

Workshop 2: Scenarios for 2050 with high RES shares

Renewable-based electrification and its role in energy service transformation towards 2050



State Grid Energy Research Institute CO., Ltd
IRENA Innovation and Technology Centre
Energy Internet Economy Research Institute, State Grid CO., Ltd
June, 2019



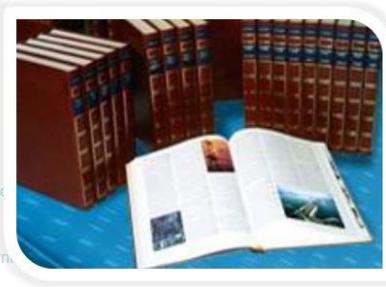
SGERI

State Grid Energy Research Institute (SGERI), the think tank of State Grid Corporation of China (SGCC), is an exclusively-invested subsidiary of SGCC, specialized in soft sciences research and consulting services for critical decision-makings.



能源电力发展与能源经济研究
Energy and Power Development and Energy Economics

- 宏观经济研究 Macroeconomics
- 能源电力与经济社会发展关系研究
Relationship between Energy and Economic Social Development
- 能源电力供需预测及预警研究
Demand of Energy Forecasting and Early-Warning
- 能源电力发展战略与规划研究
- 能源综合运输体系研究
- 能源电力结构及能源替代研究
Structure of Energy and Energy Substitute



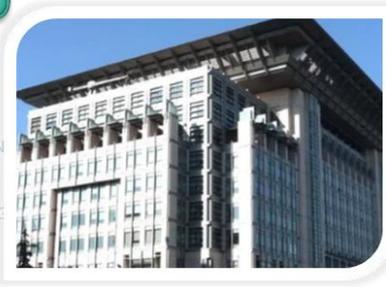
能源体制机制与政策研究
Energy Structure and Policy

4 Areas
30 specific direction



电网发展与管理决策支撑研究
Grid Development and Management Decision-Making Support

- 能源电力体制研究
- 能源电力市场研究
- 能源电力价格研究
Energy and Power Tariff
- 电网与新能源协调发展研究
Coordinated Development of Power Grid and New Energy
- 智能电网发展战略与规划研究
Development Strategy and Planning of Smart Grid
- 智能电网综合评价研究
Comprehensive Evaluation on Smart Grid

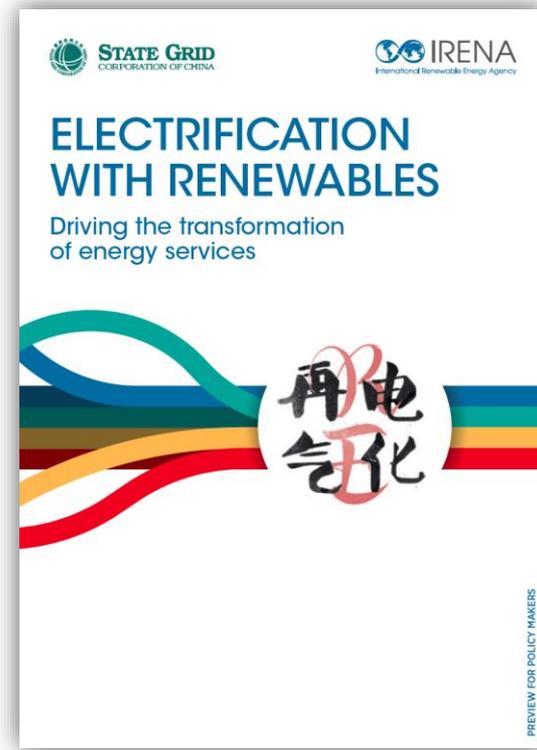
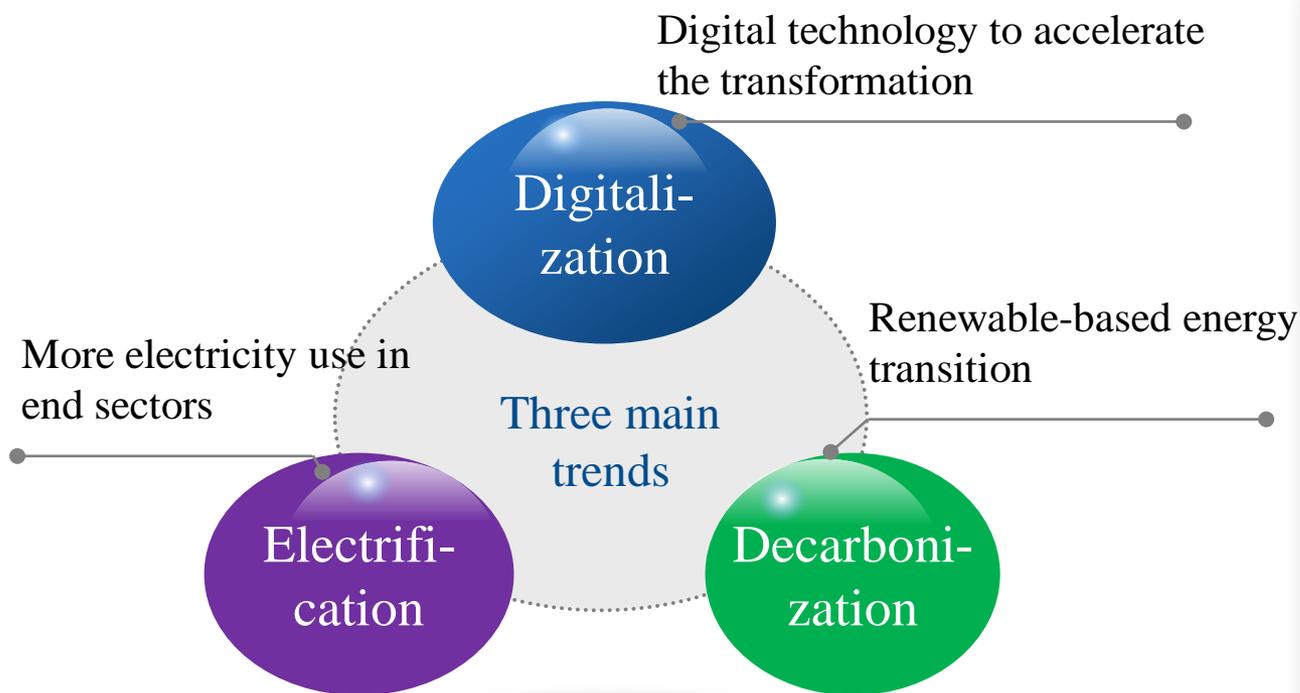


企业发展与管理决策支撑研究
Corporate Development and Management Decision-Making Support



The first Joint report of the State Grid and IRENA:

“**Electrification with renewables: Driving the transformation of energy services**” is a SGCC-IRENA joint report, with focus on the pathway towards future energy transformation driven by deep decarboni-zation, and the key is to find a strategy to meet the large-scale utilization of renewable energy and electrification of end-use sectors, by top-level design of policies and market,





The abstract of the SGCC-IRENA Joint report **was released on the 9th IRENA Assembly** on January 2019.

IRENA: Established in 2011, as **the world's only one Inter-governmental Organization in renewable energy.**

- Assembly
- Council
- secretariat

- **160** members
- **24** states under access



Mandate

IRENA plays a leading role in the transformation of the global energy system as a centre of **excellence for knowledge and innovation**, a **global voice of renewable energy**, a **network hub for all stakeholders** and a **source of advice and support for countries.**



The on-going cooperation was based on the common sense of energy transformation trends towards Energy Internet and the complementary advantages of IRENA and SGCC.

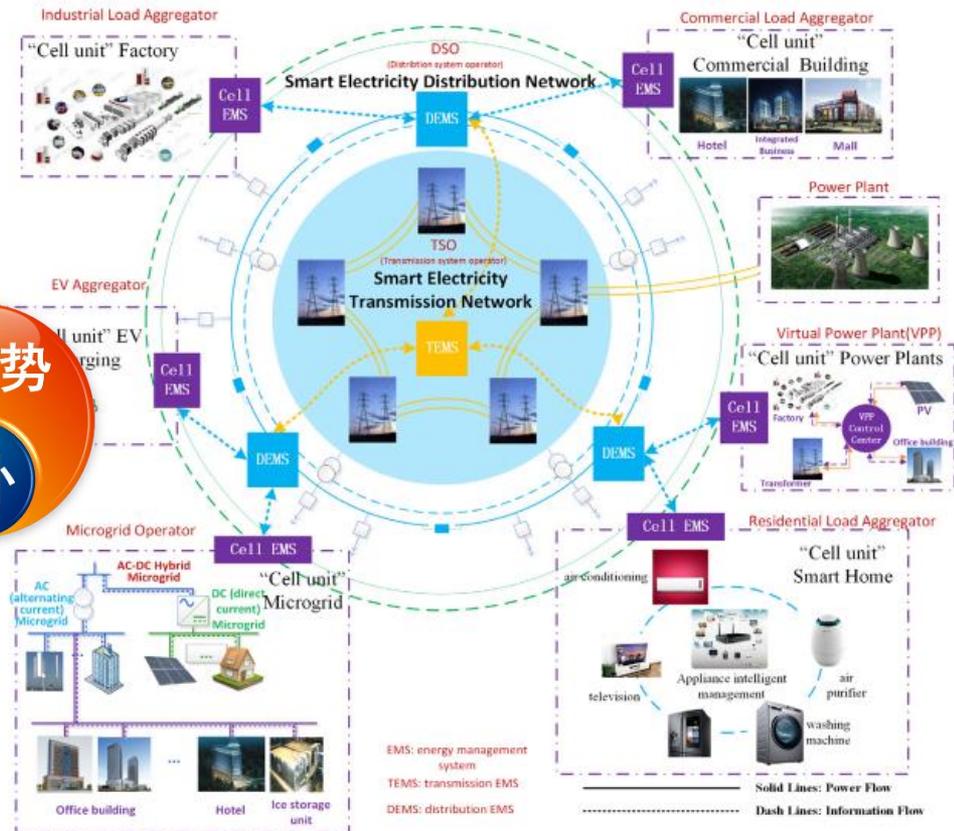
System Innovation and Application advantages of SGCC:

- Smart EV Internet Platform
- New Energy big data (Cloud) Platform
- China Energy&Electricity Outlook
-

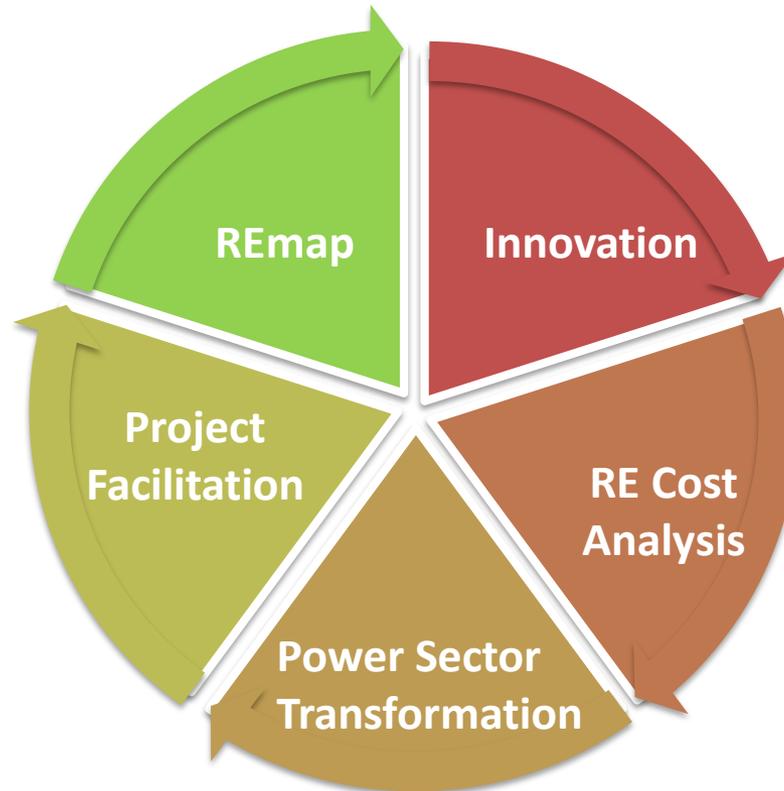


Basic research and data resource advantage of IRENA:

- GET roadmap 2050
- Long-term Energy Scenarios
- Innovation Landscape
- Renewable data Platforms.....



The research was carried on by SGERI and IRENA Innovation and Technology Centre (IITC) joint team.



- Chart technological and sectoral pathways to doubling RE shares



- Facilitate the development of bankable renewable energy projects



- Provide policy recommendations and technology outlooks



- Analyse Renewable Power Generation Costs and Competitiveness Indicators

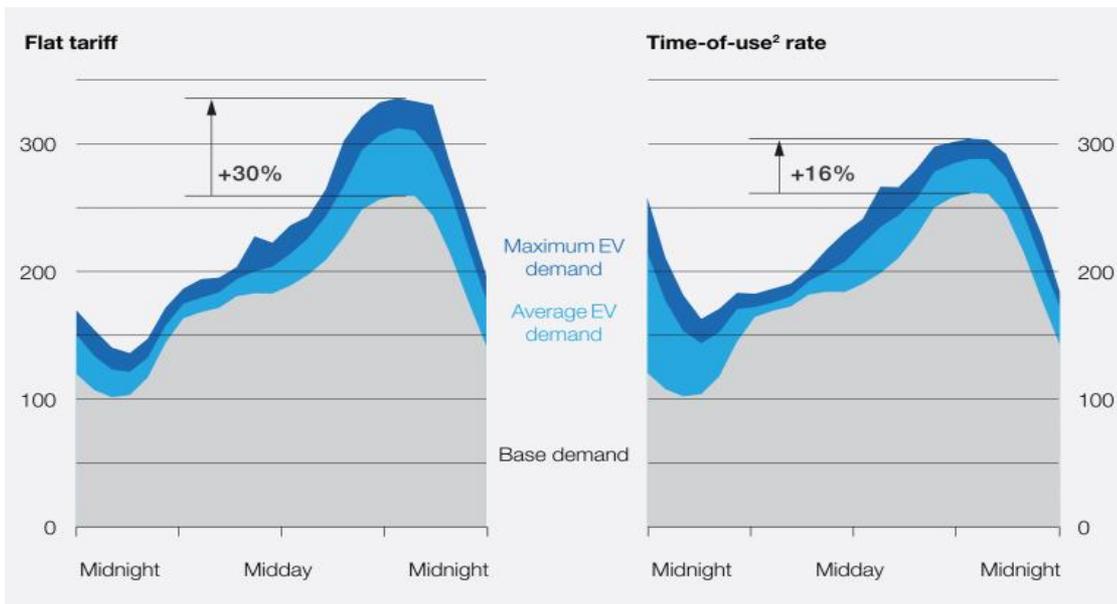
IITC teams and publications



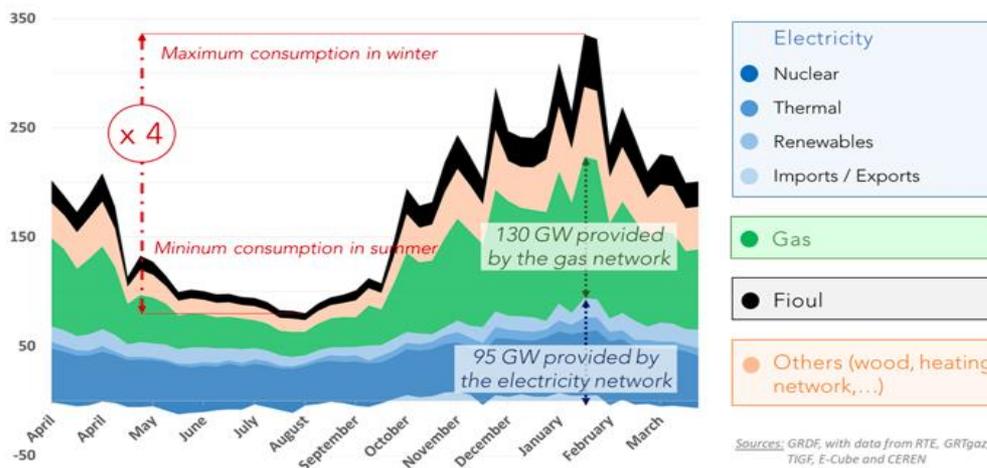
IRENA-SGCC joint report “Electrification with renewables: Driving the transformation of energy services”



Why we need Smart Electrification Strategy?



Source: (Engel et al., 2018)



Source: (Sauvage, 2018)

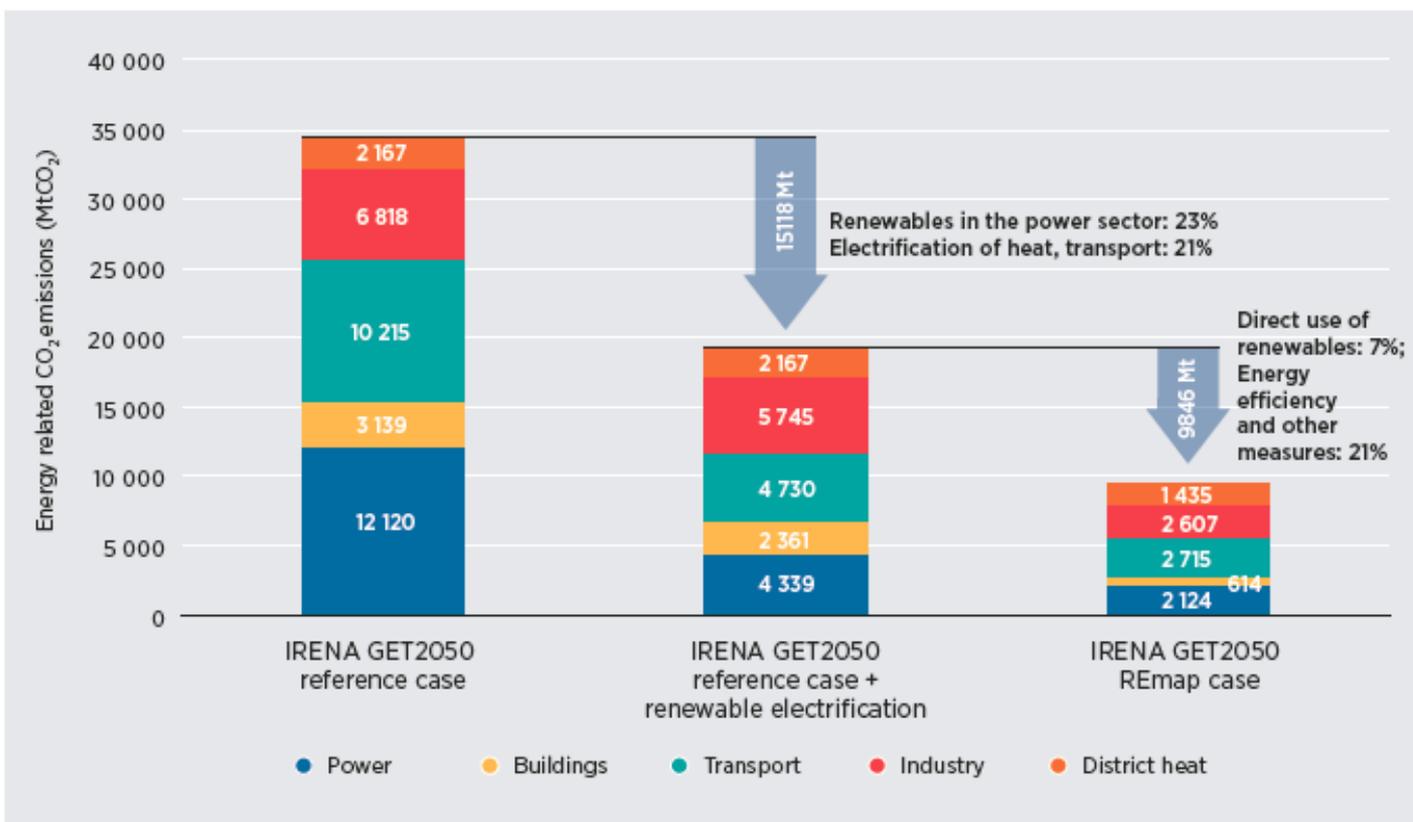
Sources: GRDF, with data from RTE, GRTgaz, TIGF, E-Cube and CEREN



RE-electrification: A vital pathway

- » Digitalization – electrification of energy service is pervasive
- » Smart technologies – growing amounts of cheap renewable energy is integrated
- » Unlocking synergies – electrification of end-use sector and integration of renewable energy
- » Flexibility – RE-electrification strategies meet emerging operational challenges by looking beyond the generation side of the power system
- » Challenges – political will is needed and market transformation will take time, and new infrastructure needs to be built

A profound transformation of global energy use



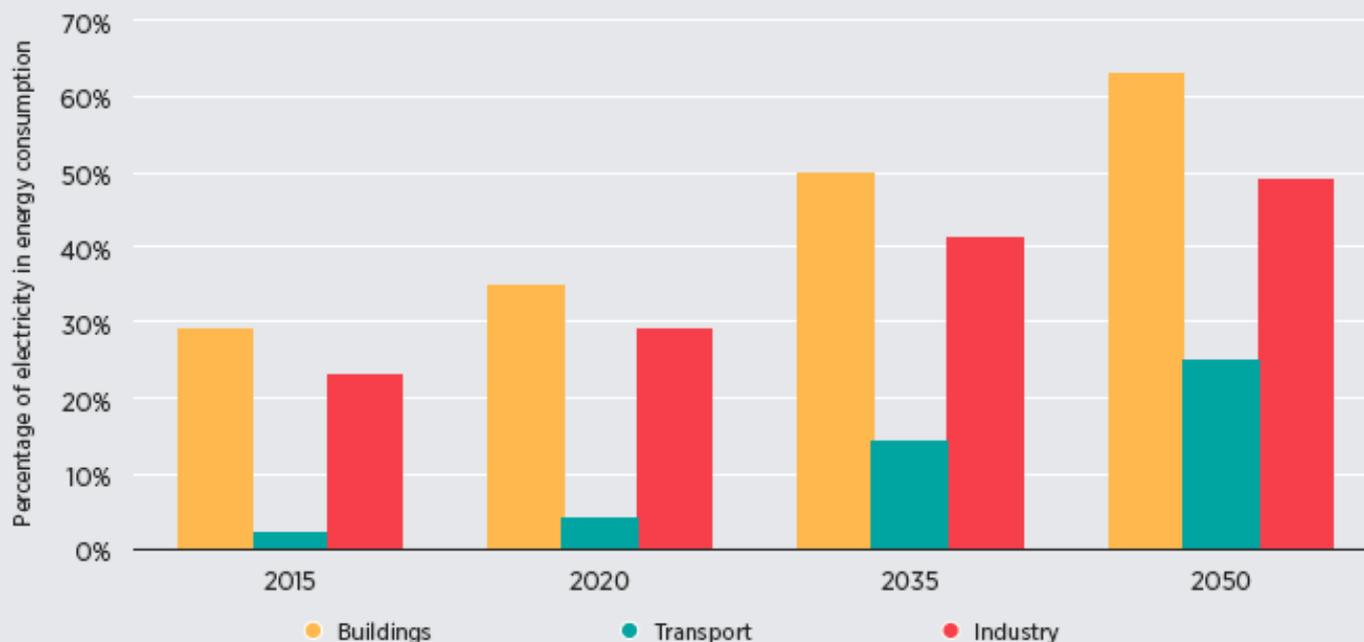
- » IRENA analysis: the overall impact of RE-electrification could reduce total energy sector emissions by 44% in 2050 compared a reference case
- » Largest declines in the power sector, followed by transport

Notes: CO₂ = carbon dioxide; MtCO₂ = million tonnes of carbon dioxide.

Source: IRENA's own analysis based on IRENA (2018a)



Potential for high electrification rates in the SGERI China RE-Electrification Scenario



Buildings

Transport

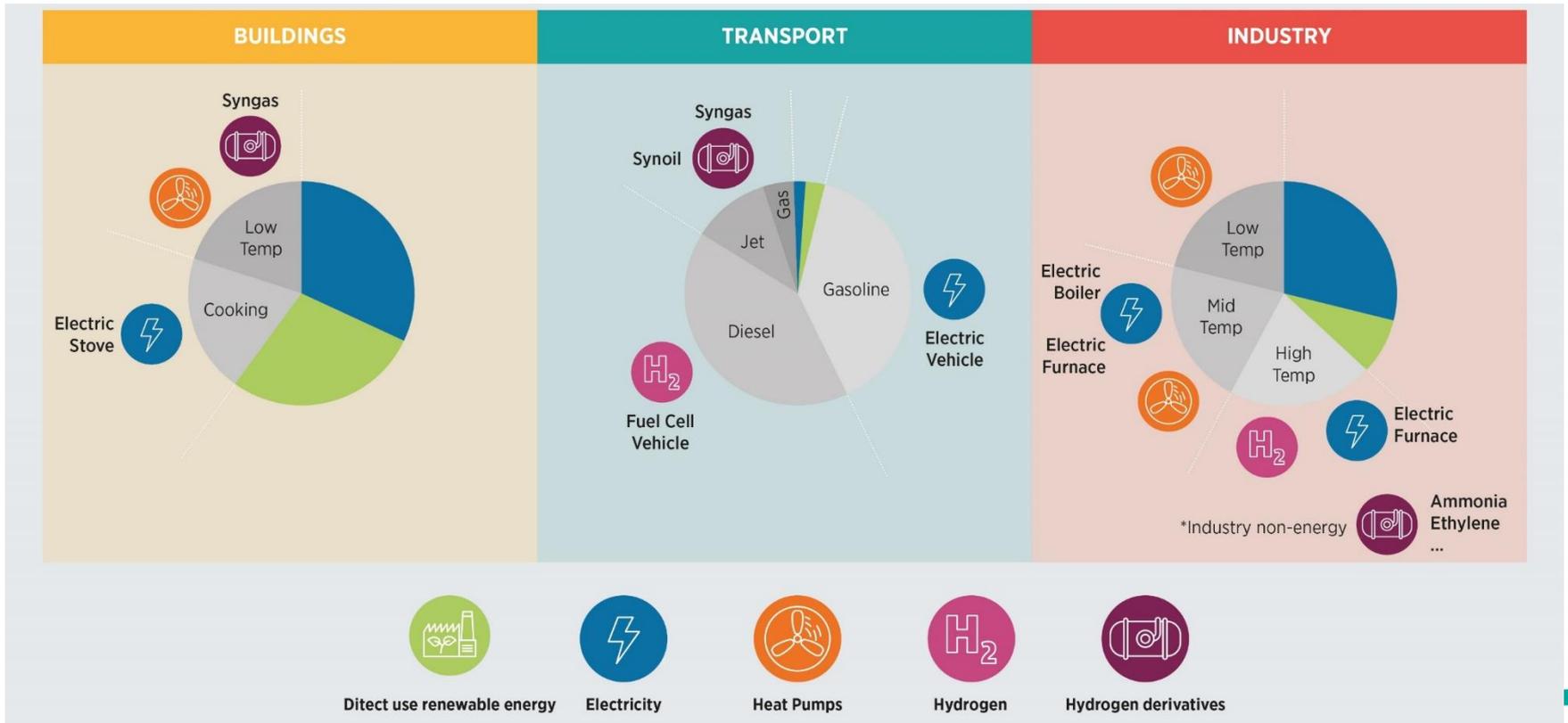
Industry



- » SGERI analysis: China leads a global trend, with the overall share of electricity in final energy consumption potentially up to 47% by 2050
- » Largest shares in the buildings and industry sectors



Potential future RE-electrification options





Network investment

- » Smart RE-electrification reduces peak-load grid costs
- » Smart grid investment pays off beyond peak-load savings
- » Transmission investment needs depend on resource location
- » Economic case for hydrogen production infrastructure still needs to be established

Network investment implications need to be taken into account when evaluating an optimal combination of RE-electrification pathways.



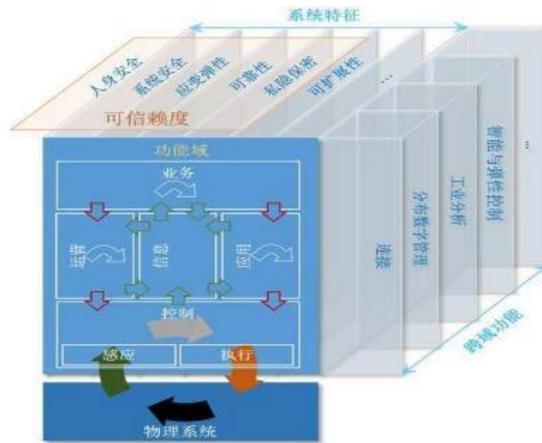
Priority for policy makers

- » Develop a long-term vision of the role of electricity in the country's energy system
- » Develop detailed roadmaps to fulfil that vision
- » Adapt regulations
- » Scale up pilot projects
- » Support key research areas

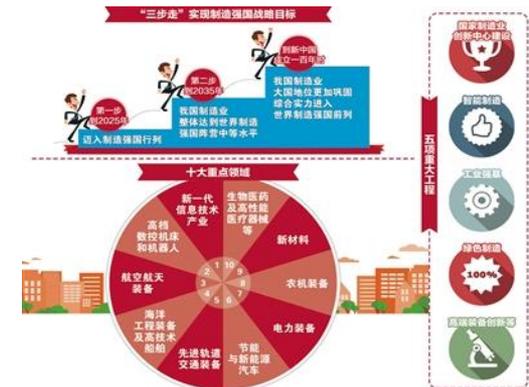
There is a trend of industry internet construction around the world, and State Grid has the opportunity to lead the trend in power sector by the proposal of Internet of Things in Electricity.



INDUSTRIE 4.0, Germany



Industrial Internet and Advanced Manufacturing plan 2.0, USA



“China Manufacturing 2025” Strategy

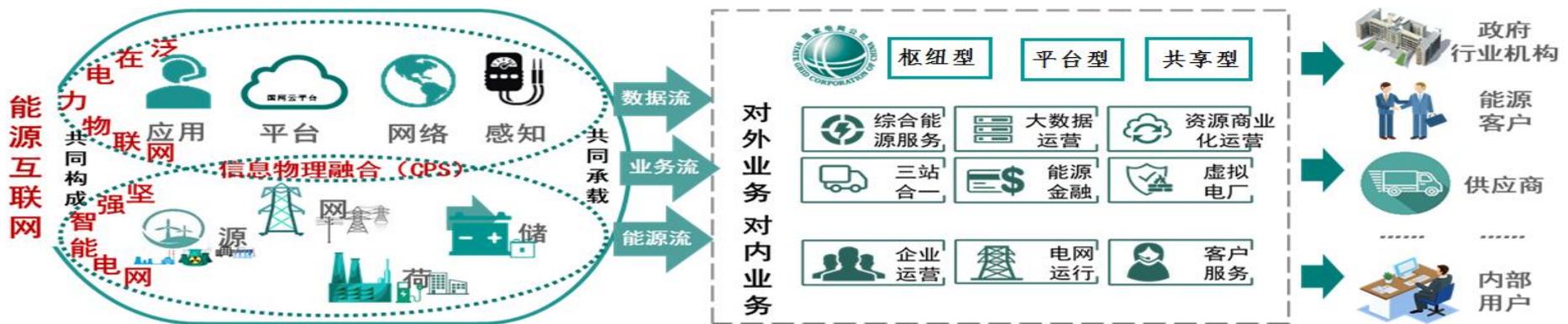
能源互联网 = 坚强智能电网 + 泛在电力物联网

Energy Internet = Strong&Smart Grid + Internet of Things in Electricity

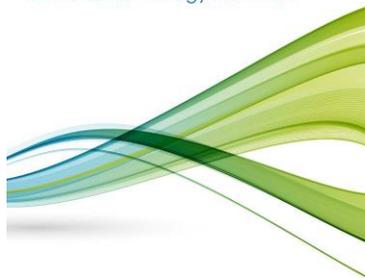


Internet of Things in Electricity construction tasks

SGCC has carried on **57 tasks** focusing on Internet of Things in Electricity construction and **16 pilot projects**, including the platforms to manage and serve for electric vehicle, energy storage, virtual power plant, and new energy, while digital technologies such as big data and block chain are widely employed.



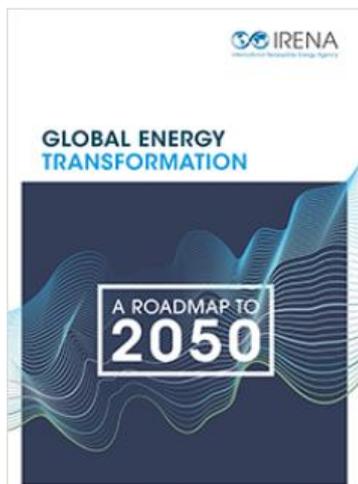
LONG-TERM ENERGY SCENARIOS
for the clean energy transition



First-year campaign findings

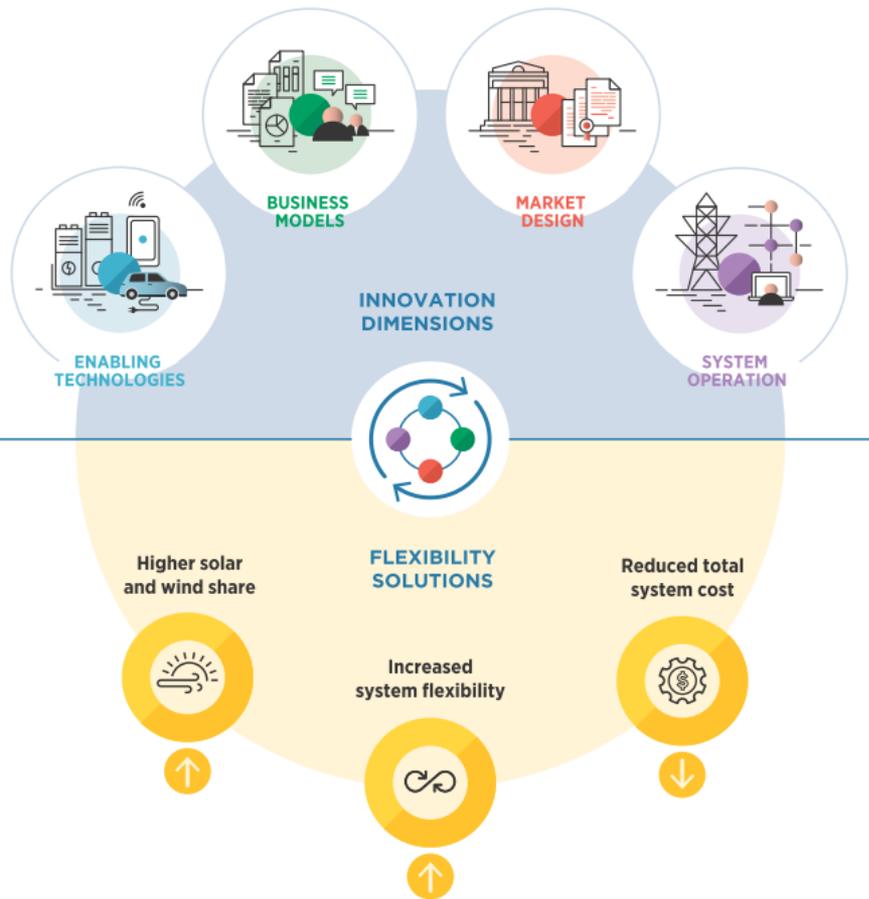
May 2019

Long-term energy scenarios as a tool



2050 Roadmap

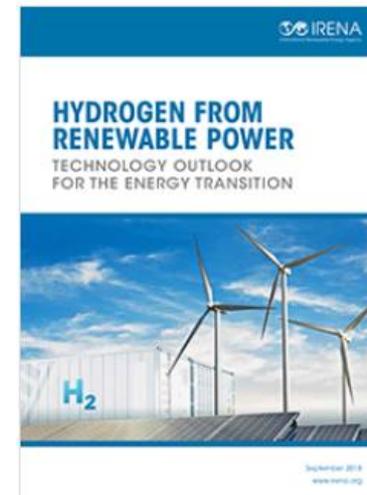
Other related activities and publications



Research framework of some key reports



Innovation system as an accelerator



Deep decarboni-zation

Long-term energy scenarios for the clean energy transition

A new campaign under Clean Energy Ministerial



Goal: promote the wider adaptation and improved use of long-term model-based energy scenarios

Use of scenarios for policy making

- » **Share experience** in the use and benefits of energy scenario modelling for national and regional policy planning

Development of scenarios for clean energy transition

- » **Showcase new tools & methods** to address new, disruptive elements of transition
- » **Improve modelling** of end-use sectors, sector coupling, and variable renewable energy integration
- » **Identify research gaps**

Building capacity

- » **Identify channels to build capacity** for long-term scenario development in countries with limited experience
- » **Act as platform** to promote and coordinate ongoing, successful capacity building initiatives

<https://www.irena.org/energytransition/Energy-Transition-Scenarios-Network/Long-term-Energy-Scenarios-Campaign>

IRENA as the operation agency, SGCC as a key technical partner.

Operation of the LTES campaign



• IRENA, CEM, member countries, technical partners

Organisation

• Germany and Denmark



Stakeholder engagement

• Campaign coordination calls, webinars, hosting events.

Communications

• Social media, focal points, website

IRENA @IRENA

Long-term energy scenarios have become an invaluable tool, both to facilitate int'l debate & guide national policy-making. @CEMSecretariat's LTES Campaign & @IRENA are organising a series of webinars. Learn more & register here: bit.ly/2JrvxqY



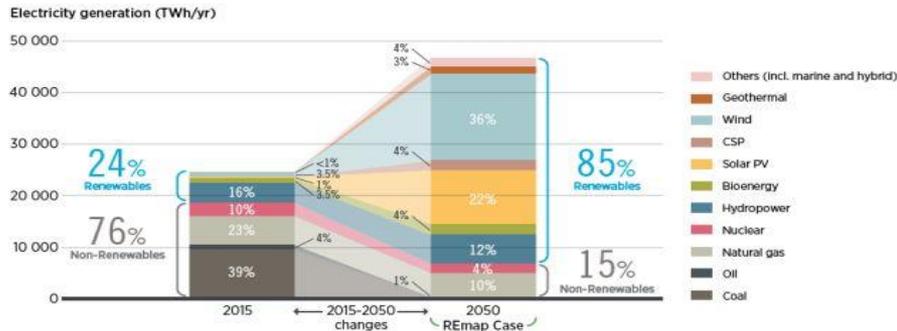
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Global Energy Transformation Roadmap to 2050

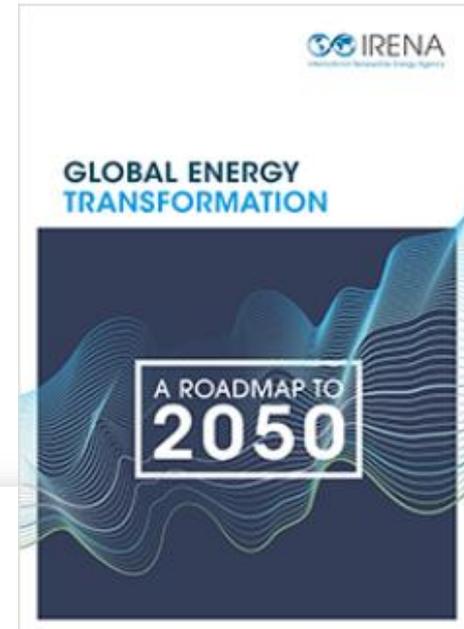
A long-term pathway to energy system decarbonization:

- In line with the Paris Agreement goal of keeping global warming below 2C.
- Based on high energy efficiency and renewable energy.
- In 2050 REmap scenario, **RE energy would be 2/3 in energy supply, and RE power accounts 85%.**

Figure 15. The rising importance of solar and wind energy in the power sector
Breakdown of electricity generation, by source (TWh/yr)



Gross power generation will almost double with renewable energy providing 85% of electricity.



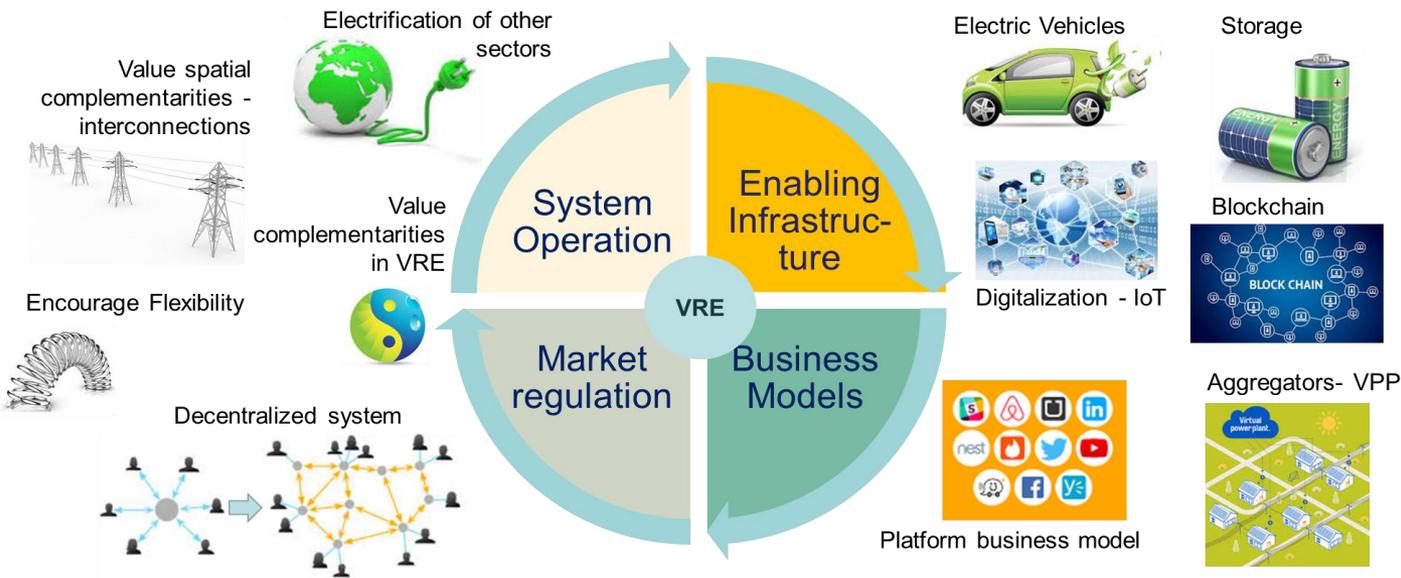
GLOBAL ENERGY TRANSFORMATION



2019 EDITION

Innovation Landscape Report:

The report focus on how to promote renewable energy deployment by **30 innovations of enabling technologies, business models, market design, and system operation**, for a renewable-powered future with high-level VRE integration.



Source: IRENA Report on Systemic Innovation for the Renewable Power Sector

IRENA Innovation Week 2018

3 days of
discussions

18 sessions
in 3 tracks

Over 80 expert
speakers

Over 350
participants

Over 70
countries

Bonn, Germany, 4 to 7
Sept. 2018.

Aim was to: **inspire & inform** decision makers;
showcasing solutions
from around the world

Discussed latest developments in **enabling technologies, business models, system operation** and **market design** that are:

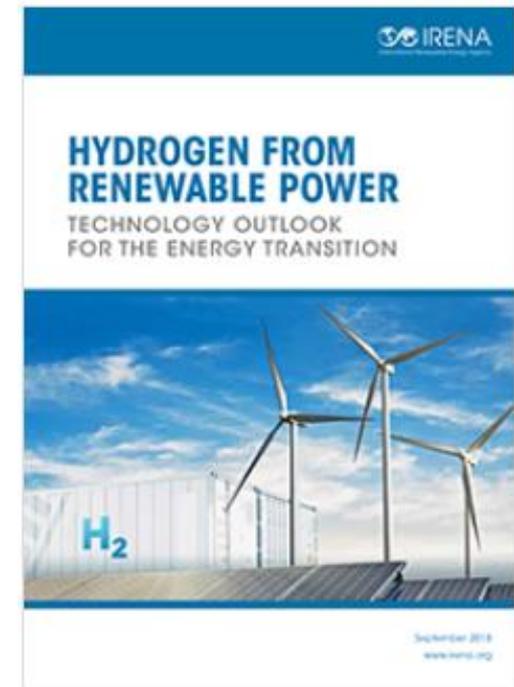
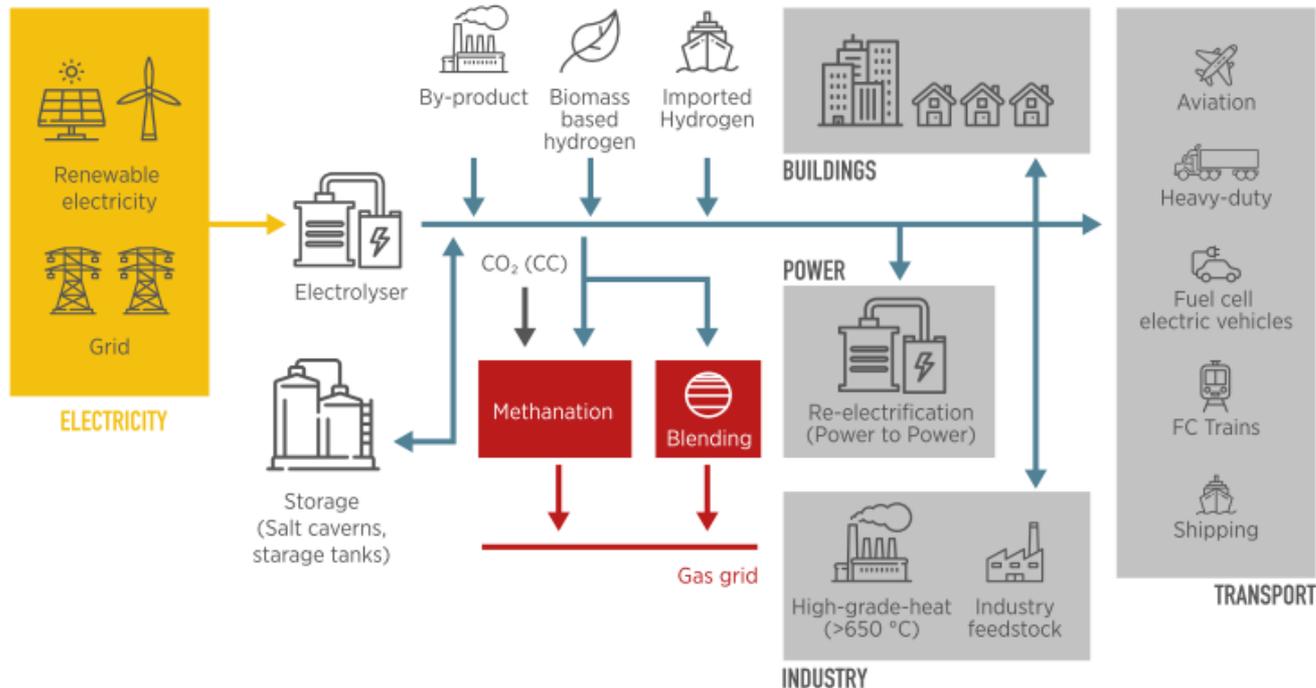
- Enabling the much higher deployment of variable renewable energy sources, such as solar and wind;
- Increasing the flexibility of power systems to integrate variable renewable generation at lower costs than present options;
- Supporting the increased electrification of the end-use sectors of transport, industry and buildings, powered by renewable electricity.

An overview of the event, together with video of each session can be found at <http://innovationweek.irena.org>.



Hydrogen from renewable power

Around **one-third** of energy-related emissions currently have no economically viable options for deep decarbonisation, hydrogen could be the “**missing link**” in the energy transition from a technical perspective.



All the IRENA reports are with open access at <https://irena.org/publications>



国家电网
STATE GRID

国网能源研究院
STATE GRID ENERGY RESEARCH INSTITUTE

Thank you!

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