

Key Challenges for Sustainable Electricity

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Challenges to Transform Energy Supply and End Use

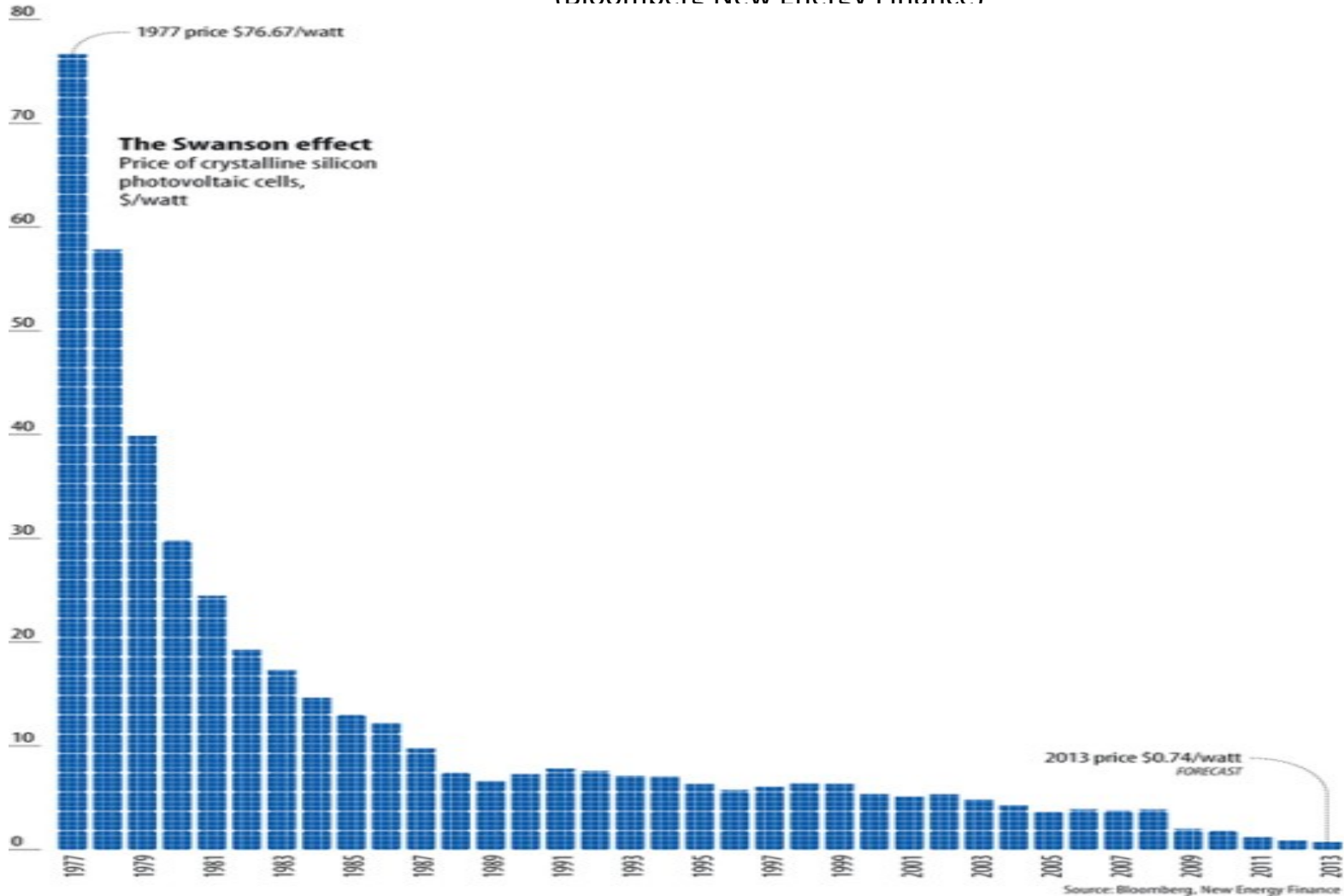
- Drivers: policy and technology together
- Addressing environmental impacts, sustainable development growing energy demand, energy security, efficiency, costs,
- The European and global strategy is dealing with zero-CO2 emissions and motivate the electricity sector to the future with ICT and active consumers
- Increasing share of electricity in the overall energy mix, EV, heat pumps, economic development, global electrification
- Exploitation of the indigenous energy sources, with priority to RES, reducing Europe's dependence from energy imports
- New ideas, innovative technologies, R&D actions and skilled human resources pave the way to clean and affordable energy

The age of renewables has begun

- Centralized generation in decline, retirement of coal plants, to decentralized and decarbonized grid for a cheap energy future
- Millions of distributed generation instead of centralized plants
- The age of renewables has begun, because it is cheaper
- Wind and utility-scale PV competitive to fossil fuels and nuclear
- More reliable technology, very low O&M costs, easy and quick implementation
- Wind and solar PV in some competitive markets through PPA, self consumption and net-metering tools
- Ambitious targets for high RES penetration in the next decades by transforming the network and the market

Solar PV's rapid cost drop of the PV modules

(Bloomberg New Energy Finance)



The Revolution of Storage

- Main drivers: the EV and the electricity networks of the future
- Storage: to face the intermittent character of wind and solar
- High penetration of wind and solar: effective through mix with hydropower (Norway), OCGT by natural gas, DSM tool, large interconnections, curtailment, and finally storage facilities
- Precondition: availability of cheap electricity produced by RES
- Pump storage is an established facility for large storage
- New technologies in distributed storage
- Smart EV with charging and discharging strategies as a tool by the utilities to manage the network

The electricity networks of the future - Smart Grids

- New concept during the last 10 years, ETP for the Electricity Networks of the Future in 2004, integration the new ICT
- New energy sources, wind and solar, OCGT, new challenge to manage millions of distributed generation and storage nodes
- Advanced ICT in the power sector to manage the future grids with new tools, from passive to active consumers
- High flexibility in generation, T&D, consumption, storage
- New structure of the electricity market, new services and large interconnections
- Storage an important component to improve the reliability and the quality of power
- Actions in energy efficiency through advanced technologies

The Utilities and the personal power plants

- High RES distributed generation a huge “negative load” for utilities with impact to conventional central power plants
- Low generation cost by RES led to the self consumption and net metering schemes with negative impact to the utilities
- Rise of personal power plants to unplug from the grid
- Energy efficiency and more RES are shrinking utility revenues
- Mass defection from the grid, a serious problem in viability of grid operator and the consumers, and that future is not far
- Technological, political and regulatory approaches toward a truly integrated system, greater connectivity and smarts, system stability, market operation and viable grid operation
- New services and business model for the utilities

Large Interconnections and the Islands

- Extensive interconnections for system and market operation, reducing price volatility, storage needs and RES curtailment
- Move to a more interconnected power grid in Europe
- HVDC/VSC technology offers high flexibility in RES management and market operation, low losses
- Development of transmission markets and policies for Investments, EU level involvement is required
- Urgent task the interconnection of the Greek islands, with annual benefits >900 million €, substituting oil by RES
- Payback period for interconnection of Crete four years and first step for the EurAsia interconnector for Cyprus and Israel

Conclusion

- Current energy conditions not sustainable, radical actions to actively transform energy supply and end use
- The age of RES has begun and storage follows, for affordable, more reliable and high quality power supply
- Electricity dominant energy carrier rivaling oil, positive contribution by natural gas to replace coal and support RES
- Smart grids and new structure of the electricity market
- New services and business model for the utilities
- Road map for RES and smart grid integration and investment for the future electricity networks

Thank you for your Attention

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