

The Future Flexible Energy System

Enabling the paradigm shift in energy

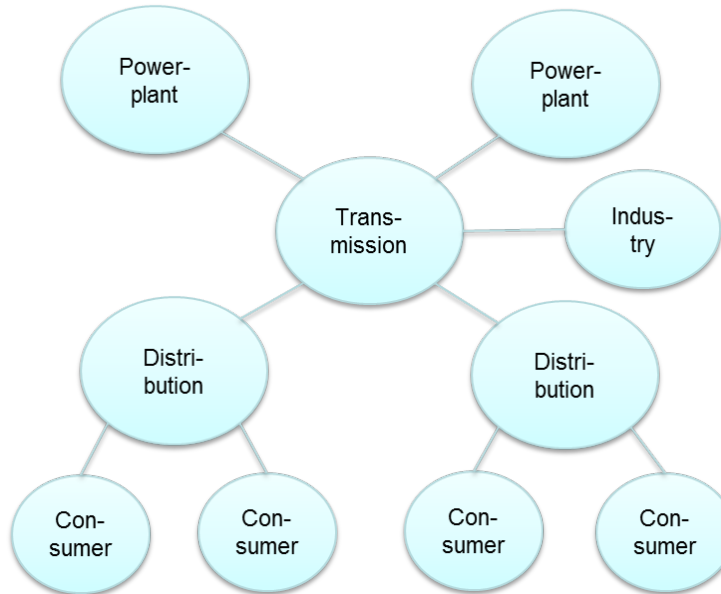


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Today's traditional energy system

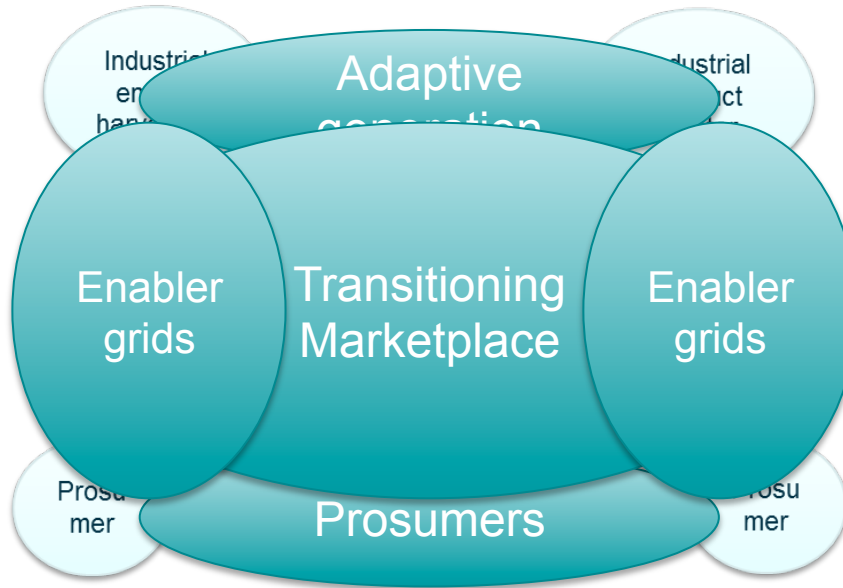


Large centralized power plants burn fuel to extract energy for resale via a structured network

The network costs are less than the efficiency tradeoff of local fuel logistics and local equipment lifecycle costs

Regulation has opened access to the capital intensive monopolies and created "the liberalized energy market"

The Energy System of the Future



Energy is extracted from renewable sources by prosumers and industrially managed sites like wind/solar farms close to controllable loads and connected to dynamic groups to balance needs and overproduction

Network costs are balanced across shared infrastructure and dynamic groups based on actual network needs

Regulation opens access to common infrastructure and allows distributed allocation of resources while promoting open markets on all levels



PROSUMERS

MARKET TRANSITION

ENABLER GRIDS

ADAPTIVE GENERATION

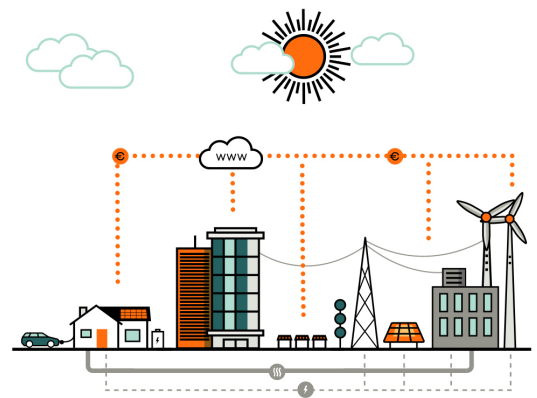
The FLEXe Energy System

Prosumers



- Prosumers are end users of energy who have invested in generation resources to cover and sometimes exceed their own needs in energy
- The dynamics of prosumer logic and rationale are driven not only by economics, but by social aspects and environmental needs
- The distributed nature of prosumer locations creates a new dynamic that enables and requires both technologies and services to be a constructive part of a smart sustainable society
- Interaction between prosumers and the energy infrastructure is key in achieving efficiency and optimum societal benefits

Market Transition



- The change in energy infrastructure and customer logic is creating a totally new need for distributing value and managing transactions
- The market needs to solve both distribution of value and allocation of resources to achieve financial and technical balance
- Existing marketplaces will evolve, new values will be commoditized across energy forms and new markets will form to complement ones serving existing infrastructure
- Developing areas will skip the infrastructure based market and start from distributed asset allocation and value sharing
- Bottlenecks in variation of implementation technologies and incompatibility of local solutions need to be resolved by facilitation to enable access and liquidity in trading for all resources



Enabler grids



- Energy grids (electricity and district heating grids) are the base of the flexible energy system
- The grids face new challenges as generation shifts from the roots to the leaves of the energy tree
- Enabling local and regional grid asset allocation and control enhances optimum usage and prevents undue investments
- Modes of energy can complement each other instead of being alternates
- Regulatory models have a key impact in how well the energy grids can evolve and embrace new ecosystems
- Resilience can be achieved with new methods, constraining adverse event damage and shortening response times

Adaptive Generation



- Future generation portfolios will solve a range of complex supply issues by combining smart generation assets and distributed generation systems
- Combined heat and power production will evolve from basic generation to supporting and enabling the multimodal energy balance of the flexible energy system
- Combustion based heat and power generation will continue to be a necessary part of the energy network but it will evolve to fulfill a new role in the ecosystem
- Generating fluctuating peak shaving and back-up power to control and stabilize the electricity system in various parts of the infrastructure will enable efficient use of other renewable assets
- Specific understanding of fuel behavior and availability of renewable fuel sources will complement the optimal use of fuel based generation in the flexible energy system



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Thank you for your attention

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