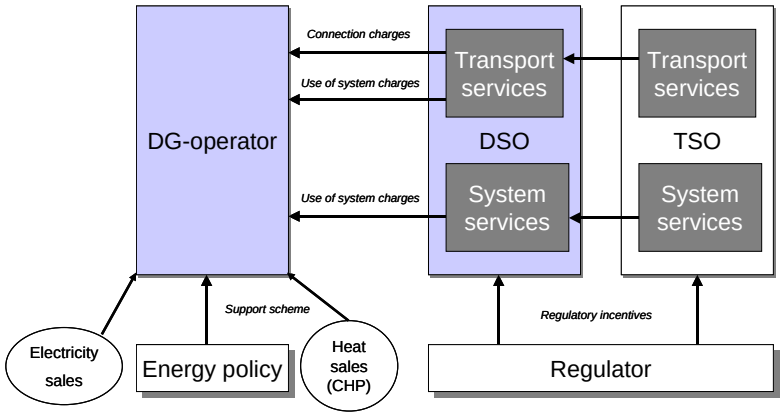
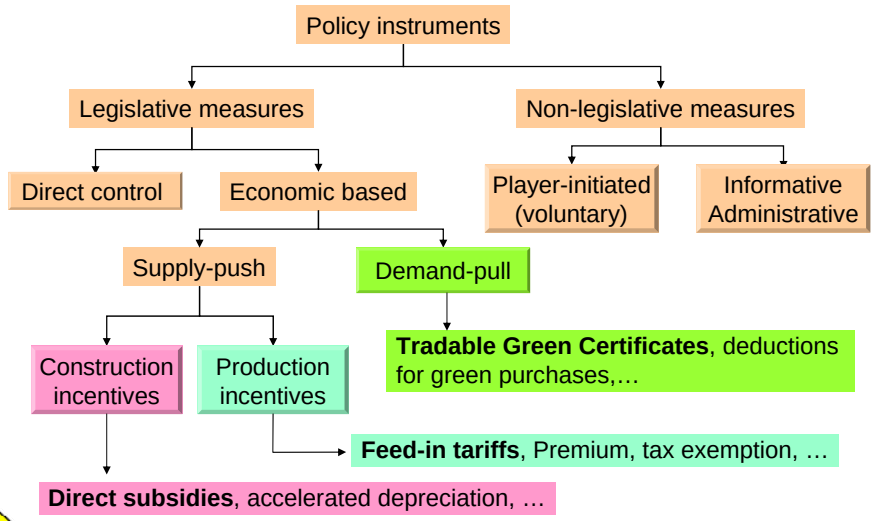
DER costs and benefits



Support of DER: different perspectives & barriers

	Perspective	Current experiences and situation
Investor on DER	-(Long-term) **stable environment** **-Clear and transparent** rules	-Frequently changing policies **-Long & complicated** procedures **-Little transparency** in network connection rules **-Dominant position** of DSOs
Network operator DSO	-Possibility to operate the network **reliably and cost-efficiently** -Willingness / possibility of DER to **contribute to network management**	-**Obligation** to connect DER -DER is currently **not contributing** to stability, network management -**High cost to connect** remote DER
Society	-Reach a **sustainable** energy system at **as low as possible costs** -"Socially acceptable" energy prices	-**Climate action and energy package of the EC**: 20%, 20%, 20% by 2020 -**Green Paper** on a European Strategy for Sustainable, Competitive, and Secure Energy (2006) -**Priority interconnection** Plan (2007) (Commission staff working document)

Support of DER: main schemes



Support of DER: EU overview

Country	Support category	Level of support (€ct/kWh) – ex. solar	% of market price	Duration of support
Bulgaria	FIT	4 – 8.5	200 – 300	12 yrs
Czech Republic	FIT (fixed or premium)	6 – 10	200 – 300	15 yrs
Hungary	FIT	10.4	~ 200	Until return is yielded
Lithuania	FIT	5.8 – 7		Until 2020
Poland	TGC	Depending on market price	Up to 233	*No limit*
Romania	TGC	Minimum 2.4 – 4.2		*No limit*
Slovakia	FIT	6 - 10	100 – 350	12 yrs
Slovenia	FIT (fixed or premium)	6 - 9	140 – 200	10 yrs
Austria	FIT	5.5 - 14	130 – 300	10-13 years
Denmark	FIT (premium)	1.6 – 7 (wind) 5.4 – 8 (biomass)	115 – 160 140 – 180	20 yrs
Netherlands	FIT (premium)			12-15 yrs
Spain	FIT (fixed or premium)	7 - 12		15-20 yrs

DER support schemes: main features of the FIT

Country	Support category	Differentiation per time of day	Other differentiation	Remarks
Bulgaria	Fixed tariff	No	Installed capacity, stepped tariffs for wind power	
Czech Republic	Fixed tariff or premium	For small-hydro and CHP	Possible to choose between green bonus and premium every year	Mandatory reporting of planned production for DER – except wind & solar) Sanctions for deviation
Hungary	Fixed tariff	Yes, except for wind and solar	Not technology-specific, but IRR specific	Tendering system for wind energy considered
Lithuania	Fixed tariff	No		
Slovakia	Fixed tariff	No		Support should cover payback of 12 yrs, but tariffs not guaranteed
Slovenia	Fixed tariff or premium	No		
Austria	Fixed tariff	No, but considered		
Denmark	**Premium**	No, but considered	Fixed tariff for old wind turbines	Fixed compensation to wind turbines for their balancing costs for which they are responsible
Netherlands	**Premium**	No		All producers responsible for day-ahead projections
Spain	Fixed tariff or premium	Yes, for RES-based CHP		CHP units above 10 MW to be part of generation control centre

Elements of an optimal FIT scheme

- No distortion from the point of the market
- DER production at peak hours should be stimulated
  - Match between supply and demand facilitated through premiums
- From the point of view of the network – as little interference as possible or support to network management
  - Recommend to differentiate feed-in tariffs by time of use (e.g. Hungary, Slovenia)
  - Gaining support combined with mandatory reporting of expected power
- Creating stable investment environment:
  - Being stable for a number of years or having a fixed regression rate
  - Making investments attractive (e.g. return period 10-15 years)
- Support is a costly option, so *overcompensation* should be avoided
  - Annual reduction for new plants (tariff reduction due to learning process)
- Stepped tariffs
  - (e.g. wind – lower tariffs after 2000 full load hours)
  - Or lower tariffs after 5/10 years

Elements of an optimal RPS scheme (with TGC)

- Determine a long-term quota tariff
  - Creates stability in the system (example of UK vs. Sweden)
- Maximum limits for the certificate price
  - Prevents making the system too costly
- Keeping the penalty above the maximum price
  - E.g. in Sweden 50% above the market price
- Minimum limits for the certificate price
  - Creating stability on the market
- Technology specific quota obligation
  - E.g. possibility to introduce quota for one type of RES or CHP and feed-in tariffs for the other
  - Older power plants can participate, but under other conditions
- Experiences with RPS scheme (e.g. Poland, Sweden) show:
  - Increase of renewable electricity shares, but focused at cheapest options
  - Little support of new technologies

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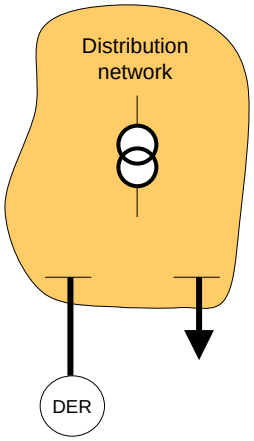
DER connection to the network

- Customers (DER or demand) must pay for the connection and use of the networks
  - **Connection charges**
    - **Shallow** connection charges: cost to the nearest point
    - **Deep** connection charges: shallow + additional network reinforcements
  - **Use of system charges** (DSO's allowed revenues)
    - Customer management costs (€/customer)
    - Capacity cost (€/kW)
    - Energy costs (€/kWh)
- **The design of UoS & connection charges**: Key issue is to ensure fair and non-discriminatory network access



DER network access, connection charges: country questionnaire & recommendations

Connection charges for DER	Countries	Structure of connection charges	Guidelines
Deep charges	**Czech Republic, Slovakia, Romania, Lithuania** Spain, The Netherlands (>10MVA)	Rules for calculation are set, but charges are subjected to DSOs or TSOs intervention	**Implement shallow charges**
Shallow charges	**Slovenia, Bulgaria, Poland, Hungary** The Netherlands (<10MVA), Austria, Germany, Denmark	-Rules exist, but total amount depends on DSOs calculations -Connection charges are published in The Netherlands and Denmark	**Evolve to regulated charges**

DER network access, UoS charges: country questionnaire & recommendations

UoS charges for DER	Countries	Structure of UoS charges	Guidelines
No	**Czech Republic, Slovenia, Bulgaria, Poland, Lithuania, Hungary** Denmark, Germany and Spain		**Implement UoS charging mechanisms.**
Yes	**Slovakia** Austria, The Netherlands	Uniform charges	**Structure UoS charges, according to voltage levels, DER size, time of use and location**
	Romania	Differentiated by voltage level and area	**-Implement time of use and DER size differentiation** **-Evaluate the efficiency of this cost mechanism**

DER network access: unbundling

Directive 2003/54/EC:

- Art 15 (1) legal unbundling required.
  - Lack of unbundling at the distribution level may negatively impact the DER access conditions & cross-subsidies may appear
  - Lack of transparency
- DER owned by DSOs
  - DSOs and DER are owned by the same mother company. Even if legal unbundling has been implemented this might pose some form of discrimination
- Art 15 (2) exemption clause for DSOs with <100.000 connections
  - Assessed on a country basis rather than on a European level

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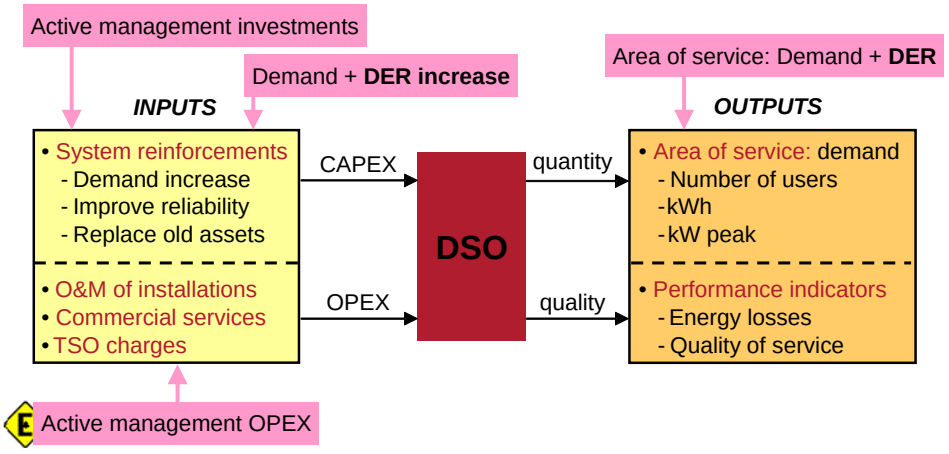
DSO regulation

- DSO is a **regulated** wire business
- Nowadays based on **passive** network management



Impact of DER on DSO regulatory model

- DSO regulatory model: used to be based on **rate of return**
- Recently changes towards **incentive regulation**

Impact of DER on DSO **capital expenditures**

- Short term: new network reinforcements, equipment
- Depends on voltage level and production at peak load. Permanence in the long-term

- Impact of DER on DSO **operational expenditures**
  - Increase transaction and data management costs
  - Higher complexity of network operation
  - With active management of the network the purchase of ancillary services from the TSO can be reduced
- Impact of DER on DSO **performance indicators**
  - Energy losses: depends on the penetration level
  - Quality of service: i.e. islanding operation, voltage control

Compensating DSOs for CAPEX & OPEX increase

- DER impact on DSOs depending on the level of penetration
- For increasing levels (e.g. above 20%) → neutralize negative impact

Type of regulation	Countries	Incremental OPEX and CAPEX due to DER	Guidelines
Cost of Service	Germany	YES No specific mechanisms	Migrate to incentive regulation
Incentive regulation: Price or revenue cap	**Poland, Romania, Slovakia, Slovenia** Denmark, Austria, Spain, The Netherlands (>10MVA)	NO Incremental CAPEX and OPEX are not considered	Implement explicit mechanissms to take into account incremental costs due to DER
Incentive regulation plus incremental CAPEX	**Lithuania, Bulgaria** The Netherlands (<10MVA)	Only CAPEX Investments necessary to connect DER not covered by connection charges are remunerated as any other CAPEX	Include specific treatment of incremental OPEX
Incentive regulation plus explicit mechanisms for OPEX and CAPEX	**Hungary, Czech Republic** Denmark	YES Incremental costs are remunerated after approval of the regulatoty authority	Implement mechanisms that consider DER performance and give incentives for the connection of more DER

Impact of DER on performance indicators: energy losses

- Energy losses are a main cost driver for DSOs due to DER connection & depends on penetration levels
- None of the alternatives specifically considers DER effect on losses
- Impact modulated with: UoS tariffs or revenue driver to DSOs

Incentives for losses reduction	Countries	Guidelines
DSOs are compensated for **actual losses**. No incentives to reduce them	Austria, Germany	**Implement some kind of incentive for losses reduction**
An **upper limit** on compensated losses is established. DSOs have no incentives to reduce losses further	**Lithuania, Slovenia**	**-Give incentives to DSOs for reducing losses beyond the limit value -Take into account the influence of DER over energy losses**
DSOs have to compensate energy losses by **buying them in the market** Losses are regarded as a controllable cost	The Netherlands	**-Compensate DSOs for incremental losses due to DER -If losses reduce thanks to DER, these generators should benefit from that**
DSOs have **incentives** to reduce losses below specific **regulated targets**	**Czech Republic, Slovakia, Romania, Lithuania, Slovenia, Bulgaria, Poland, Hungary** Spain, Denmark	**Include the impact of DER on energy losses to compute the losses targets**

Impact of DER on performance indicators: quality of service

- Quality of service consist of: i) continuity of supply, ii) voltage and power quality
- DER can improve DSO performance indicators by participating in different ancillary services -> Active network management
- Currently, DER mainly seen as a source of problems rather than an opportunity

Incentive/penalties to meet quality of service requirements	Countries	Guidelines
DSOs have no incentives or penalties	**Lithuania, Poland, Czech Republic** Austria, Germany	**Implement incentives for quality of service improvements**
Performance based regulation for quality of service	**Romania, Slovenia, Bulgaria, Hungary** Denmark, Spain, The Netherlands,	**Implement specific innovation actions to integrate DER as a control source to improve quality of service**
DSOs have non-regulated targets for quality of service	**Slovakia**	**Implement specific innovation actions to integrate DER as a control source to improve quality of service**

DSO incentives for innovation

- Current regulation lacks on mechanisms to promote network innovation
- Innovation is becoming a need for the adequate system operation
- DSOs only invest in mature technologies → new incentives

Incentives for DSO innovation	Countries	Guidelines
No incentives	**Slovakia, Slovenia** Austria, Germany, Spain	**Implement incentives aimed at improving DSO performance**
Implicit incentives associated with incentive regulation	**Czech Republic, Romania, Bulgaria, Lithuania** Denmark, The Netherlands	**Critical review of current situation to asses wheter performance based regulation is enough to bring DSO innovation**
Explicit incentives	**Poland, Hungary**	**Validate and tune current scheme**

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Conclusions (i): DER support mechanisms

- **Support has created sufficient stability** for investors in most EU MS (recently also NMS) so that modifying the system by market or network incentives has to be considered.
- For **feed-in tariffs** this can be done through **differentiations** in feed-in price / premium: time-of-day, voltage level or location
  - → alternative is to differentiate through generator UoS
- Optimizing DER integration through support schemes or changes in **connection or UoS charges**
- Give **market-based signals** through feed-in tariffs
- **Tradable green certificates** create a market, so in principle, they give sufficient market signals – other signals may distort
- In this case, network signals should be given through the **network tariffs**
- **Choice between TGC and FIT** often determined by other factors, e.g. willingness to support renewable technology industry

Conclusions (ii): Network regulation

DER perspective:

- Connection charges should ensure fair and non-discriminatory network access
- UoS charges should reflect real impact (costs/benefits) of DER on the Distribution Networks
- DER should be allowed to participate in provision of ancillary services
- Lack of DSO unbundling may negatively impact on DER network access

DSO perspective:

- Incremental costs in CAPEX & OPEX due to DER should be compensated to DSOs (investments, energy losses, higher complexity in operation, …)
- DER can help DSOs to improve their performance indicators
- DSO remuneration schemes should introduce explicit incentives to network integration of considering DER
- Implement innovation programs to introduce Active Network management

Conclusions (iii): Network integration

- Most pan European regulations (both OMS & NMS) have similar treatment of DER
- Some best practices have been reported
  - OMS: UK, Spain, etc.
  - NMS: Czech Republic, Poland, etc.
- Future increase of DER penetration in Distribution networks will require Electricity Regulators to introduce some of the proposed recommendations

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Thank you for your kind attention !

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