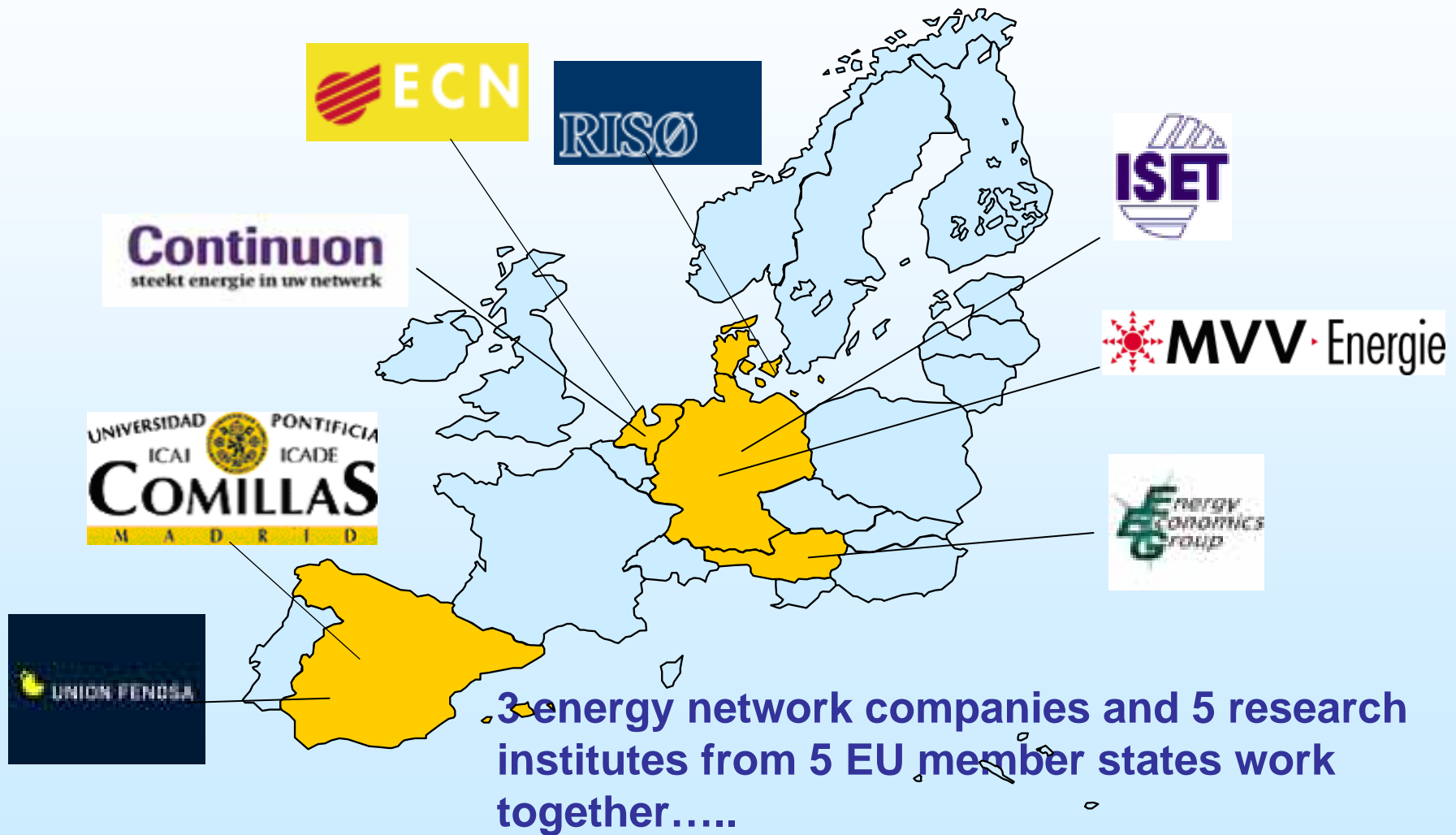


Integration of distributed generation and electricity system benefits

CEPS/ECN/IMPROGRES Workshop
The future of EU electricity grids:
Who will benefit from smart grids and at what costs?
Brussels, 8 March 2010

Frans Nieuwenhout
Energy research Centre of the Netherlands ECN
(IMPROGRES project Coordinator)





... in the IMPROGRES project

- to improve the social optimal outcome of market integration of distributed generation (DG) and electricity from renewable energy sources (RES-E) in European electricity markets
- during 2,5 years (September 2007-March 2010)
- Funded by the EU Altener programme in Intelligent Energy Europe



What is the problem?

Increase in DG/RES-E electricity production leads to:

- ***Increase in power generation costs***
 - electricity from RES is relatively more expensive than conventional power production
- ***Increase in network integration costs***
 - e.g. reinforcement costs
- ***Increase in system integration costs***
 - e.g. increasing balancing costs due to intermittent power production



One of the solutions: Active Network Management

- Definition: DG integrated into network control, with greater coordination of power system operation, rather than connection only
- Fundamental difference with existing congestion management:
 - a) ANM is a permanent and not a temporary solution
 - b) DSO no longer has obligation to relieve congestion as soon as possible

Note: DG = Distributed Generation, including demand response

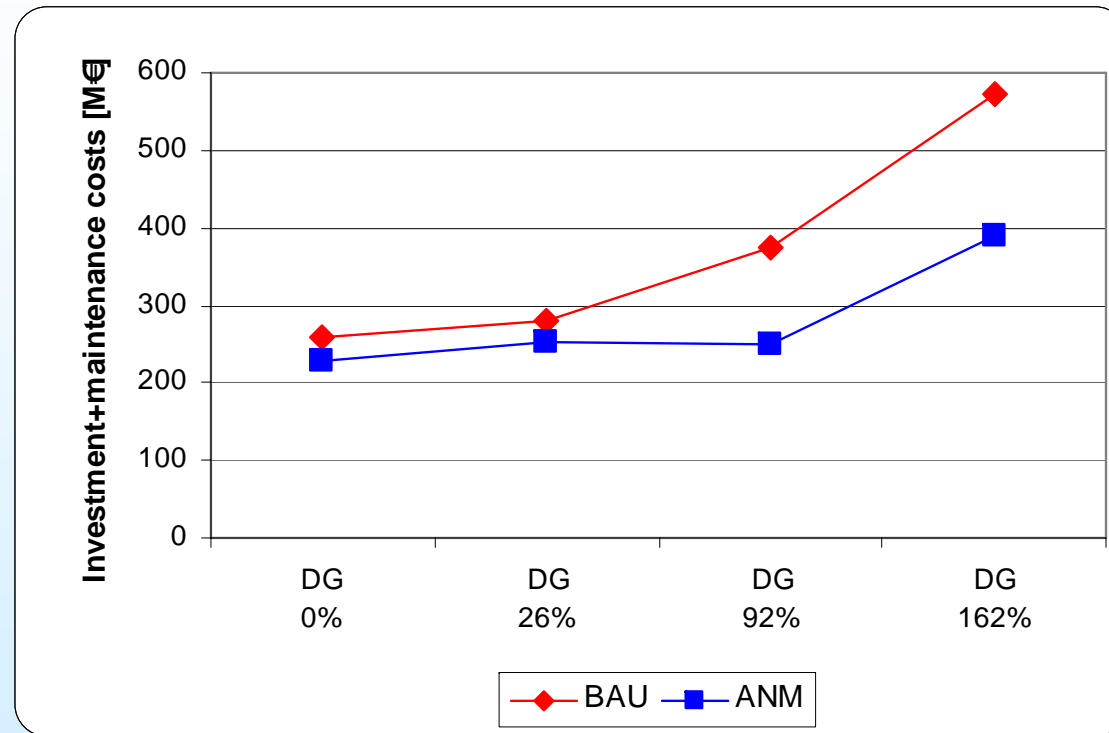
Active Network Management: Options to reduce network costs in North Holland

1. Wind curtailment (temporarily reduce output of wind turbines)
2. Shifting combined heat and power (CHP) generation (reduce during peak generation; increase during peak load)
3. Demand response (shifting greenhouse lighting load to different hours)



Network cost reduction due to smart grids in North Holland case study

Demand in 2020 and different levels of DG



- DG in North Holland case study as % of contracted load
- Red=Business as Usual, Blue=Active Network Management
- ANM: Wind curtailment (200 MW); CHP reduction (265 MW); Demand Response (100 MW)
- Conclusions: a) Network costs will increase with larger shares of DG
b) There is a substantial technical potential for Active Network Management



Network cost reduction with ANM in North Holland

- CHP units in NH export electricity 1500 hours/year
- Paying these CHP to produce less for 1500 h/y is too costly compared to network savings
- Wind farms producing at maximum at the same time as CHP units run for only 150 h/y => better business case
- Consequence: only about 1/5 of technical potential provides a sound business case
- In 3 business cases: 5-10% network cost savings possible due to Active Network Management
- *For smart grid applications it is important to consider the step from technical to financial viable potential*

Annualised costs and benefits of Active Network Management

| | Network cost savings €/kW _{DG} /year | Technology cost (ICT) €/kW _{DG} /year | Net benefits €/kW _{DG} /year |
|-------------|---|--|---|
| Spain | 3.3 | 7.9 | -4.6 |
| Germany | 10.5 | 2.5 | 8.0 |
| Netherlands | 8.6 | 0.1 | 8.5 |

- ICT costs differ, depending on household-scale applications (ES, DE) or only large-scale (NL)
- High uncertainty on costs and net benefits => more pilot projects needed such as e.g. the German E-Energy programme



Extrapolating to EU-25 level in 2020 Cost for DG, networks and ANM

- DG will increase from 201 to 317 GW (investments of about 200 bn €)
- Requiring additional network cost of about 25 bn €
- ANM will reduce network costs by 1-3 bn € (5-10% savings in additional network costs)
- Putting ANM in perspective: Network benefits of flexible integration of DG are only about 1% of the investment cost in DG



Consequences/conclusions

- Demand response and active generation control of DG can contribute to market integration of wind (and solar)
- Less investments in back-up generators are needed to compensate for wind fluctuations
- These benefits for the **electricity system** are likely to be more important than the **network benefits**
- Electricity retailers and ESCOs may become important players in smart grids projects
- When an infrastructure for demand response and active generation control is established, this can also be made beneficial for ANM
- Challenge for regulators: a substantial share of the cost smart grids is in the regulated domain, while most of the benefits accrue to market parties (generators, retailers)



For more information and project results:
www.improgres.org

