

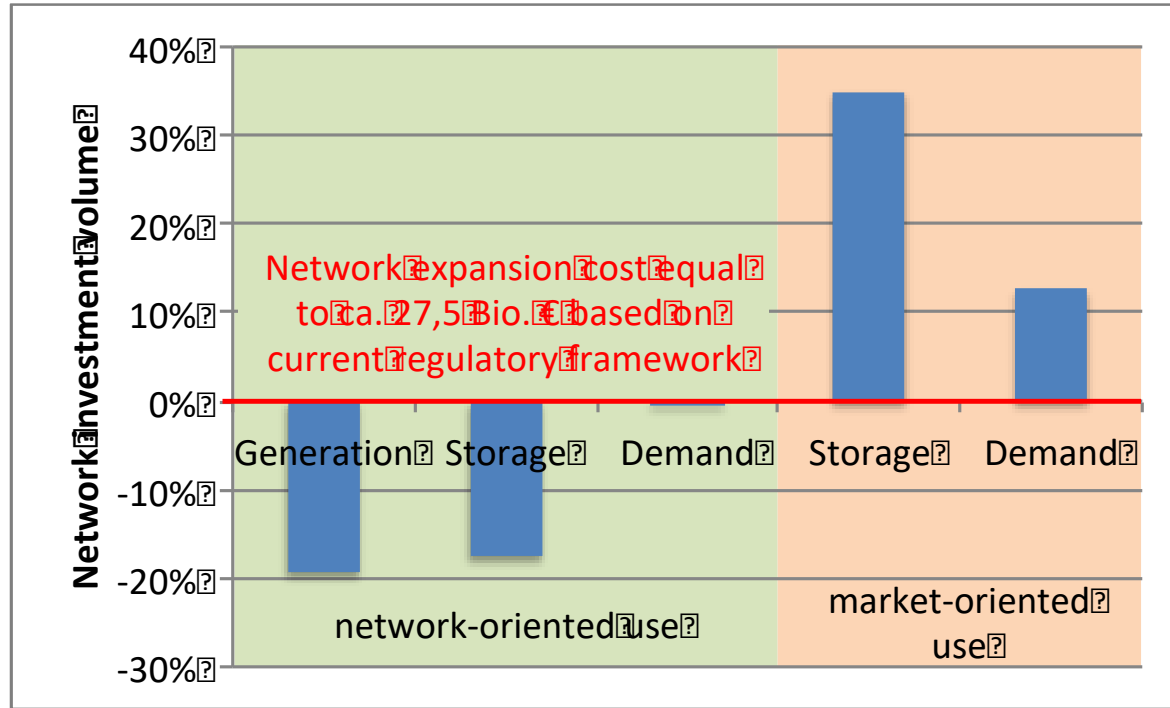


SMART GRID CONGESTION MECHANISMS MEET NETWORK REGULATION: HOW TO ALIGN INCENTIVES?

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41st IAEE International Conference
Groningen, 11. June 2018

“Established network regulation instruments (esp. regulatory account) allow smart grid solutions to efficiently manage network congestion even in the absence of locational marginal pricing.”



Impact of local flexibility on the investment cost of the German distribution networks by 2030 (source: Dena, 2012; own illustration)

RENEWABLE GENERATION CURTAILMENT

TRADING-OFF NETWORK EXPANSION AGAINST CURTAILMENT

Assume:

There is network incentive regulation

Revenues of renewable generator equal to his cost in the presence of curtailment (zero profit)

Network expansion costs x

Q: When is there an efficient investment into the network expansion?

	Decision	Payoff	
		Network Operator	Renew. Gener.
No Compensation	Curtail	0	0
	Expand	- x	> 0
Compensation Payment	Curtail	< 0	> 0
	Expand	- x	> 0

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Regulatory Problem: Incentives towards the efficient network expansion provide perverse incentives for generation (misalignment of incentives)
HOW TO GET THIS RIGHT?

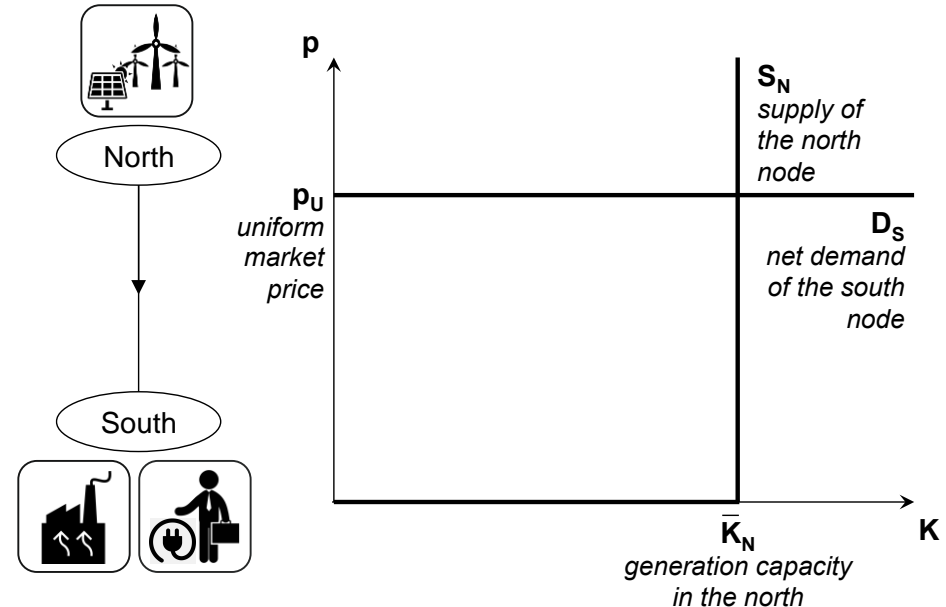
EFFICIENCY BENCHMARK LOCATIONAL MARGINAL PRICING

No congestion

There is uniform power price for all nodes

Renewable generation has an incentive (profit) to invest into new capacity

Network operator has no congestion revenues, i.e. correct incentive not to expand the network



EFFICIENCY BENCHMARK

LOCATIONAL MARGINAL PRICING

Network congestion

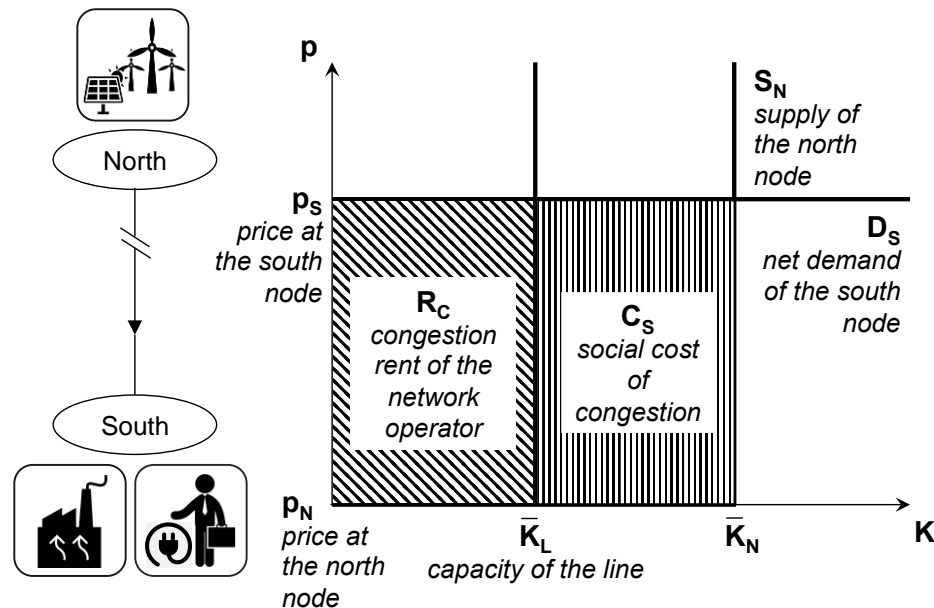
Price at the north node falls down to zero;
price at the south node remains unchanged

Generation at the north node is indifferent
between producing and staying out of the
market (voluntary curtailment)

**Renewable generation has no incentive to
invest at the north node (zero profit)**

Network operator collects congestion
revenue (price difference between the nodes)

**Social cost of congestion provides the
correct incentive to expand the network**



RENEWABLE GENERATION CURTAILMENT

ALIGNING INCENTIVES WITH THE REGULATORY ACCOUNT

Implications of locational marginal pricing for the efficient curtailment compensation

1. Under the incentive regulation, network operator ideally compensates the forgone market revenues of the curtailed generation
2. Efficient design for renewable generation curtailment is characterized by no compensation payments at the curtailed generation

Solution

Use of a regulatory account as an intermediary step for financial flows between the network operator and curtailed generation aligns the incentives and allows for an efficient design

- Congestion payments of the network operator are collected by (booked at) the regulatory account of the network operator and subtracted from the network charge in the next period

Implementation considerations

- ? Financial risks for the older renewable generation facilities
 - ✓ Grandfathering compensation for established facilities is possible
- ? Payments of the renewable generation subsidy on the curtailed generation
 - ✓ Curtailment should have no effect on the renewable generation subsidy payment

Applicability concerns

- ? Applicability of the argument on the local flexibility markets
 - ✓ Considering the results of the locational marginal pricing model, any smart grid congestion mechanism needs to transfer the congestion cost on the congesting network users in order to signal scarcity
 - ✓ Problem of misaligned incentives is expected to apply to any congestion mechanism applied by network operator under the incentive regulation

“Innovative use of regulatory account is a necessary component of smart grid congestion mechanisms that allows to align incentives of network operator with those of network users. Efficient network congestion management is herewith possible even in the absence of the locational marginal pricing.”

THANK YOU FOR YOUR ATTENTION!

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