

# **Curtailment: an option for cost-efficient integration of variable renewable generation?**

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## OVERVIEW

Wind and PV boom in some Member States

Accommodation of high shares of renewables requires major infrastructure investments

System security issues: network congestion, system stability, operating reserve, voltage control

Are we better off when we don't accommodate every kW of renewable feed-in in times of surplus production ("economic" curtailment)?

Or do we risk missing our targets when we allow that?

## Outline of HET 2

- Situation concerning curtailment to date
- The case of Germany, Denmark, Spain, Portugal, Ireland and Italy
- The way towards high shares of renewables: upcoming challenge
- Conclusion and recommendations

# Situation concerning curtailment to date

European Directive 2009/28/EC:

- Renewable energy systems are given **priority in so far as the secure operation** of the national electricity system **permits**.

Definition:

- The limitation of the electricity output of renewable plants for system security reasons is referred to as **technical curtailment**.

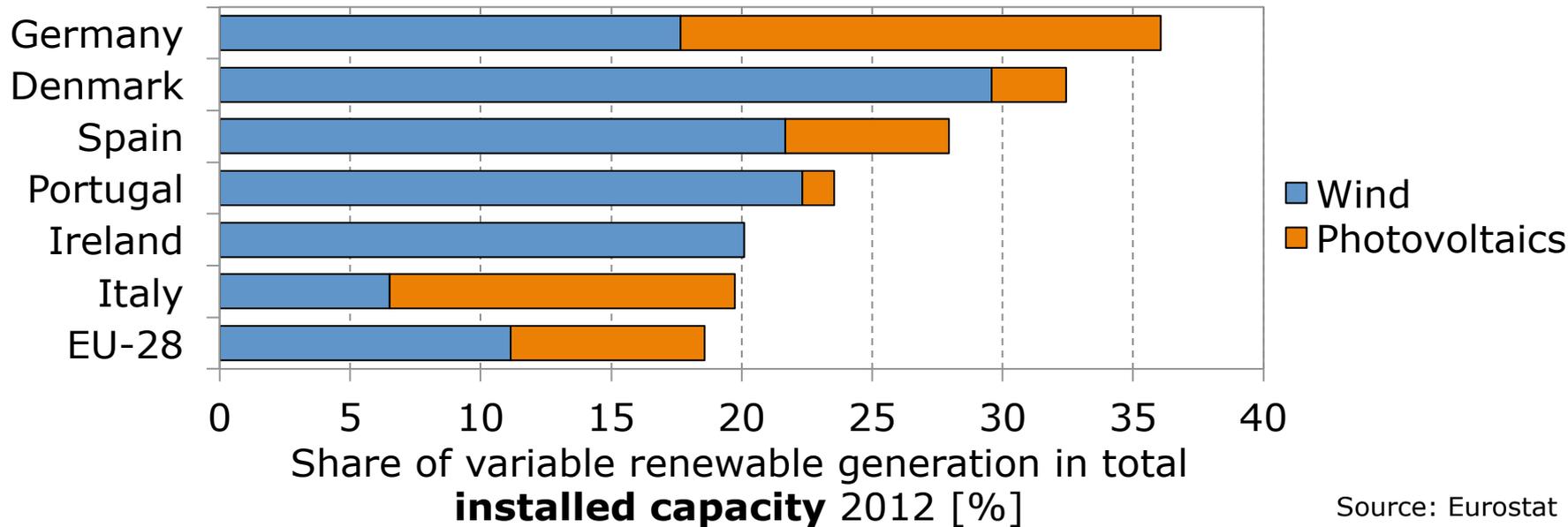
Situation to date:

- High installed capacities of wind and photovoltaics induce **temporary local overproduction** in some European regions.
- Technical curtailment occurs when **local network constraints or system wide security limits are violated**.
- In the years 2009-2012 **about 1 TWh a year or 0.3 - 0.6 % of the electricity production from wind and PV** was curtailed for system security reasons in the EU, most part of it from wind.

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In what extend and for what reasons are the different Member States concerned by technical curtailment so far?

# Situation concerning curtailment to date in the concerned Member States



<b>Curtailed energy [GWh]</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2015</b>
Germany	127 (0.3%)	421 (0.6%)	385 (0.5%)	3.5%
Spain	320 (0.6%)	202 (0.4%)	148 (0.3%)	2.1%*
Ireland	26 (1.0 %)	106 (2.4%)	103 (2.5%)	4.4%
Italy	527 (4.8%)	264 (1.3%)	166 (0.5%)	0.6%

No considerable amounts of renewable feed-in have been curtailed in Denmark and Portugal.

Sources: BNetzA, REE, EirGrid, NREL

# Reasons for technical curtailment in the concerned Member States

Country	Reason for technical curtailment	
	local network constraints	system wide violation of security limits
<b>Germany</b>	mainly congestion of distribution network in the North	minor issue
<b>Spain</b>	congestion on both distribution and transmission level	important issue because of poor interconnection with France
<b>Ireland</b>	Mainly congestion of transmission network in the Northwest and the Southwest	important issue because of low IC
<b>Italy</b>	mainly congestion of transportation network between South and North	minor issue

- **Denmark:** renewable surplus production can be transported to Germany or Norway (hydro resources)
- **Portugal:** renewable surplus production can be transported to Spain

## Recommendation: model-based assessment considering all relevant flexibility options

From a theoretical perspective, curtailment should take place up to the point where the marginal system cost of avoiding this curtailment equals the marginal value of spilled energy (including externalities).

For an adequate economic evaluation, the use of curtailment has to be assessed in the context of all **other relevant options for balancing variable renewable feed-in.**

Recommendations:

- To conduct an assessment of the economically optimal use of curtailment supported by a **comprehensive optimization model**  
This optimization model should
  - have a high temporal and regional resolution
  - consider all relevant flexibility options
  - cover the whole EU
- To **consider carefully all relevant impacts** of the use of curtailment including renewables investment security and innovation stimulation
- To assure **uniform and transparent rules** concerning curtailment between countries to avoid asymmetrical impacts

# Thank you for your attention

For further information please contact

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