Cuculus‘ Market Vision

A holistic approach to market developments

October 23, 2013

Background & Objective

Cuculus GmbH offers smart metering & smart home systems to utilities

- Makes it easy for utilities to offer propositions related to smart metering and home
- Serves more than 45 utilities in six countries
- Is a young company with strong retail markets background and special focus on commercialization of data and services
- Believes that utilities need to take more holistic view at the business to address the challenges in the current market

Objective is to share analysis and vision about what needs to be done assure investment security and respond to challenges for the coming years

- Analysis of market developments
- Discuss holistic approach to address challenges

Demand response is recognized smart metering benefit

Smart metering introduction is generally driven by the traditional view of benefits expected from demand response, consumer transparency and smart grids

- Expected benefits relate to consumer savings, cost benefits relating to alignment of supply and demand as well as assuring the functioning of the grid

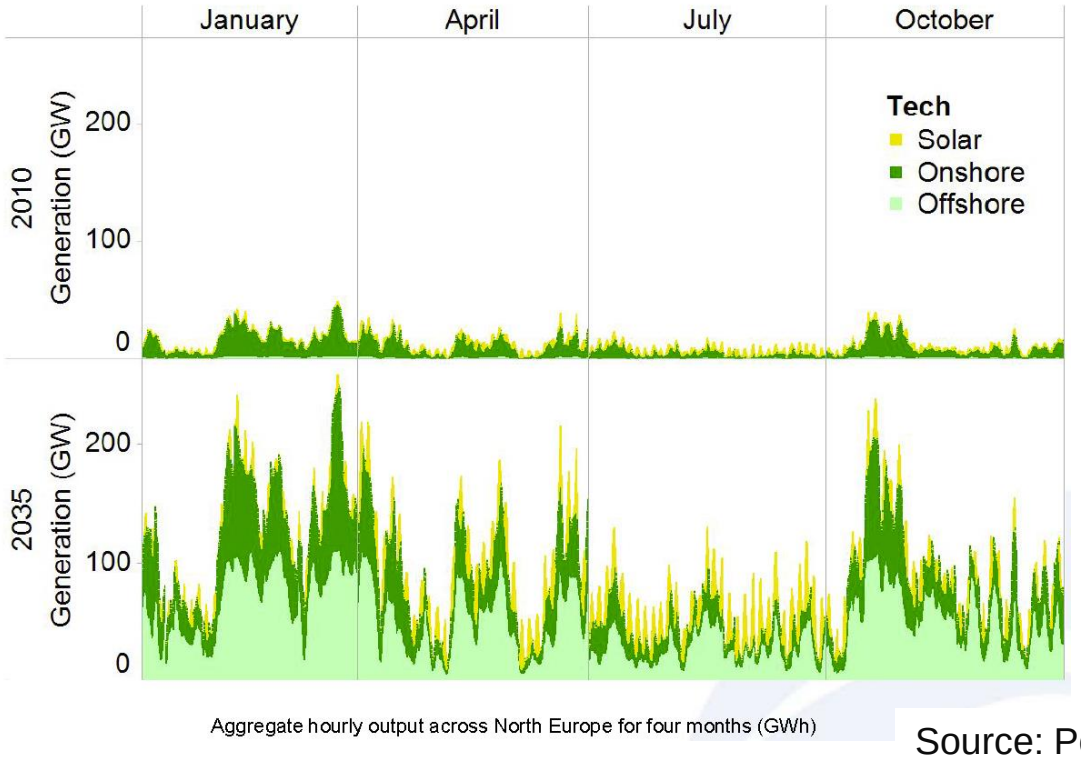
Benefits of smart metering rely on market conditions; consequently some countries are looking at alternative implementation scenario's

- E.g. Germany with discussion about "hybrid" model

Are there other benefits that might be important for whether or not to implement smart meters?

- Are there new developments that might influence the decision?

Transition to sustainable energy: The volatility challenge



Aggregate hourly output across North Europe for four months (GWh)

Installed capacity 2010:
Non renewables 486 GW
Renewables 68 GW

Source: Pöyry

Overall market developments pose new challenges

Ambitious governmental targets to stimulate renewables and to reduce emissions

- Subsidies drive high growth of (de-central) production assets with volatile output and low marginal costs

U.S. transition to shale gas makes coal cheap and coal fired generation competitive

- Lack of investments in gas fired power plants due to “high” fuel costs

The combination of these two developments will be detrimental long term

- Higher share of renewable generation will require range of measures to manage volatility
- Regional differences in how easy this will be (e.g. fuel mix)
- Investments in additional gas fired power plants with variable output will be essential to interact and be back-up when renewables are not available

Security of supply could be at stake

Existing situation is "ticking bomb" with little hope of improvements

- Emission certificate trading system will help, but unlikely that politicians will agree to measures that will increase costs for businesses
- German installed peak renewable capacity is expected to surpass peak demand in 2013

Utilities realize that investments in power plants with capabilities to deal with volatility are required, but the business case is negative in the current system

- Financial crisis has driven down utilities' margins and reduced investment capacity
- Solution needs to address how to make investments profitable

Capacity markets seen as solution in some countries to secure reserve capacity

- Costly manner to secure capacity

Consumers pay a high price for the renewable transition

Consumers pay for the investments required for the transition to renewable energy

- Financing of wind parks and solar typically through subsidies (taxes or mark-ups) possibly in combination with proceeds from generated electricity
- Germany: Consumers currently pay a mark-up of € 5,3 ct/KWh for this

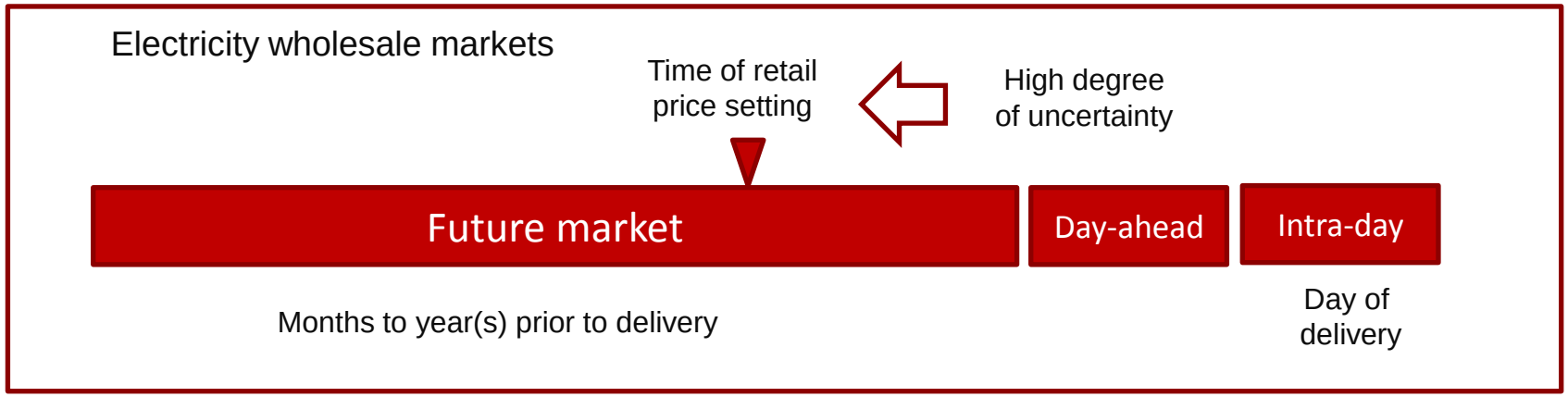
In addition consumers pay "hidden costs" through the pricing mechanism underlying their electricity contracts

- Renewable electricity creates volatility and this increases the costs of traditional energy contracts

Hidden costs occur through how electricity is priced and sourced

Most utilities source electricity over time to manage risks and provide stabile pricing

- Most electricity is purchased in the future market with adjustments and balancing mainly taking place in the day-ahead and intra-day market



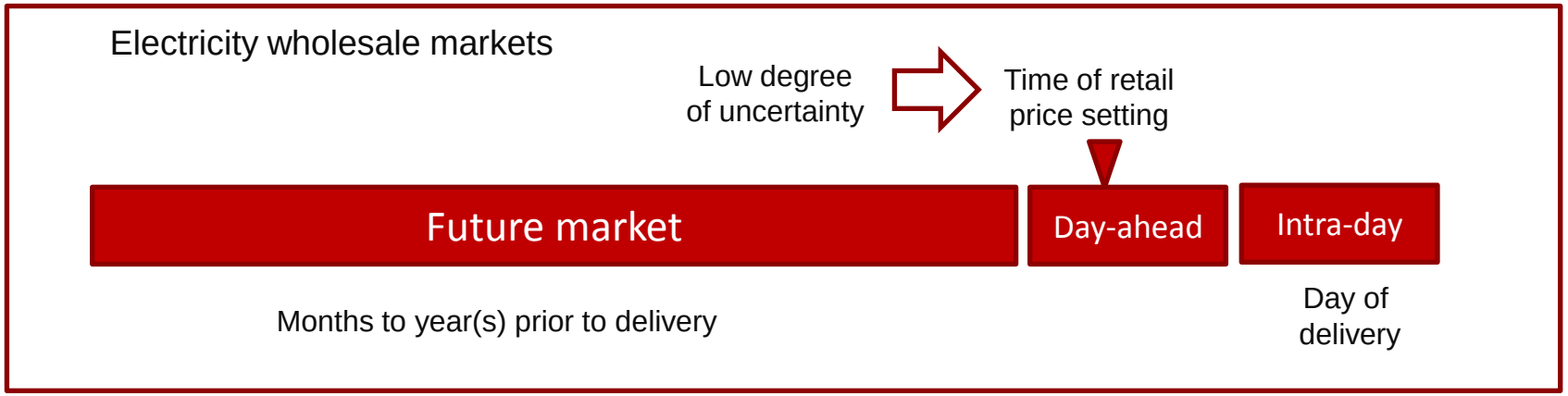
Prices are set based on sourcing costs, risk mark-ups, balancing as well as margins

- Risk mark-up are required to provide stable prices due to the timing of price setting
- Increased volatility caused by renewables leads to higher risk mark-up

Risk mark-ups can be avoided through dynamic pricing

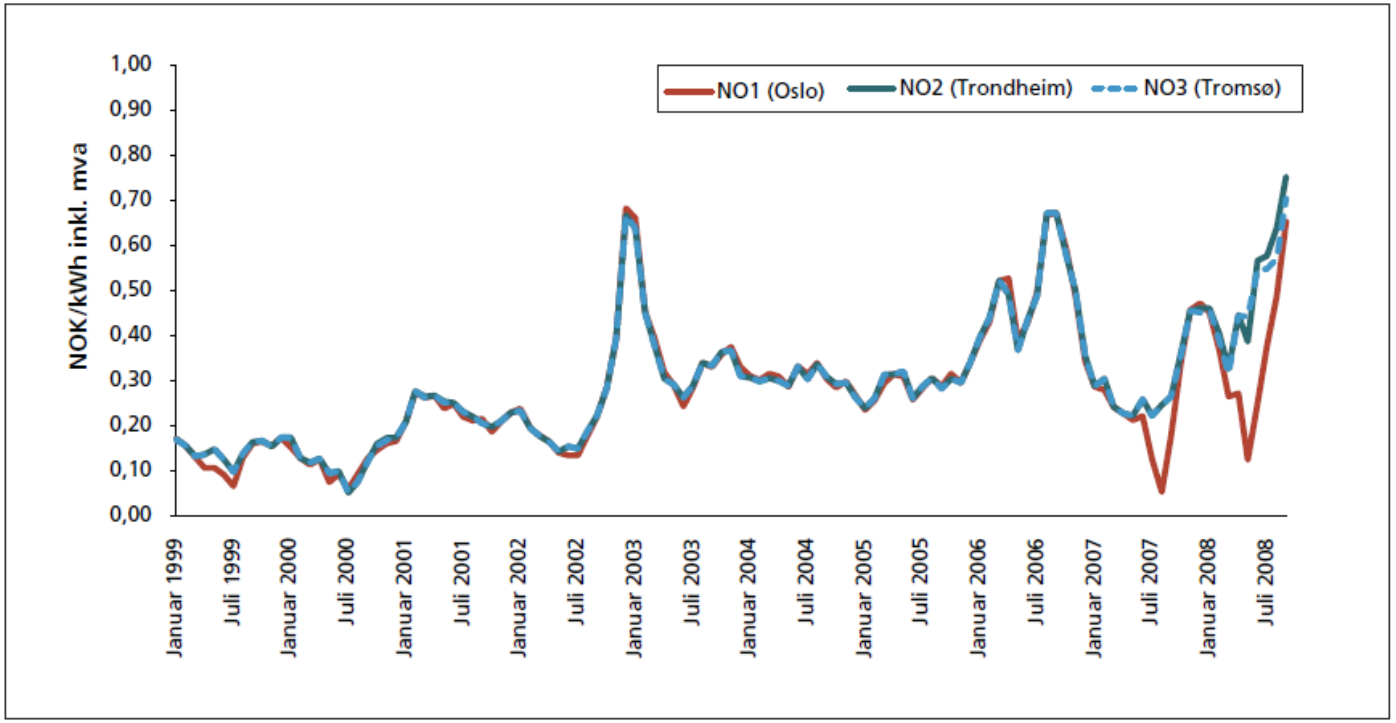
Consumers could avoid the risk mark-ups if given the opportunity to choose for contracts with dynamic pricing

- Price contract typically consist of a fixed monthly fee and the hourly day-ahead power exchange price with a small mark-up



Norway‘s electricity supply is volatile due to weather influence

Figur 4: Utvikling i spotpris i NO1, NO2, NO3 - månedlig gjennomsnitt, 1999 3. kvartal - 2008.

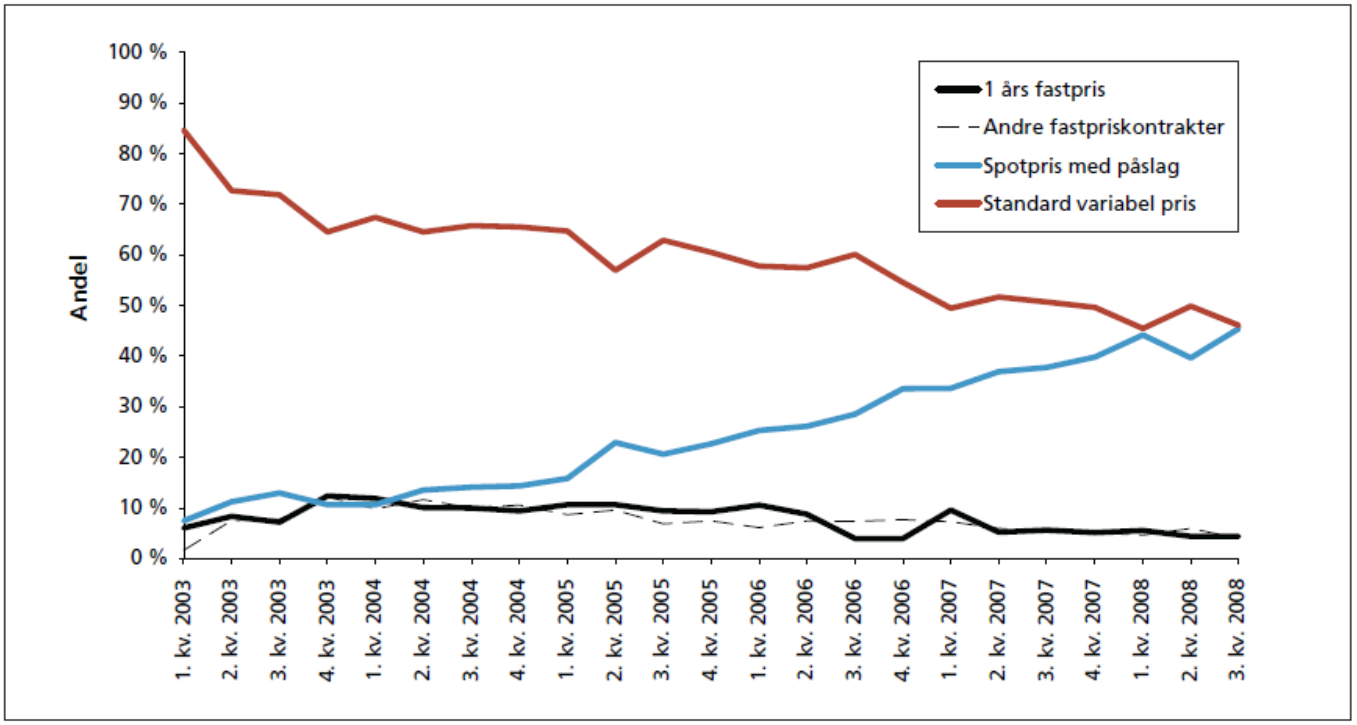


Kilde: Nord Pool Spot, Konkurransetilsynet

Average spot price developments for three price areas

Consumers prefer dynamic pricing due to lower costs

Figur 5: Utvikling i valg av kontraktstype, 2003 - 3. kvartal 2008.



Kilde: NVE og SSB

Variable price plans (blue is dynamic price)

Fixed price plans

Influx of renewables also influences wholesale prices

Renewables have extremely low marginal costs relative to fossil fuel fired power plants, so surplus due to much wind or sun will drive down prices

- Main effect is in day-ahead and intra-day market

Electricity wholesale markets

Requirement to be able to guarantee delivery for a certain price far ahead of delivery
- Guarantee requires traditional power plants
- Producers aim to sell out production capacity

Wide range of pricing factors
- Adjustments to demand
- Strong influence of volatility of renewables

Months to year(s) prior to delivery

Day of delivery

Renewables will drive down day-ahead and intra-day prices

A larger share of renewables will increasingly reduce prices in the day-ahead and intra-day markets

- Cross-boarder effects will also occur through electricity exports (e.g. D to NL)

Electricity wholesale markets

Pricing mainly driven by the cost structure of traditional power plants
- Currently mainly coal & nuclear plants due to spark spreads

Pricing driven by
- Flexibility of running plants
- Volatility in demand/supply

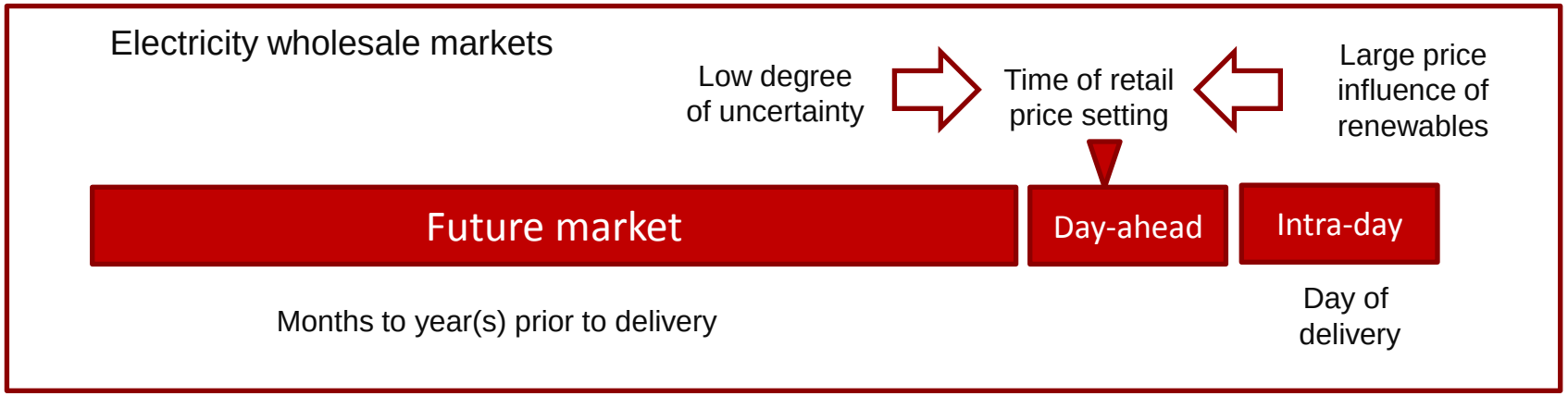
Months to year(s) prior to delivery

Day of delivery

Lower wholesale prices create further consumer benefits

Dynamic pricing will also enable consumers to benefit from further reduction of their energy bills through the shift of sourcing from future to day-ahead markets

- Avoidance of the current risk mark-ups as well as from lower prices caused by the low marginal costs of renewables in the day-ahead and intraday markets



A shift in sourcing would have further consequences

Power plant owners make decisions about which plants to run based on market prices and demand

- Objective is to sell production (and secure margin) at prices above marginal cost to minimize risk
- Plants with limited flexibility (i.e. coal and nuclear) are costly to start/stop, so preference is to be able to run these with sold out capacity

Power plants owners are likely to not to run their least effective coal fired power plants should there be less demand in the future market

- This will cause demand to increase in the day-ahead and intra-day markets
- The price increase particularly for moments where there is little availability of renewable power thus making it more interesting to run power plants with flexible capacity

Introducing dynamic pricing will help secure reserve capacity

Better conditions for power plants with flexible capacity (e.g. gas fired power plants) will make it more interesting to keep these available and to make investments

- Will reduce the cost of securing reserve capacity available through capacity markets
- Better prices for reserve capacity will also further stimulate investments in storage and make demand response propositions more interesting

Consumers will benefit from this through the reduction of the costs related to capacity markets

- Costs for reserve capacity in the day-ahead and intra-day markets (i.e. set in dynamic market) are likely to be lower than the costs set through a capacity market mechanism (i.e. set through upfront prochurement)

Dynamic pricing needs smart meters to be fair and efficient

Dynamic pricing in Scandinavia has traditionally been based on monthly meter reads and average consumption distributions

- Consumers who tried avoiding peak price periods did not get lower bills since pricing was done according to average consumption profile
- Lead to massive complaints after period with high prices from consumers who had taken action

Smart meters guarantees fair bills and will also assure further benefits for those consumers who actively try to optimize the timing of consumption

- Exact metering is also pre-requisite for aligning incentives across the value chain (i.e. from production to consumption)

Consumer benefits occur with no behavioural change needed

Consumers will gain the primary benefits by opting for a contract with dynamic price

- Savings achieved through avoidance of risk premium, low marginal costs of renewables as well as lower costs for reserve capacity
- No active behavioural change required (i.e. not demand response related benefits)

Consumers have the possibility to achieve further savings through optimizing the timing of their consumption when they have opted for a dynamic price contract

- This is demand response related benefits

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Market practices lock pricing to traditional models

Consumer pricing in traditional energy contracts are aimed at locking in margins through pre-sourcing in wholesale market and mark-ups for risk premiums

- Extremely low marginal costs of renewables will create periods with very low wholesale prices, but current pricing practices limit the benefit for consumers

The frequency and duration of periods with low wholesale prices will increase

- Germany: Growth of periods with negative pricing to 40 – 60 hours in 2012

Current market practices are insufficient to address problem

- Pricing and wholesale markets are fossil fuel focused

Consumers can benefit more from renewables

Required to break with old system and adapt consumer energy contracts that avoid unnecessary costs

- Scandinavian model that provides choice for consumers as to whether they want to pay risk premium mark-up for stable pricing or not

Dynamic consumer pricing eliminates lock-in to forward wholesale markets (primarily driven by fossil fuel pricing) as well as high risk premiums

- Will make it less attractive to run “steady state” coal fired power plants

Smart meters required for fair pricing and to create incentives to stimulate efficiency through avoiding consumption in times with limited supply

- Additional possibilities for “smart” consumers to save through energy management

What benefits can consumers achieve?

Benefits are mainly driven by the share and type renewables in a market along with what power plants and demand related conditions are present

- Risk mark-up: Example 0,8 ct/KWh prior to the high growth of renewables
- Shift of sourcing to day-ahead & intra-day & capacity savings: Guestimate 1-2 ct/KWh
- Modelling required to determine this per market

Savings are more substantial in markets with high renewables share

- Requires electricity pricing to be market based and not set through regulation

Savings could be sufficient to cover a large share of the renewable transition costs

- Savings could be sufficient to cover ca. 50% of Germany's current 5,3 ct/KWh mark-up for renewables financing

The importance of smart metering needs to be re-considered

Smart grid (DSO's) and energy efficiency (Retailers) have been main focus of European smart metering activities

- Differing views on value for consumers due to "low" consumption and doubts about economics

The most important reason for smart metering could be to create capability to finance reserve capacity and to make sure renewable transition stays affordable

- Will align renewable and economic objectives
- Differs from demand response applications aimed at limiting volatility

Vision: Solve challenges by aligning value chain

Continuing to address the challenges in the current power supply with traditional means will not work

- Mismatch between sustainability and economic objectives will ultimately threaten security of supply
- Traditional Retail Markets sourcing and pricing models create advantages for the wrong power plants and makes renewable transition expensive

Solution is to introduce dynamic retail market pricing that better reflects the underlying changes in the power supply

- Consumers will benefit more from renewables and finance production assets that are capable of dealing with volatility

CUCULUS

www.CUCULUS.net

Smart Metering – Smart Home Lösungen

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