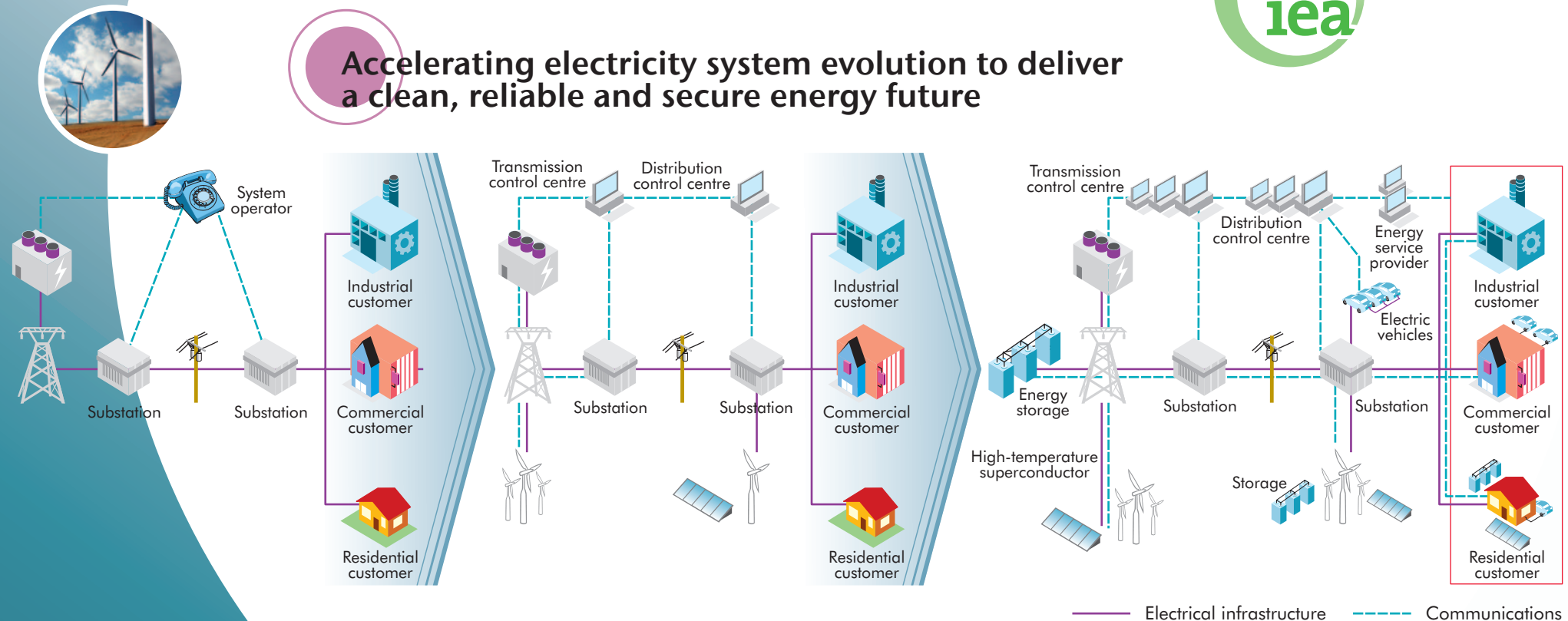


Accelerating electricity system evolution to deliver a clean, reliable and secure energy future



Key findings

► Technology

- Large-scale systems-based demonstration of mature and nearly mature smart grid technology is urgently needed to determine solutions that can be deployed at full scale
- Solutions that integrate smart grid technologies with existing electricity infrastructure is essential
- The “smartening” of grids is already happening through incremental investments in modernisation - it is not a one-time event
- Under the right conditions emerging economies can conceivably leap frog directly to smart electricity infrastructure
- Global smart grid technology standards are needed to optimise and accelerate technology development and deployment while reducing costs for all stakeholders

► Comprehensive Strategies

- Physical and institutional complexity of the electricity system makes it unlikely that the market alone will deliver smart grids. Government, private sector and customer and environmental

advocacy groups must work together to define electricity system needs and determine smart grid solutions

► Electricity System Markets and Regulation

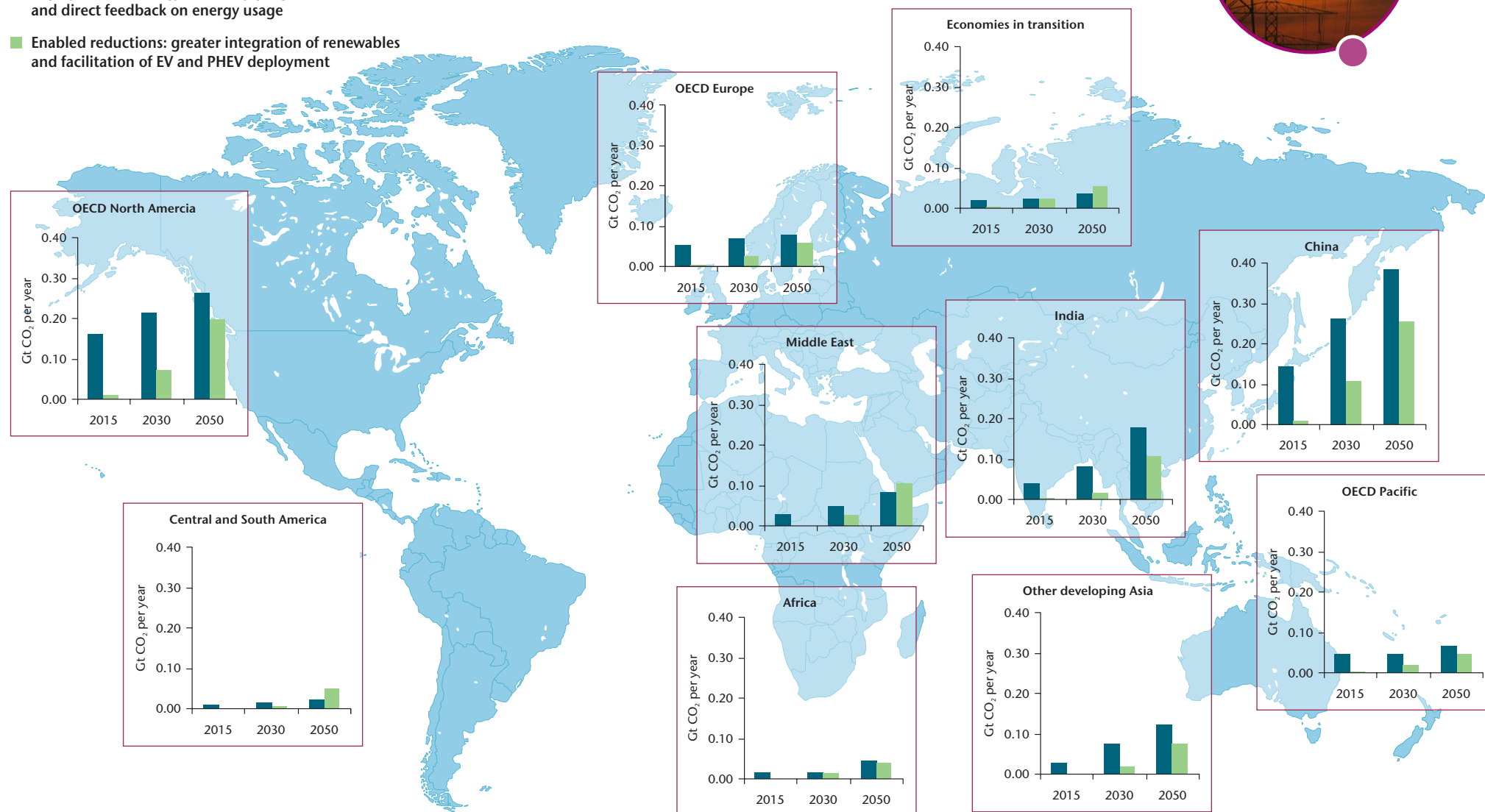
- Current regulatory and market systems can be a barrier to smart grids demonstration and deployment. Regulatory and market models - such as those addressing system investment, prices and customer participation - must evolve as technologies offer new options over the course of long-term incremental smart grid deployment

► Consumer Policy

- Regulators and consumer advocates must engage in system demonstration and deployment to ensure customers benefit from smart grids
- Building awareness and seeking consensus on the value of smart grids must be a priority with energy utilities and regulators having a key role to justify investments

Regional smart grids CO₂ emission reduction potential

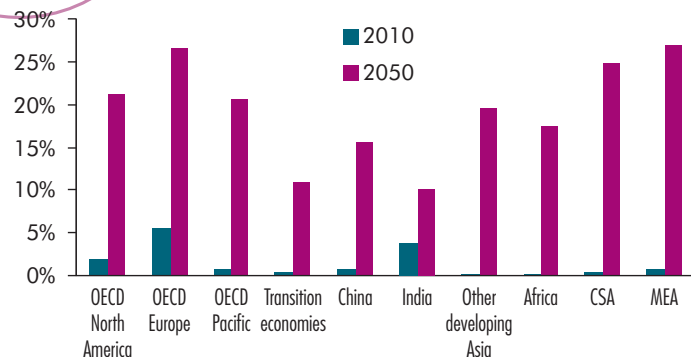
- Direct reductions: energy savings from peak load management, continuous commissioning of service sector loads, accelerated deployment of energy efficiency programmes, reduced line losses and direct feedback on energy usage
- Enabled reductions: greater integration of renewables and facilitation of EV and PHEV deployment



Smart Grids have the potential to reduce global CO₂ emissions by over 2 gigatonnes per year by 2050

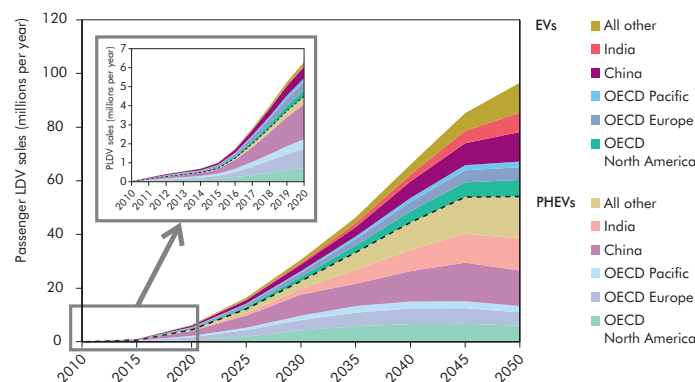
Why the grid needs to be smart

% variable generation by region

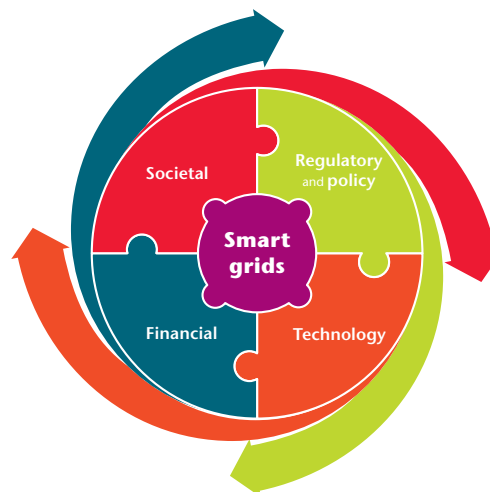


Climate and security goals will necessitate large-scale deployments of variable generation such as wind, solar and combined heat and power. Smart grids will enable high penetration of these resources while maintaining system reliability and stability.

EV/PHEV roadmap vision for growth to 2050

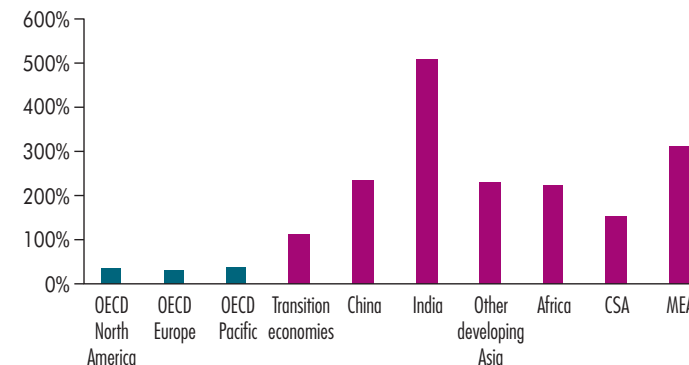


Electricity demand for transportation will reach 10% of total demand by 2050 under the EV/PHEV roadmap scenario. Smart grids will facilitate effective management of EV/PHEV and avoid negative impacts on electricity system performance.



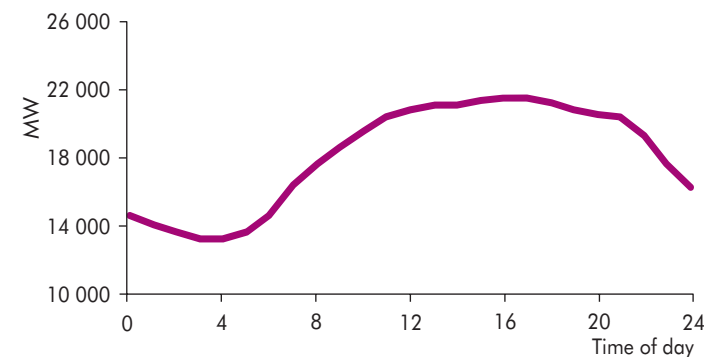
Smart grids will increase electricity system information and transparency, improving the ability to make system investment decisions to address aging infrastructure and demand growth while enabling the sharing of costs and benefits with all stakeholders.

Blue Map % growth from 2007 - 2050



Electricity demand will grow globally. Smart grids can provide grid efficiency improvements, better asset utilisation, and foster growth and significantly reduce electricity system losses in emerging economies through construction of smart infrastructure.

System electricity demand



Peak demand is growing faster than overall demand in many regions. Smart grids can reduce peak demand by deployment of advanced system operation and customer programmes.

Actions for key stakeholders

► Electricity generators

Utilise flexibility and enhancements delivered by smart grids to evolve generation mix by increasing use of variable generation to meet demand growth, decrease emissions and decrease fuel security concerns

► Transmission and distribution system operators

Demonstrate smart grids together with business models that share both benefits and costs with customers in order to gain regulatory approval and customer support

Lead education in collaboration with other stakeholders on the values of smart grids, especially with respect to system reliability and security benefits

► Government and regulators

Collaborate with public and private sector stakeholders to determine regulatory and market solutions that can mobilise private sector investment in the electricity system

Recognise that smart grid deployments should reflect regional needs and conditions — a “one size fits all” does not apply to the deployment of smart grids

Plan for evolution in regulation along with technology development — new technologies will offer new regulatory options

Invest in research and demonstration that provide insights into behavioral aspects of electricity use.

► Technology and solution providers

Deliver full technology solutions to system operators through partnership with others in the value chain to address concerns with technology system integration and long term post installation support

Develop standards in participation with industry and government stakeholders to ensure interoperability of system components and reduce risk of technology obsolescence

► Consumers and consumer advocates

Develop understanding of electricity system reliability, quality, security and climate change benefits of smart grids. Help develop regulatory and market solutions that share investment costs and benefits with all consumers

Actively engage in developing system demonstrations and deployments in order to ensure consumer contribution to and benefit from future electricity systems and markets

► Environmental groups

Support the development of smart grids necessary to support a range of environmental technology deployments such as wind, solar and electric vehicles

Smart grids deployment can be optimised only through the active collaboration of all stakeholders on a regional and international basis