

# Locational Distribution Network Pricing in Germany

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# Agenda

## 1. Need for Locational Coordination

## 2. Present Charging Options

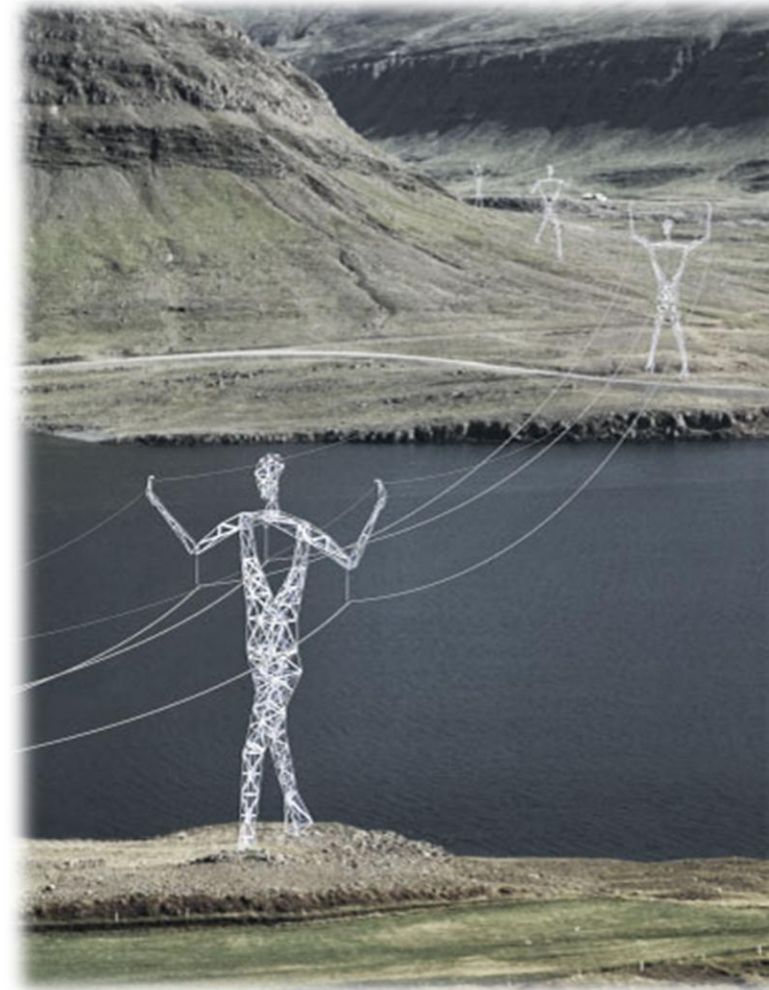
## 3. Smart Contracts:

- Appeal
- Prerequisites

## 4. Germany:

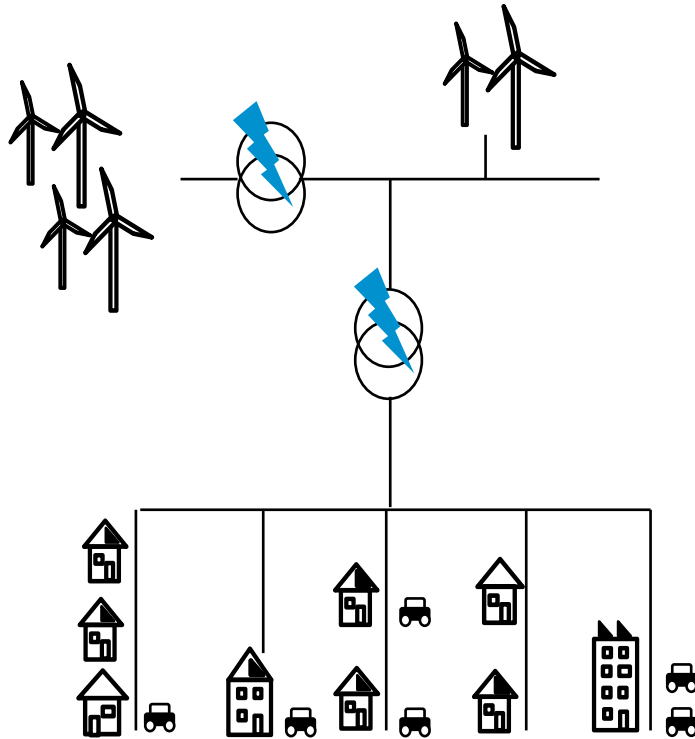
- Status Quo
- Promising Developments
- Desired Developments

## 5. Conclusions



source: <http://www.pylonofthemoth.org/>

# Background



- increase of distributed generation
- development of smart grids



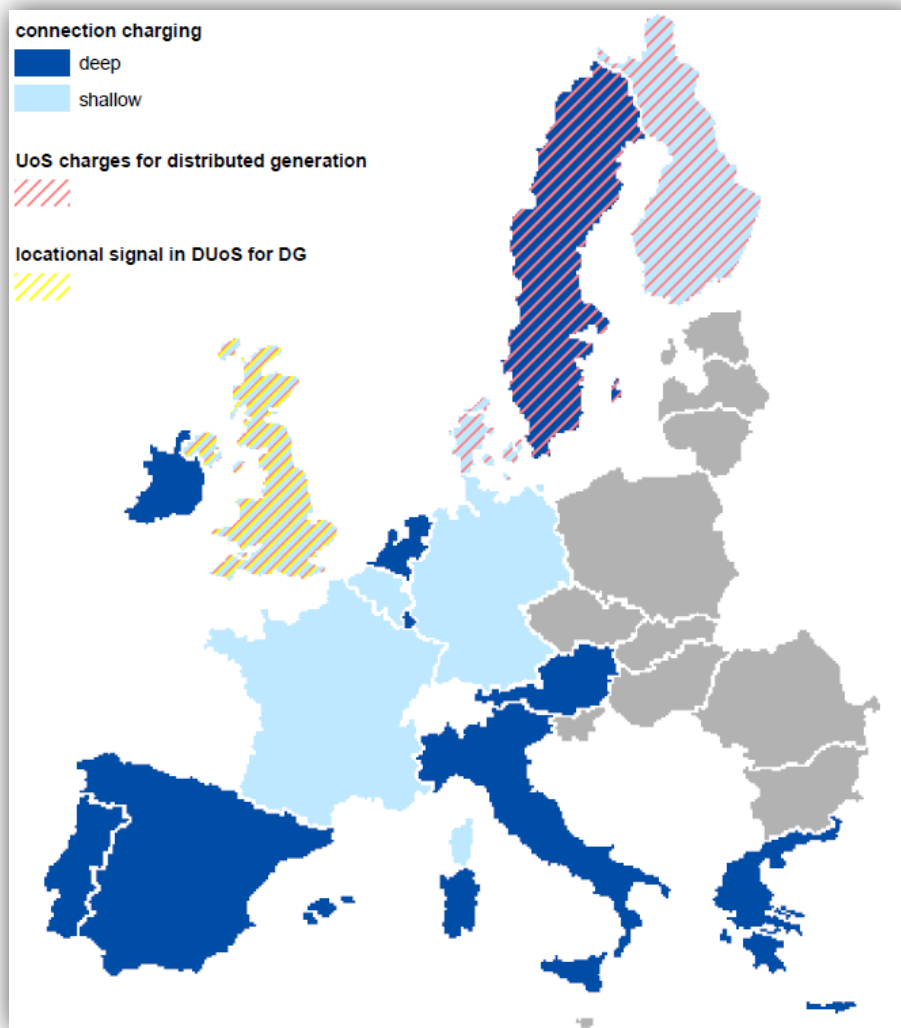
- investment needs in distribution grids
  - additional investment cost in Germany: €21 – 27 billion\*
  - annual expenditure for network infrastructure: €5.57 billion\*\* (2008, Germany)

Sources: \* Expertise on Network Expansion Need for PV and Wind, BDEW  
\*\* Monitoring Report, Federal Regulatory Agency of Germany

# Need for Locational Coordination

- challenge: avoid unnecessary but not impede necessary network investment
- decentralized systems at distribution level
  - small network users (renewable generators, business, households)
- decentralized market / price system to achieve coordination
- network and/or energy charges should reflect network condition
  - steer generation and demand to relieve the system
  - attract flexible users (controllable generation / demand or storage) to suitable locations

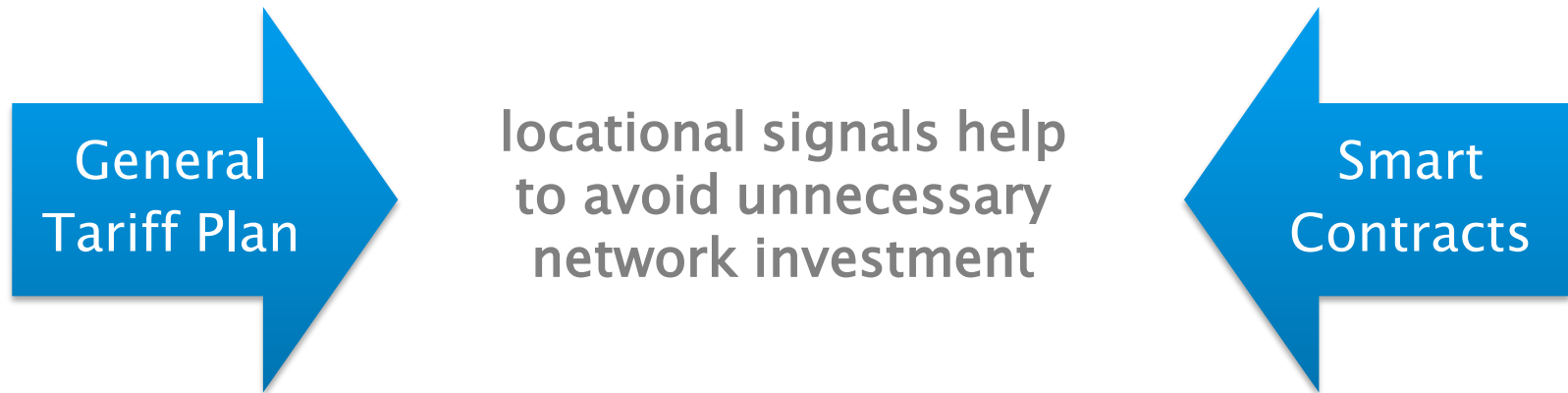
# Status Quo of Network & Energy Charging



- widespread use of uniform pricing/charging
- Locational Marginal Pricing /Nodal Pricing and Zonal Pricing mostly at transmission level
- almost no cost-reflective charging at distribution level (strong opposition)
  - only few examples of deep charging
  - locational differentiation still very rare

distribution network charging in the EU-15  
data compiled from various sources

# Locational Signals in Charging



- local energy / network prices internalizing network condition based on dispatch model
  - Nodal Spot Pricing
  - Locational Marginal Pricing
  - Zonal Pricing
- voluntary agreements between system participants creating a Pareto improvement
  - reward for grid-friendly behavior
  - compensation for control

# Appeal of Smart Contracts

## individual agreement rather than one-fits all solution

- **target specific users**
  - spare weak and small users
  - comply with prioritization of i.e. renewable generation
  - maintain regional competitiveness in attracting new industry
- **some standardization to retain transaction cost**
  - according to location
  - but also size of the user, pattern / flexibility of network use

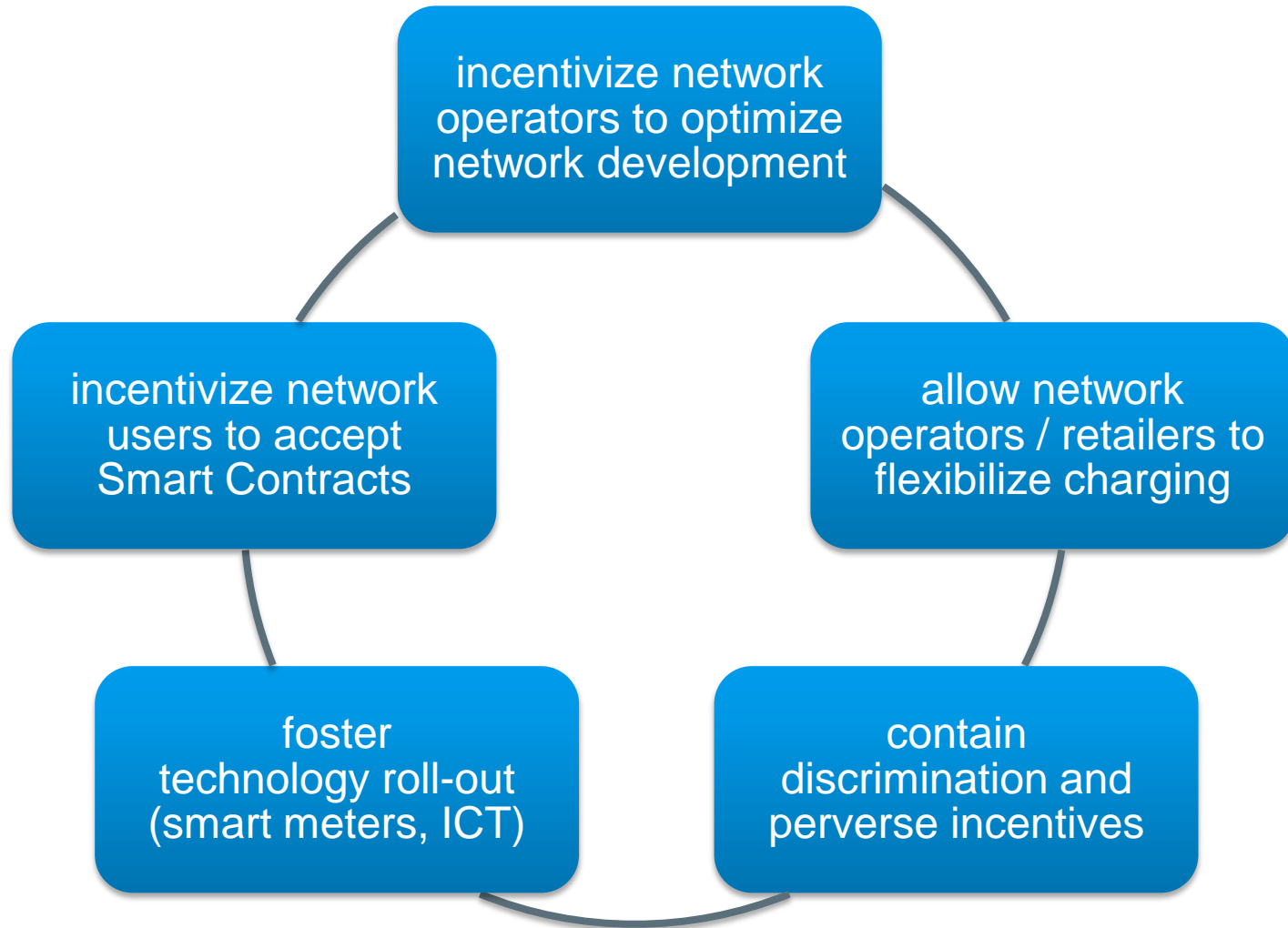
## voluntary agreements with standard tariff as fall back solution

- default tariff for most customers
- individual contracting where additional benefit is possible

## no major system reform required

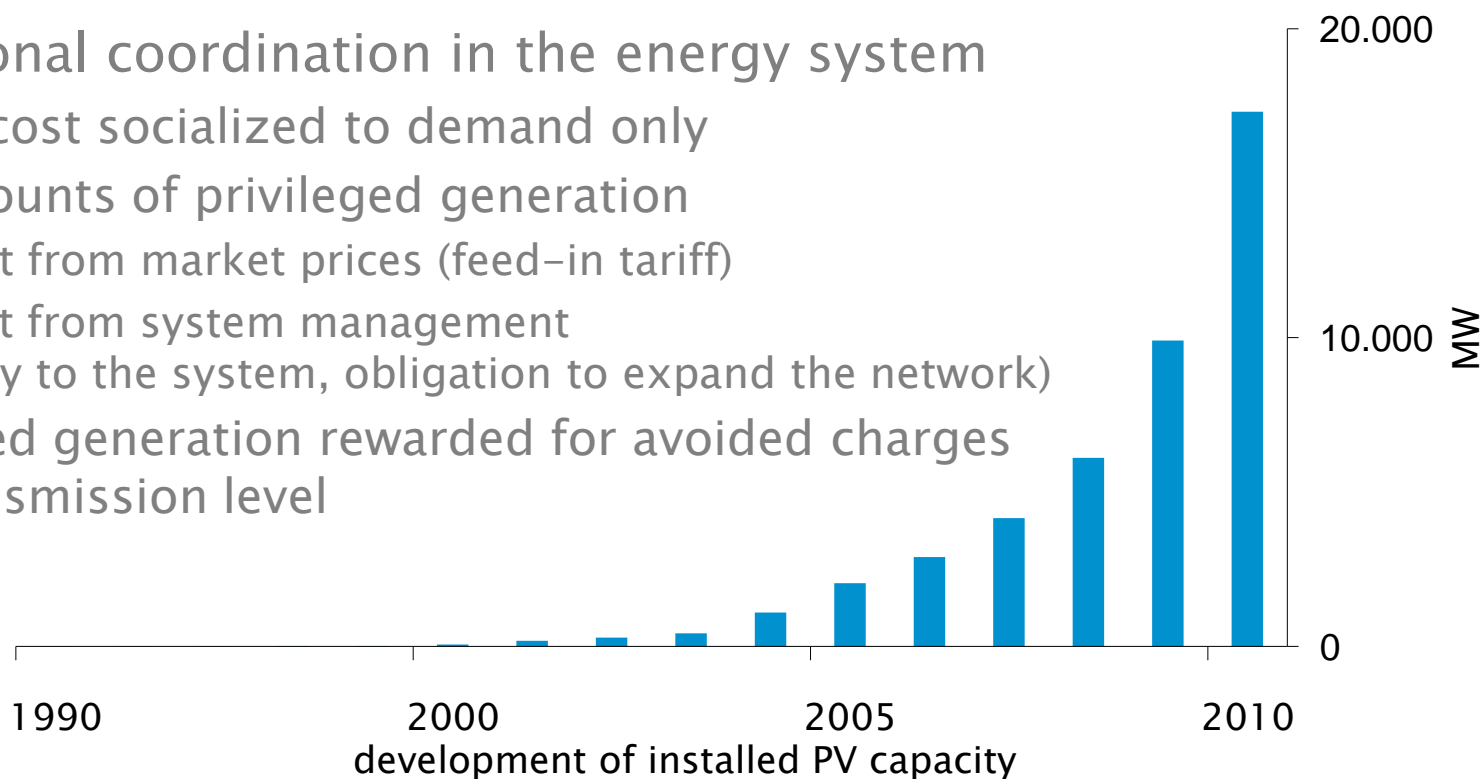
- few requirements concerning market design
- regulatory approval only for standard (fall-back) tariffs

# Prerequisites for Smart Contracts



# Status Quo in Germany

- strong increase in distributed generation
- investment needs in distribution grids ahead
- little locational coordination in the energy system
  - network cost socialized to demand only
  - large amounts of privileged generation
    - exempt from market prices (feed-in tariff)
    - exempt from system management  
(priority to the system, obligation to expand the network)
  - distributed generation rewarded for avoided charges from transmission level



# Potential in existing legislation

## contribution to connection / construction cost

- steering capacity demand of network users → no financing function
- typically standard calculations used → little differentiation
- usually not charged to generators → allowed for small generators

## individual network use-of-system charges

- non-standardized tariffs for some network users  
→ only large users or users with unusual peak behavior
- tariffs lower than regulated default → not less than 20% of standard
- approval from the regulator required → transaction cost

## call and curtail agreements

- reduce demand upon call or allow remote control
- for users that individually lower network cost in peak periods  
→ obstacle for small users
- mostly for demand → difficult for (privileged) generators

# Small reform proposals

## voluntary curtailment of distributed generation

- offer compensation for foregone feed-in and additional remuneration  
→ careful with negative environmental effects and perverse incentives

## adjustments in existing charges

- reform of premium for avoided charges from higher voltage levels

## investment in storage

- exploit trade-off between network expansion and storage  
→ relieve congestion when users are not flexible

## incentives for network operator to optimize investments

- network operator should benefit from avoiding unnecessary investment
- exploit trade-off between network and generation  
→ obligation to expand the network for privileged generation

# Conclusions

- changes in distribution networks call for locational coordination (distributed generation, smart grids)
- Smart Contracts can be a good alternative or amendment to locational pricing schemes
  - network operators seek optimal agreements to avoid investment
  - network users can only improve
- small changes in the regulatory framework and charging method can result in Pareto improvement
  - more flexible tariff options (evolving in Smart Grids anyways)
  - good incentives for network operators

# Thank you for your time and attention!

## Feel free to ask questions.

See also:

- “Locational signals to reduce network investments in smart distribution grids: what works and what not?” forthcoming in Utilities Policy
- “Smart pricing to reduce network investment in smart distribution grids – experience in Germany” forthcoming in F.P. Sioshansi „Smart Grid: Integrating Renewable, Distributed and Efficient Energy”

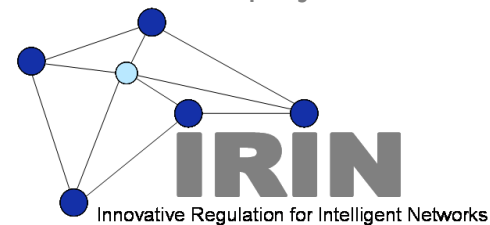
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