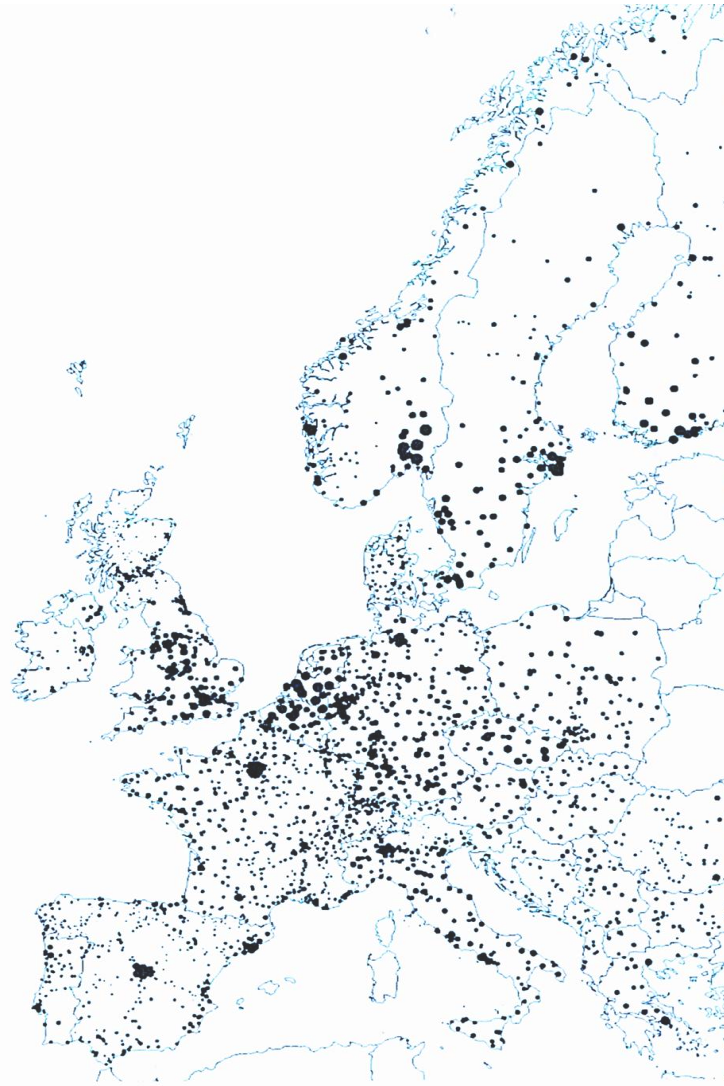
The interplay between zonal spot and locational redispatch markets

Strategic Bidding



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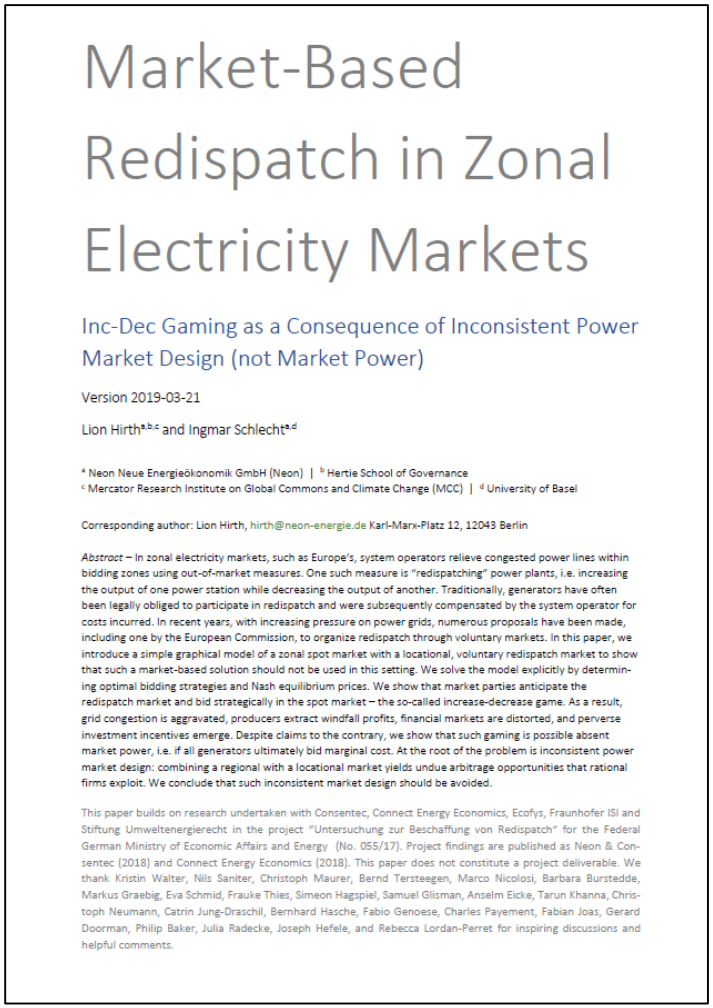

Market-Based Redispatch in Zonal Electricity Markets

Inc-Dec Gaming as a Consequence of Inconsistent Power Market Design (not Market Power)

Version 2019-03-21

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Abstract – In zonal electricity markets, such as Europe's, system operators relieve congested power lines within bidding zones using out-of-market measures. One such measure is "redispatching" power plants, i.e. increasing the output of one power station while decreasing the output of another. Traditionally, generators have often been legally obliged to participate in redispatch and were subsequently compensated by the system operator for costs incurred. In recent years, with increasing pressure on power grids, numerous proposals have been made, including one by the European Commission, to organize redispatch through voluntary markets. In this paper, we introduce a simple graphical model of a zonal spot market with a locational, voluntary redispatch market to show that such a market-based solution should not be used in this setting. We solve the model explicitly by determining optimal bidding strategies and Nash equilibrium prices. We show that market parties anticipate the redispatch market and bid strategically in the spot market – the so-called increase-decrease game. As a result, grid congestion is aggravated, producers extract windfall profits, financial markets are distorted, and perverse investment incentives emerge. Despite claims to the contrary, we show that such gaming is possible absent market power, i.e. if all generators ultimately bid marginal cost. At the root of the problem is inconsistent power market design: combining a regional with a locational market yields undue arbitrage opportunities that rational firms exploit. We conclude that such inconsistent market design should be avoided.

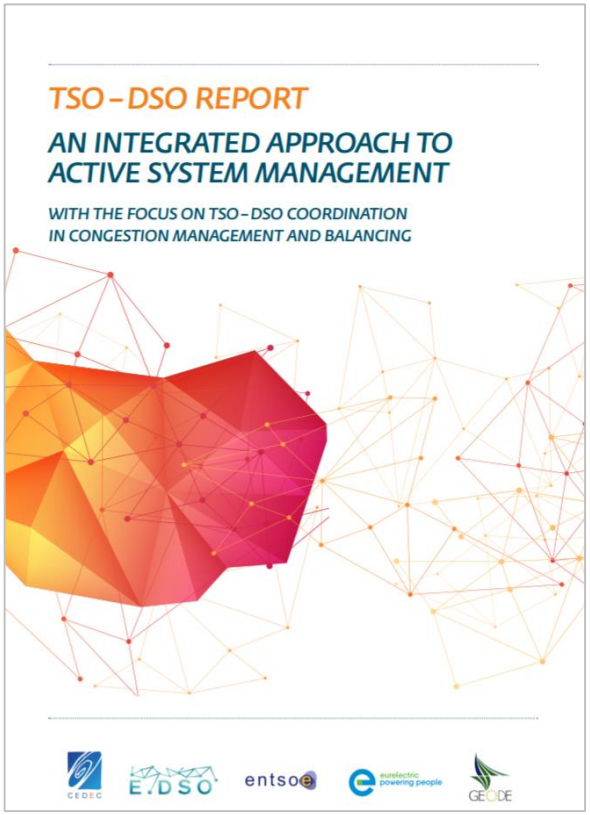
This paper builds on research undertaken with Consentec, Connect Energy Economics, Ecofys, Fraunhofer ISI and Stiftung Umweltenergierecht in the project "Untersuchung zur Beschaffung von Redispatch" for the Federal German Ministry of Economic Affairs and Energy (No. 055/17). Project findings are published as Neon & Consentec (2018) and Connect Energy Economics (2018). This paper does not constitute a project deliverable. We thank Kristin Walter, Nils Saniter, Christoph Maurer, Bernd Tersteegen, Marco Nicolosi, Barbara Burstedde, Markus Graebig, Eva Schmid, Frauke Thies, Simeon Hagspiel, Samuel Glisman, Anselm Eicke, Tarun Khanna, Christoph Neumann, Catrin Jung-Draschil, Bernhard Hasche, Fabio Genoese, Charles Payement, Fabian Joas, Gerard Doorman, Philip Baker, Julia Radecke, Joseph Hefele, and Rebecca Lordan-Perret for inspiring discussions and helpful comments.

Working paper: http://hdl.handle.net/10419/194292

Local flexibility markets

Many proposals for local flexibility markets

- SINTEG projects, Nodes, Interrface, ENERA, C/sells, Windnode, IDCONS, DA/RE, NEW 4.0, bne Flex Market, Flexrouter, Designnetz, EnergiePlattform
- TSO and DSO position paper on local flexibility
- Clean Energy Package: Market-based redispatch



Fundamentally: Redispatch markets

- Zonal spot market, local redispatch
- Local flex product: Changes to production schedules relative to base-line.

Strategic bidding in a stylized model

Two nodes: North and South

- Roughly modeled after Germany (transmission grid level)
- Oversupplied North and demand concentrated in the South
- First zonal spot market, then nodal redispatch market (RDM)

Generators in the North

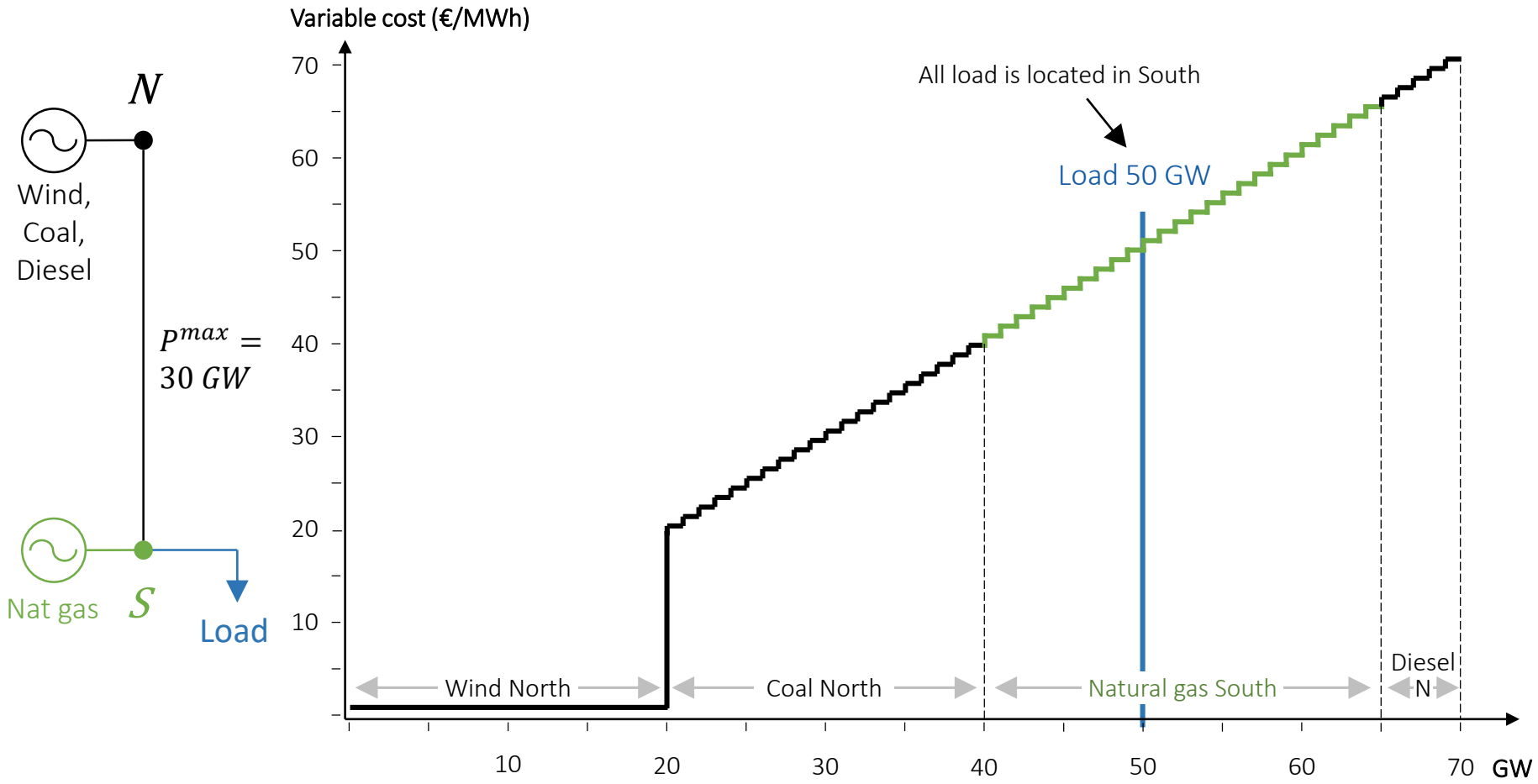
- Anticipate redispatch market for ramping down – if they are available (i.e., producing)
- Bid below variable cost in spot to be eligible to participate → aggravate congestion

Generators in the South

- Anticipate they will be paid for ramping up – if they are available (i.e., not producing)
- Bid above variable cost ("withhold capacity") → aggravate congestion

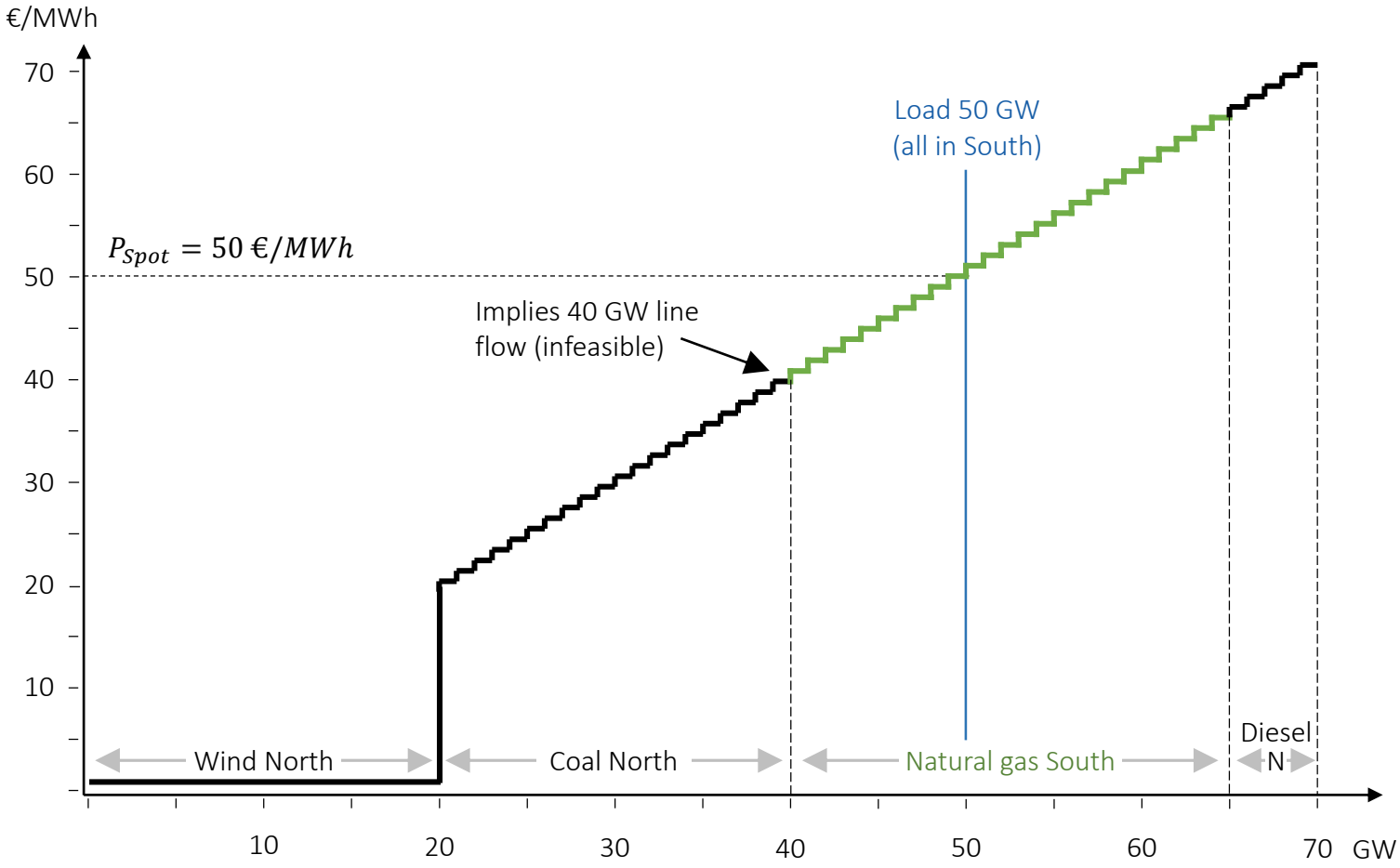
→ This is also known as inc-dec (increase-decrease) gaming

Model setup

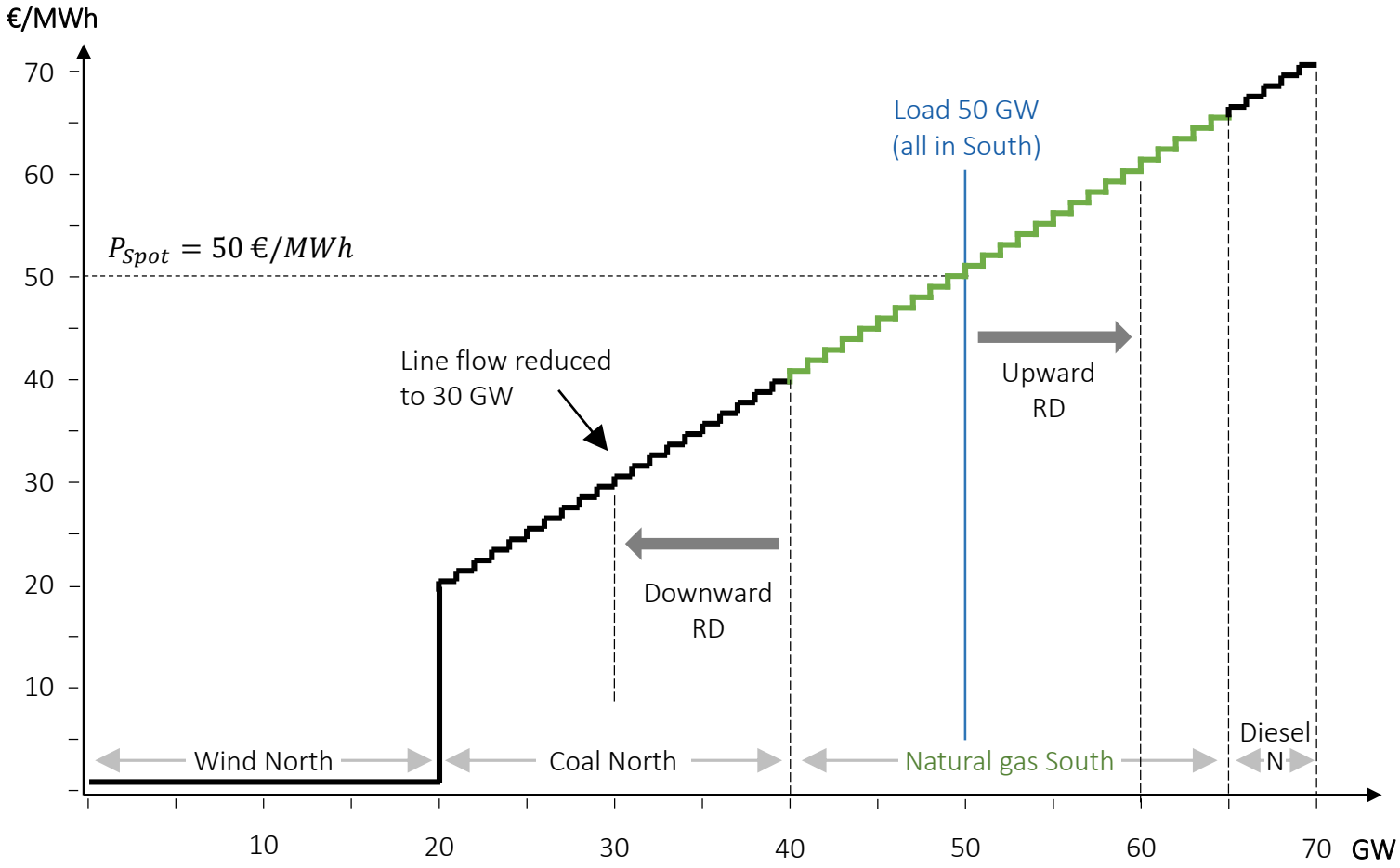

N
Wind,
Coal,
Diesel
$P^{max} = 30\ GW$
Nat gas
S
Load
Variable cost (€/MWh)
70
60
50
40
30
20
10
All load is located in South
Load 50 GW
Wind North
Coal North
Natural gas South
Diesel
N
10
20
30
40
50
60
70
GW

Regulatory redispatch

Spot market (regulatory RD)

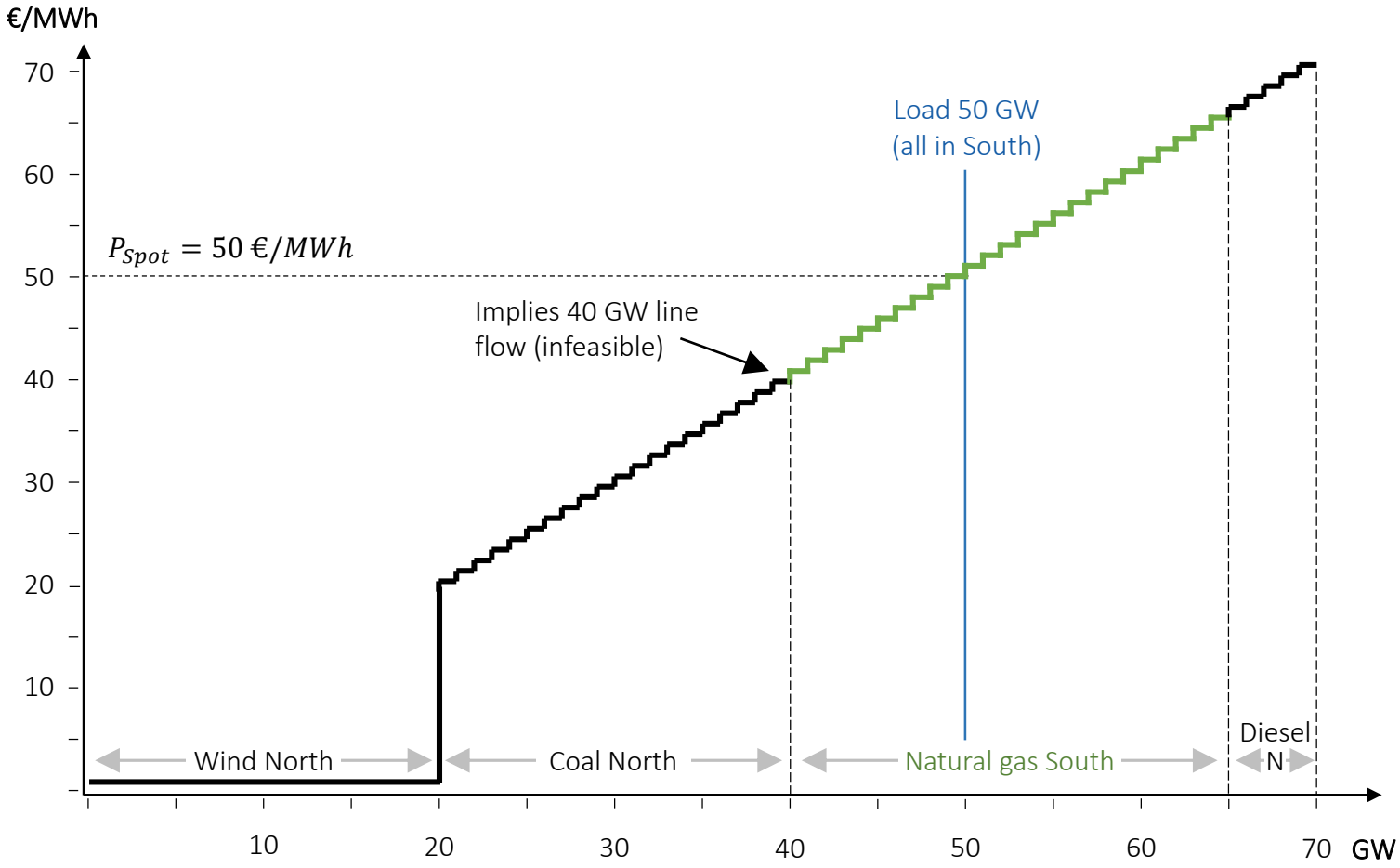


Cost-based redispatch (simple visualization)

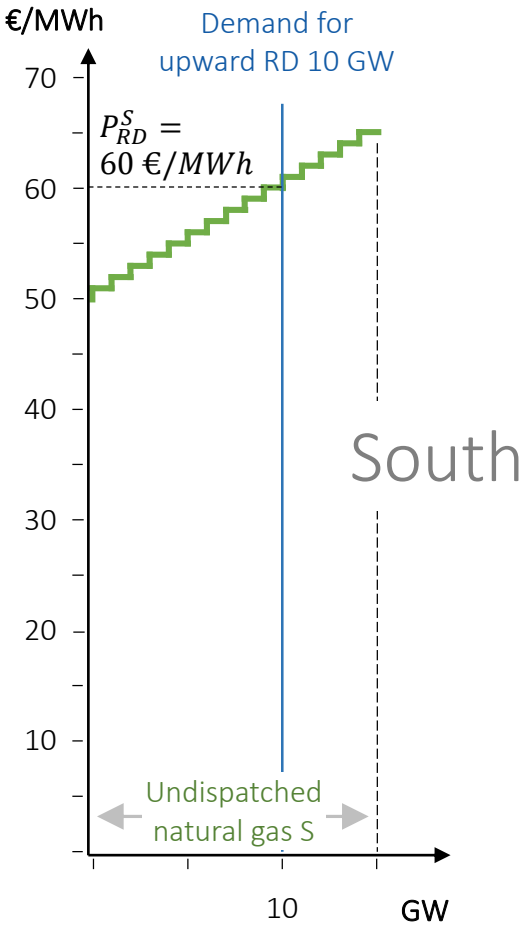


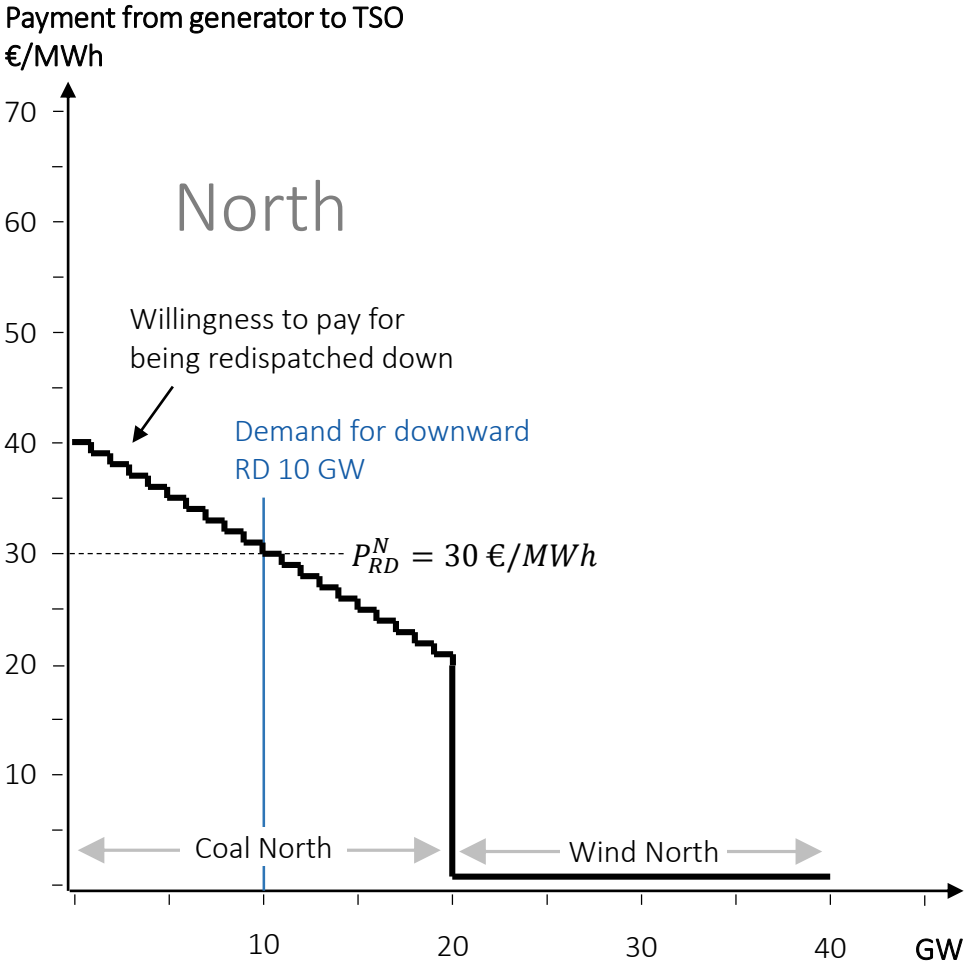
Without anticipation

Spot market (no anticipation)



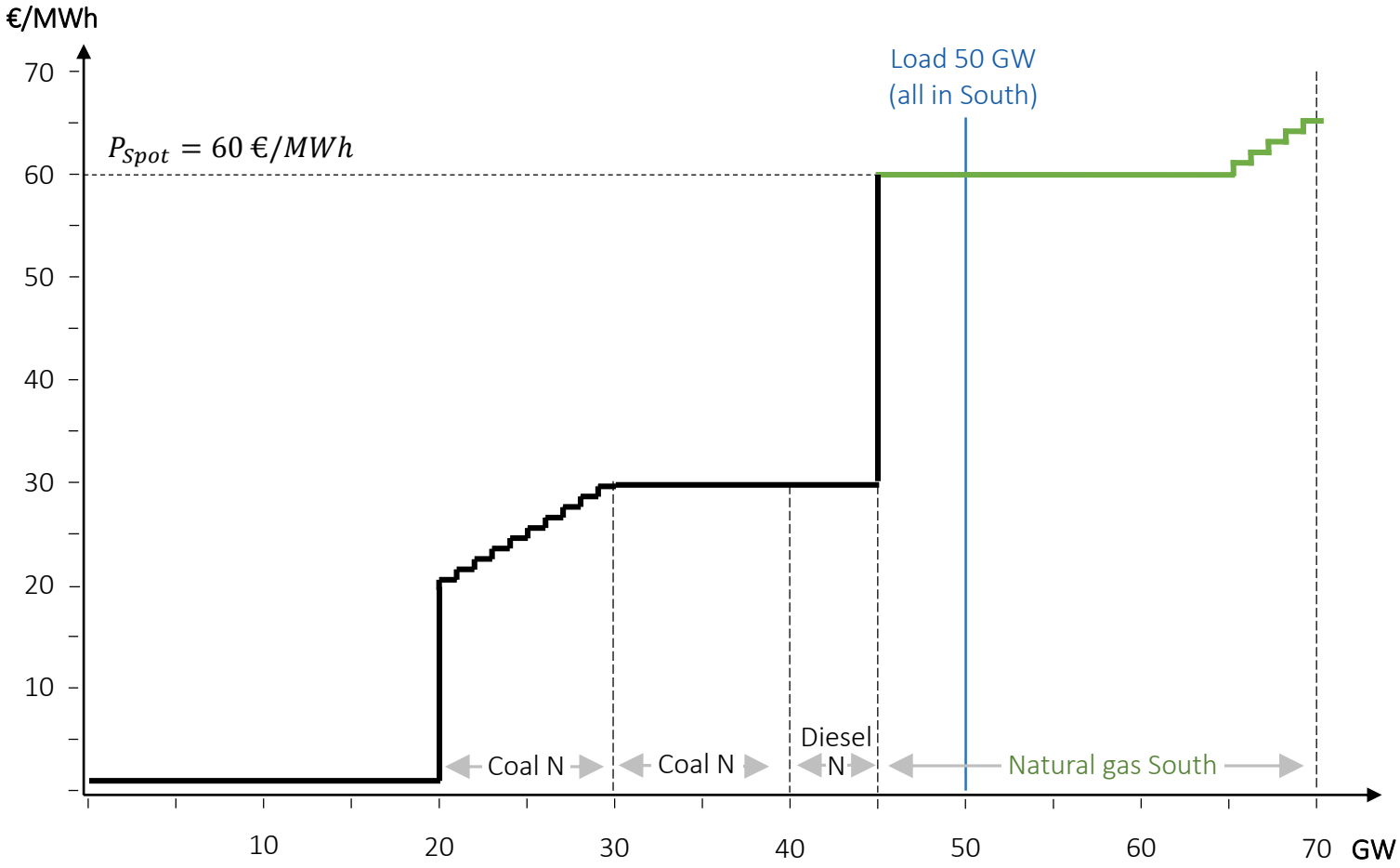
Redispatch markets (no anticipation)



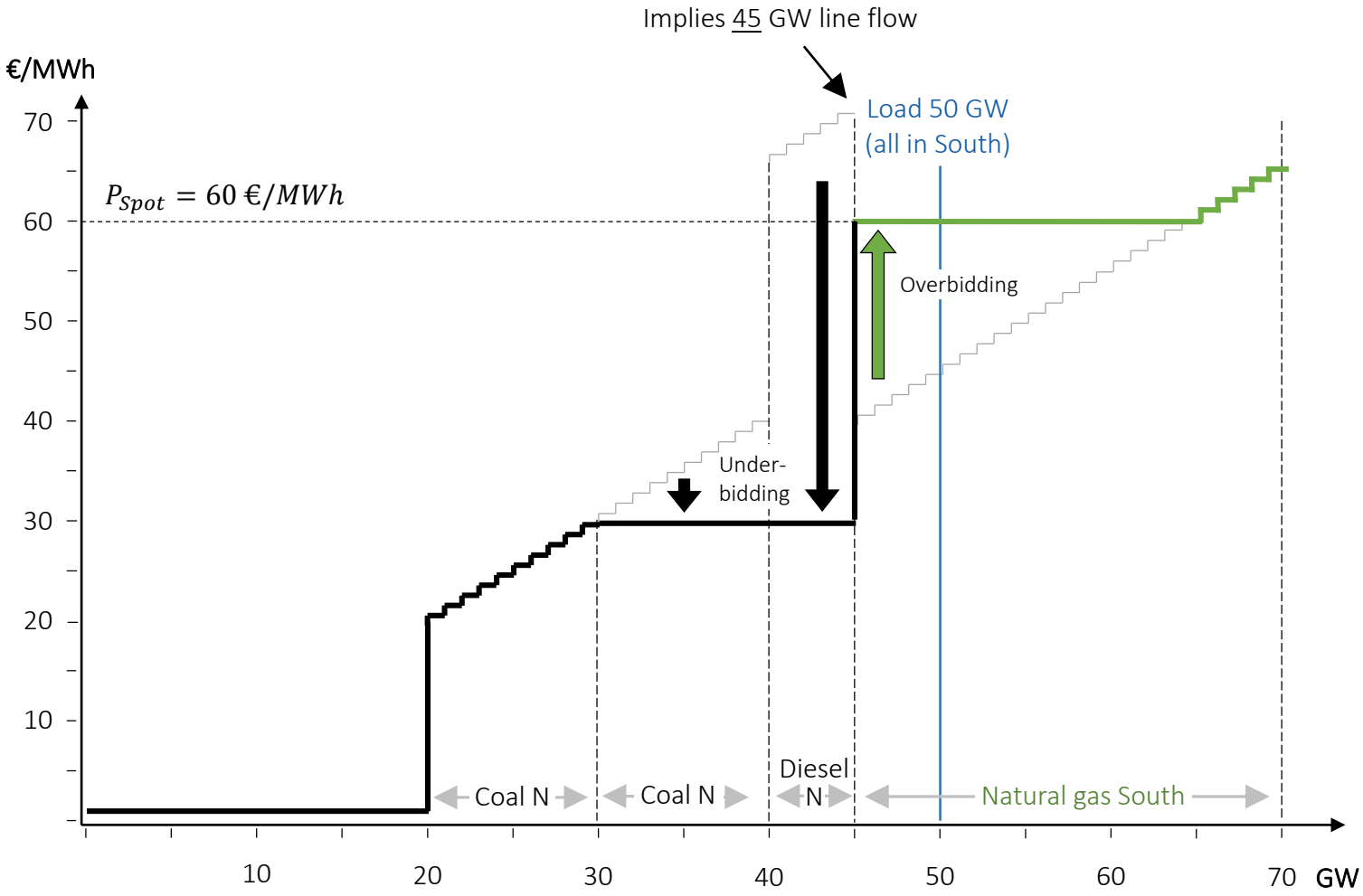


With Anticipation

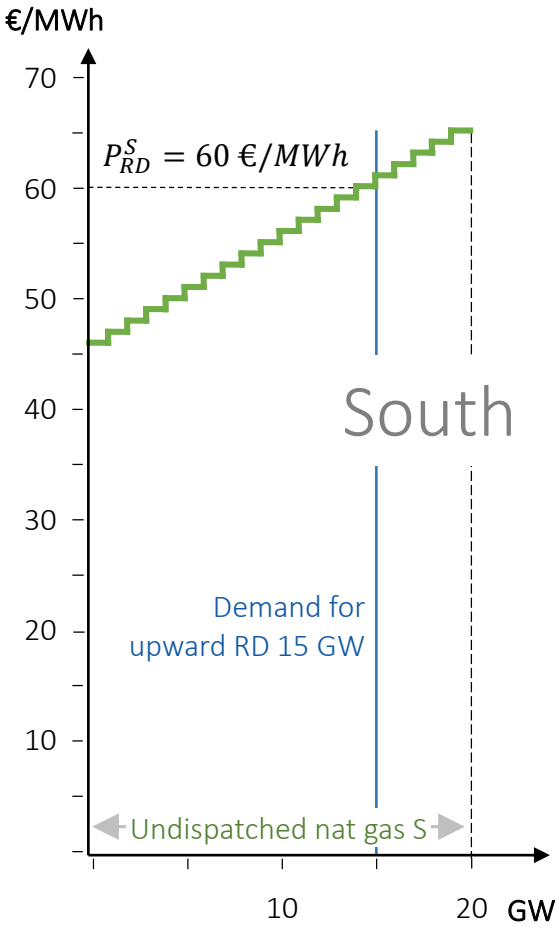
Spot market (with anticipation)

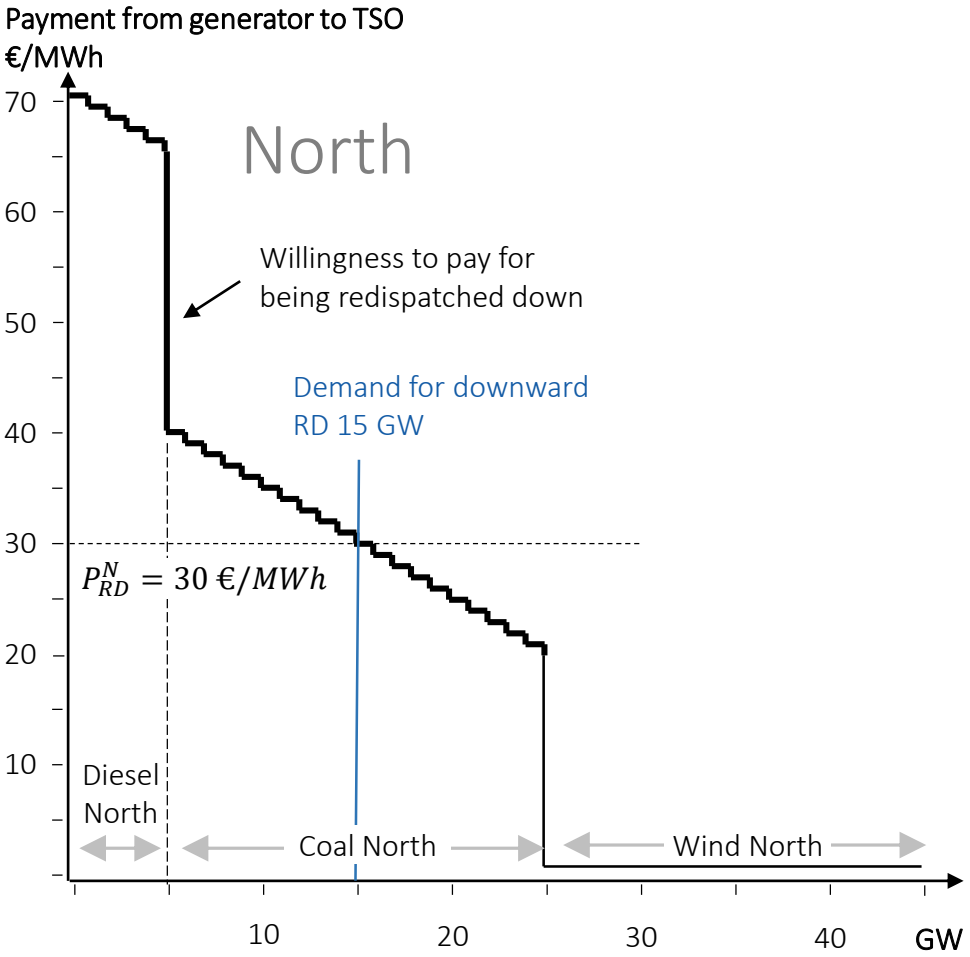


Spot market (with anticipation)



Redispatch markets (with anticipation)





Requirements for the strategy

No market power needed

- Even smallest actors can exert the strategy
- Therefore: competition is not a solution

Not a violation of competition law

- Actors price-in opportunities – comparable to balancing market
- Sanctioning would be difficult

Some foresight of congestion required

- Currently in Germany: high degree of anticipation due to structural congestion

All forms of local “extra” markets are concerned

- Pay-as bid is no solution
- Loads can also bid strategically
- Distribution grids: potentially even worse than transmission grid

Existing literature and historic cases

We are not the first to note this

- Holmberg & Lazarczyk (2015), …
- Our contribution: simple example, mechanisms clearly outlined, comprehensive discussion of consequences, related to policy debate

California

- Inc-dec gaming contributed to the energy crisis 2000/01, rolling blackouts
- Introduced nodal pricing in 2009
- Hogan (1999, 2001), Brunekreeft et al. (2005), CAISO (2005), Hobbs (2010)

Great Britain

- Inc-dec gaming at Scottish-English border
- “Transmission Constraint License Condition” introduced in 2012, similar to cost-based RD
- Ofgem (2012, 2018) Konstantinidis & Strbac (2015)

Consequences from strategic bidding

Congestion is aggravated

- Higher redispatch volume
- Difficult system operation

Windfall profits

- Profits of generators increase, consumers pay more (mostly through grid charge)

Perverse investment incentives

- “Ghost” plants which are built but never produce

Two market stages with differing locational resolution: Inconsistent

- Feedback effects: spot is *not* independent from redispatch market

The interplay between zonal spot and locational redispatch markets

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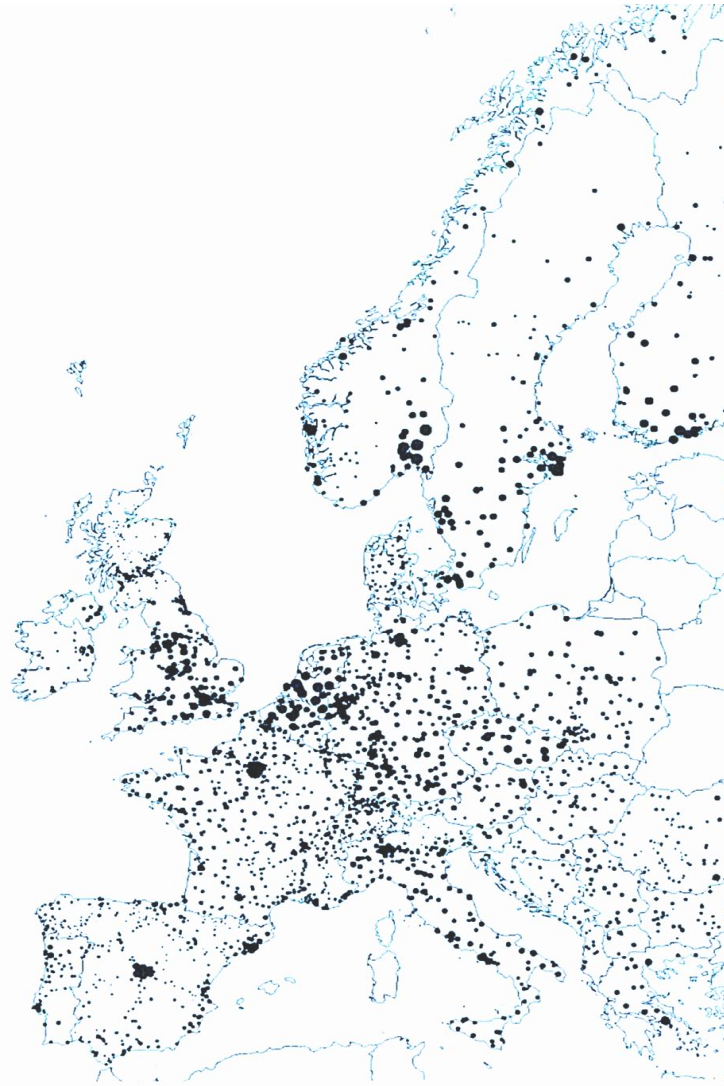

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