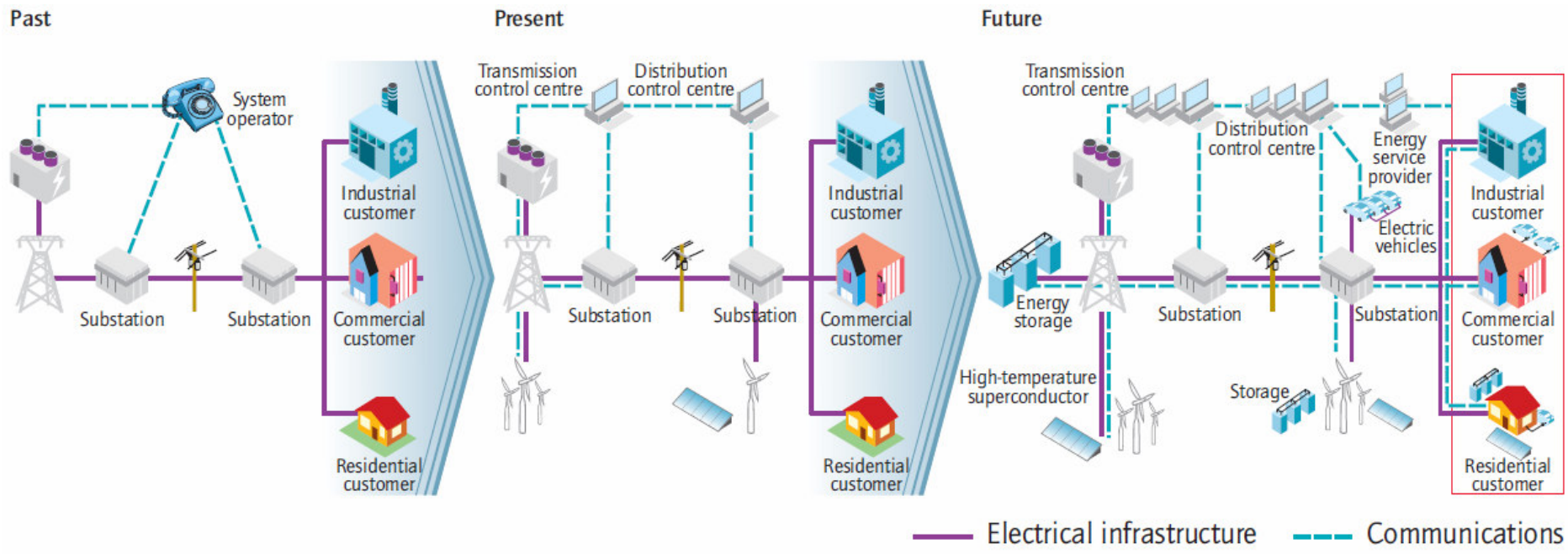
Technology Roadmap

Smart Grids

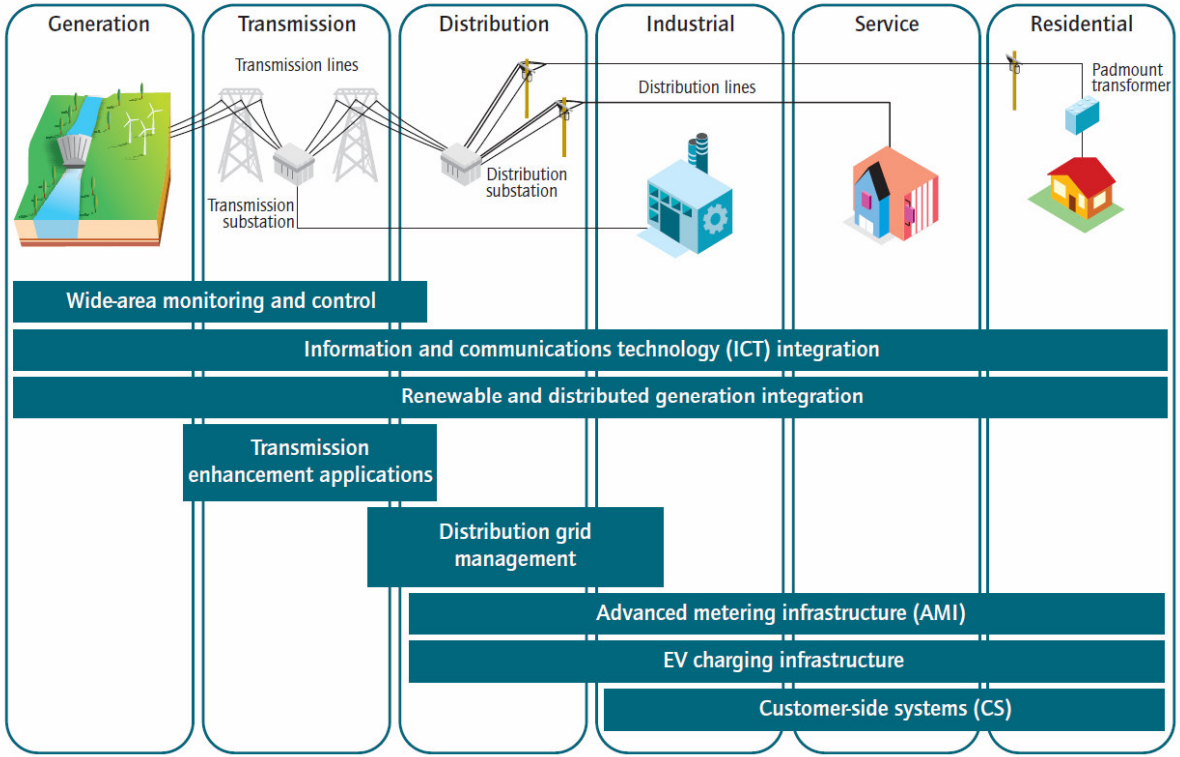
International Energy Agency

Electricity Systems are evolving



Smartening the grid is not a one time event

Smart Grid Technologies



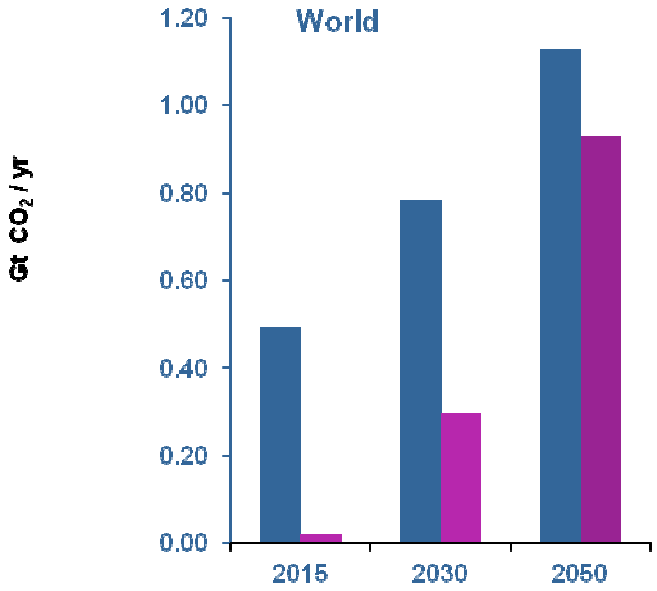
Source: Technology categories and descriptions adapted from NETL, 2010 and NIST, 2010.

Smart grid technologies are applied across the entire electricity system

What can smart grids do?

- Enables informed participation by customers
- Accommodates all generation and storage options (inc. varRE)
- Enables new products, services and markets (inc. DR, EV's)
- Provides the power quality for the range of needs
- Optimises asset utilisation and operating efficiency
- Provides resiliency to disturbances, attacks and natural disasters

Direct and enabled emission reductions



Smart Grids have the potential reduce global CO_2 emissions by over
2 gigatonnes per year by 2050

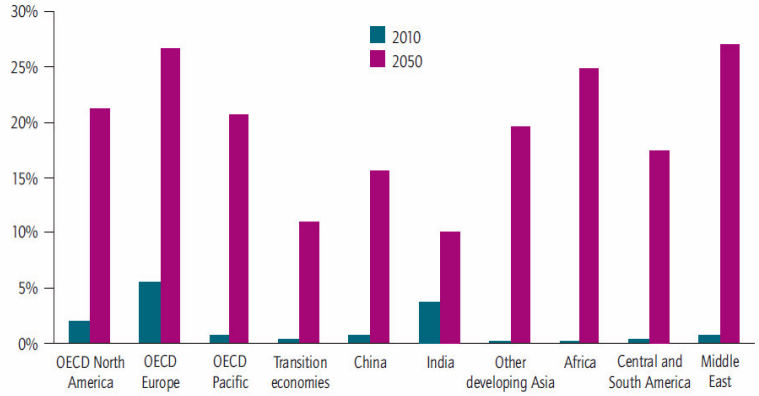
Direct reductions: energy savings from peak load management, continuous commissioning of service sector loads, accelerated deployment of energy efficiency programs, reduced line losses, and direct feedback on energy usage

Enabled reductions: greater integration of renewable and facilitation of EV and PHEV deployment

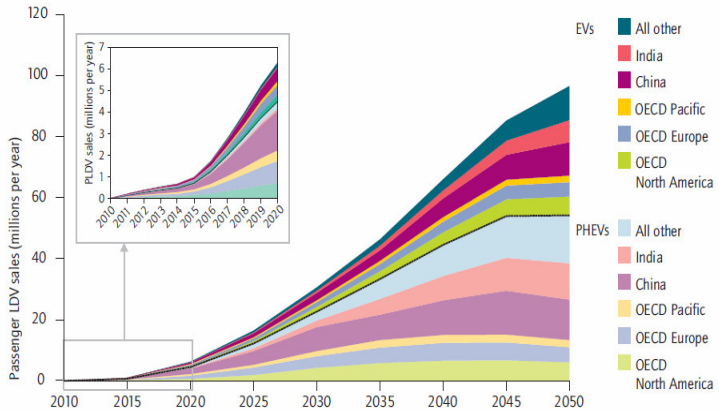
Current and Future Electricity System Data

Electricity consumption growth 2007-50

Portion of variable electricity generation

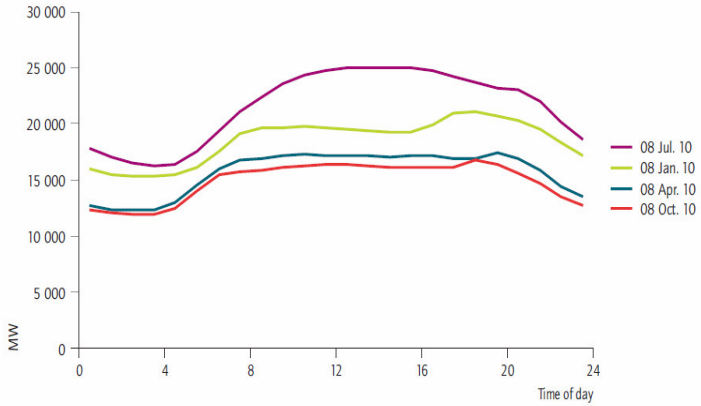


Deployment of EV's and PHEV's



Source: IEA. 2009.

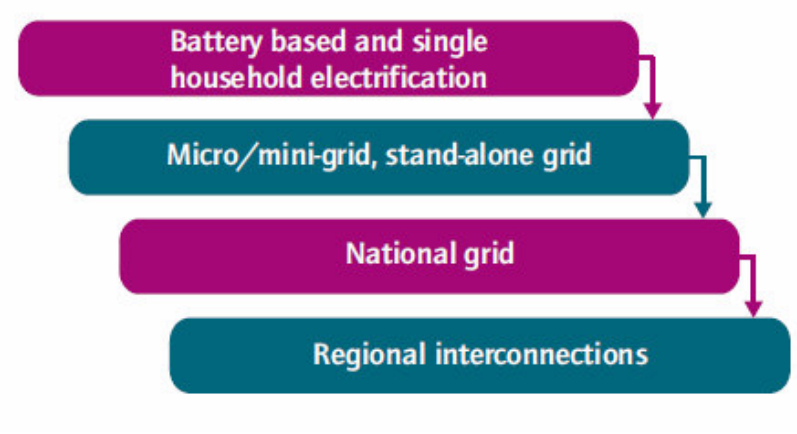
24-hour electricity system demand



Source: Data from Independent Electricity System Operator, Ontario, Canada.[7]

Emerging Countries and Smart Grids

- **Under the right conditions – emerging economies could leap-frog directly to smart grid infrastructure**
- **Targeted analysis and roadmaps – created collaboratively with developed and emerging countries – are required to determine specific needs and solutions in technology and regulation.**



Emerging economies can use smart grids to build from household electrification to community and regional systems

Leading countries and initiatives

- **Japan**
  - Focusing on distribution systems and integration of all energy systems (smart communities/smart cities concept)
- **Korea**
  - Has announced plans to implement smart grids nationwide by 2030
- **Norway**
  - Established the Norwegian Smart grid Centre to promote and encourage research, development, education and innovation.
- **USA**
  - USD 4.5 billion was allocated to grid modernisation under the American Recovery Reinvestment Act of 2009
- **Italy**
  - Through the Telestore project have invested over €2.1 billion, implementing more than 33 million smart meters, completed the automation of more than 100,000 MV/LV distribution substations, and radical change in the management of the operating of the system

Smart grid deployments must reflect regional needs and conditions. A "one-size-fits-all" does not apply to the deployment of smart grids.

Smart grids:

Accelerating electricity system evolution to achieve shared goals for energy security, economic development and climate change mitigation.

For more information:

www.iea.org/roadmaps

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Thank you