IRENA INNOVATION WEEK 2018

Report from the Rapporteur

Digitalisation & Decentralisation

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Overview - Digitalisation & Decentralisation

Digitalisation and decentralisation are key parts of innovation and in line with global megatrends.

Digitalisation is an enabler for the power sector transformation, managing data, optimising systems, unlocking flexibility, all to integrate more renewable energy (esp. wind and solar) towards decarbonised energy.

Digitalisation plays a role in large systems and wholesale market optimisation (e.g. Europe's Common Grid Model, ENTSO-E Awareness System, Transparency Platform), but particularly much needs to be done with decentralised energy resources and the distribution systems.

It facilitates their physical integration, but it also enables new forms of operation that were not possible previously. Market design is key to enable business models and revenue stacking for distributed energy resources like solar PV, batteries, electric vehicles and heat pumps ("DER").

Digitalisation strengthens the links, coordination, system optimization between all actors in the system, with consumers' investments and behaviour in the center (e.g. during energy scarcities).

Energy usage of data centers and cyber security are concerns. Blockchain systems might help with this.

Digital applications for the energy transition: Blockchain

Majority of blockchain use cases today are around verifying how much renewable energy has been produced, whether for carbon/renewable energy credits or for retail-based transactions around p2p trading or billing. P2P depends on laws and regulations but there are lots of startups and pilots:

189 companies working in blockchain in energy
71 projects focused on blockchain in energy
$466 million invested in blockchain in power

Blockchain can lower transaction costs, increase cyber security and increase visibility for system operators of distributed generation but this depends on evolutions of the regulatory framework. It can enables demand-side flexibility by aggregating, connecting and managing distributed resources, as trialled by TenneT.

Blockchain has the potential to open up new connections in the energy marketplace that by were not previously possible. For example, Electron is opening new forms of collaboration through the creation of marketplaces that can stack multiple bids across the electricity system. SunExchange is opening up new avenues to finance 1 kW-5 MW solar equipment in emerging economies.

Biggest challenges around interoperability of different blockchain platforms as well as being able to connect the digital world with the physical world.

Digital applications for the energy transition: Artificial Intelligence & Big Data

Machine learning is part of AI and AI relies on Big Data. They all are enablers to make best use of new mountains of data and guide human decision makers. The goal is not 100% automation but with the growing complexity of our energy systems, experts alone cannot do the job without the help of data + analytics.

Data is the fuel that powers AI. The quality of AI output depends on the quality of the data input.

Greater complexity requires greater intelligence. The energy system is becoming more complex, electricity is more nonlinear and real-time than fossil fuels, and renewables as well as consumer empowerment and choice bring more uncertainties and degress of freedom. We need greater visibility of the system.

A key AI application for variable renewables integration today is advanced weather forecasts (for wind, solar and demand) integrated with near real-time grid data (e.g. integrating 160 different forecast models). AI can also bring improved long-term infrastructure (grids) planning and asset management.

Through combining AI forecasts with high-resolution price signals and analytics, substantial reductions in energy use have become a reality (e.g. BeeBryte – reducing bills by 10% and energy consumption by 26%).

Careful about energy consumption from IT servers (growing from 2 to 8%).

The new consumer in the digital world

In Finland, smart meters are part of regulation and are fully rolled out. 9% of the retail consumer are exposed to dynamic pricing – with direct connection between retail and wholesale prices.
Consumers are willing to change their behavior if they can see the benefits. Automation is needed, ready made services for the customers are key for demand management and demand response.

Many initiatives to unlock demand side flexibility. In Germany, Sonnen uses small batteries with PV for demand management, providing balancing + congestion mgt services to the grid, and “sharing”. Virtual Power Plant Next Kraftwerke is aggregating distributed energy generation to provide flexibility to the grid. However, regulation to enable fair remuneration of such services and avoiding free-riding, is still missing.

Market design should incentivize the deployment of RE generation in the entire power system, enable the participation of small actors as flexibility providers, and enable a bankable market. Improving competition is challenging, especially as reliability must be ensured. Innovation in grid fees is needed to cover the cost of the grid in a fair manner for all consumers and give right incentives for flexibility or P2P trading.

Decentralized generation is still marginal when looking at the total energy consumption, but it is key to engage the consumer in this energy transition in order to meet the climate goals. Great potential to grow. What payback consumers need to engage their flexibility, depends on automation and “coolness”.

Broadening energy access through innovation

Energy access is a key SDG and interlinked with many SDGs:

- E.g. 4 million deaths due to cooking smokes
- 300 million children without electricity at primary schools
- Unreliable electricity access costs 2% of GDP in Sub-Saharan Africa

60% of people with new access to electricity likely to come through off grid solutions – governance crucial.

Deployment and dissemination of innovations are key challenges. Offgrid solar solutions often implementable faster and cheaper than grid-based ones. Capacity building needs more attention.

Much discussion about financing and risks: Only few kinds of companies and business models that could work in Africa fit easily into the international finance rules. The capital needs to be very patient. Risk perception and actual risk both play a role (e.g. exchange rate fluctuations, government regulations e.g. customs).

Mobile money exists in Africa but not in India, so there are differences between continents.

Make it easy to do the business. Start with the energy needs of the people, especially productive use (it is about people's lives, not about an energy "ladder"). Localized solutions. Ensure product quality to build trust. Don't work in silos. Make it affordable. Maintain scale to go forward and accelerate.

Future Grids: getting bigger and smaller

Grids, often designed and operated on national scale, are getting bigger towards continental and global interconnections, and smaller towards microgrids. Technology enablers: UHV and microgrid controllers.

Why bigger? A global grid is explained by GEIDCO and feasibility-studied by CIGRE – high % of VRE entails large capacity, regional surpluses/deficits, high value of geographic diversity, as transporting VRE surpluses often cheaper than curtailing or storing them. Preliminary CIGRE results encouraging: inter-continental connection capacity of 15% of global installed generation capacity, would lead to less fossil generation, lower costs and reduced CO2.

Why smaller? Resilience and electrifying remote areas (SDG 7!). Much RES connected at distribution level. 12 GW microgrids installed worldwide, most commercial (ca. 40%) and remote (30%), in US 500 MW added per yr.

Balancing will likely happen cooperatively at all levels, from micro- to global grids, also DC grids addressed by IEC. Needs fair trading rules, and environmental and social factors to be included. Chinese global grid vision emphasizes UHV but also smart grids as key to reach RES + consumers. Both big + small grids need to be thought with sector coupling (P2G, heating, mobility). Innovation in planning needed to ensure small/big technologies will be compatible and well-coordinated.

Thank you!

Innovation is about ‘doing it’!