



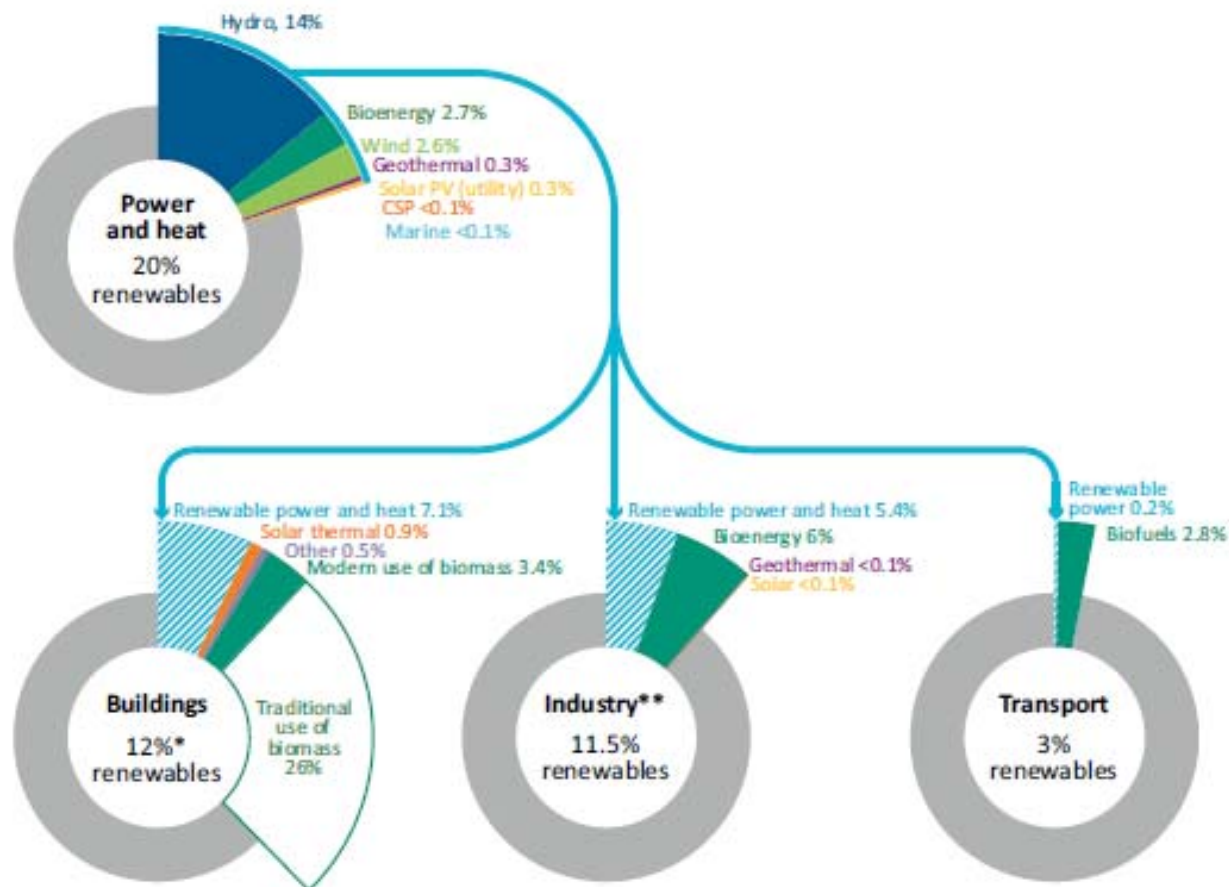
# Renewable Energies for Industries

*Paolo Frankl  
Head, Renewable Energy Division  
International Energy Agency*

*IEA-EPRI Workshop, 29-30 Nov. 2016, Washington DC*

# Renewables in the present energy mix

World share of renewable energy by sector and type, 2014

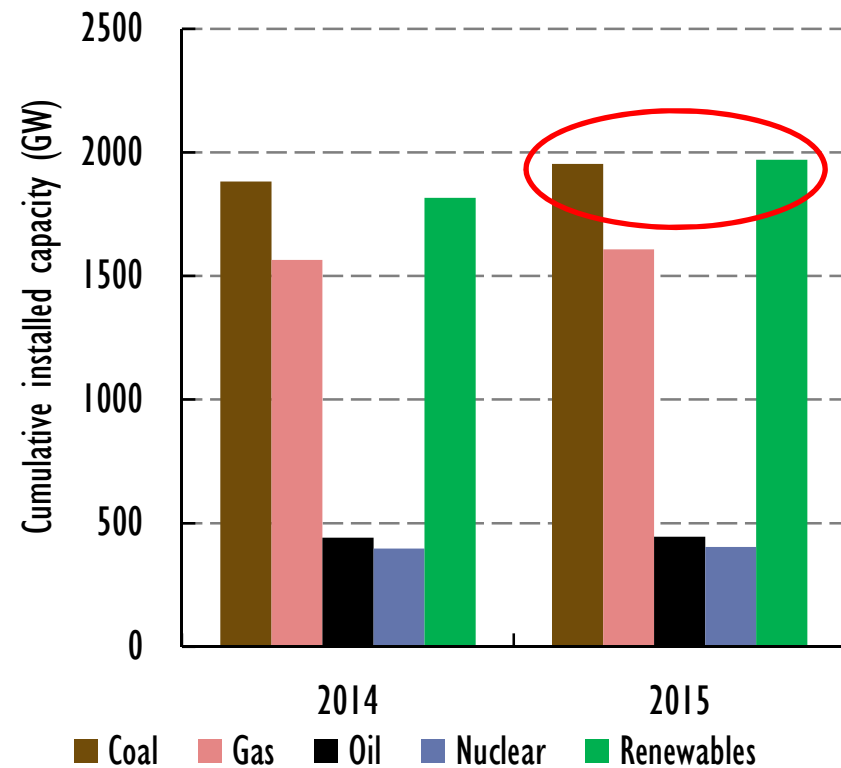
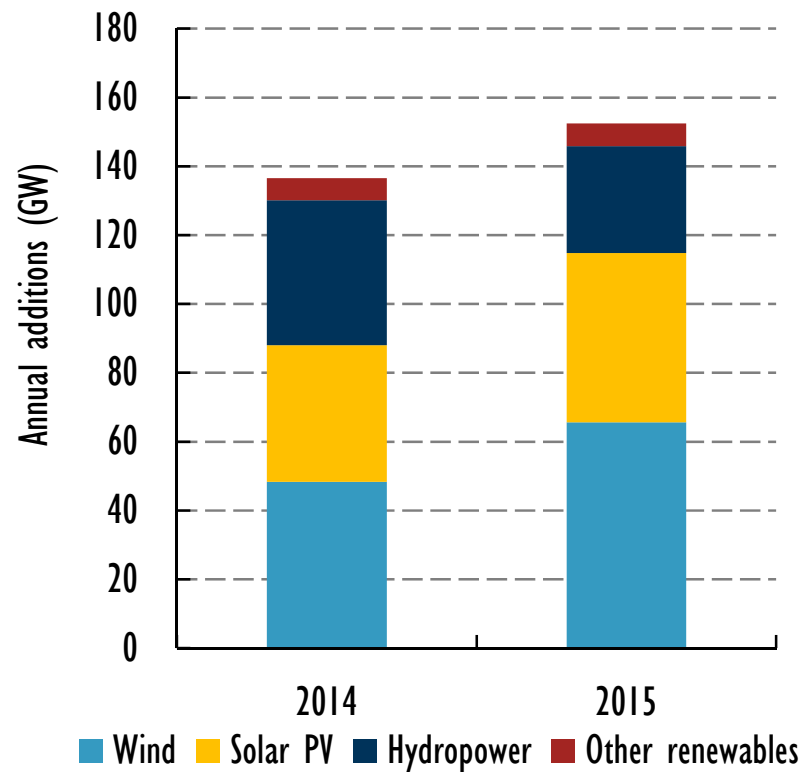


Power is leading the transition to renewable energy; other sectors lag behind

\* Excludes the traditional use of biomass. \*\* Includes blast furnaces and coke ovens in industrial energy use.

# 2015: a record year for renewables

Renewable additions (2014-15) and cumulative installed power capacity



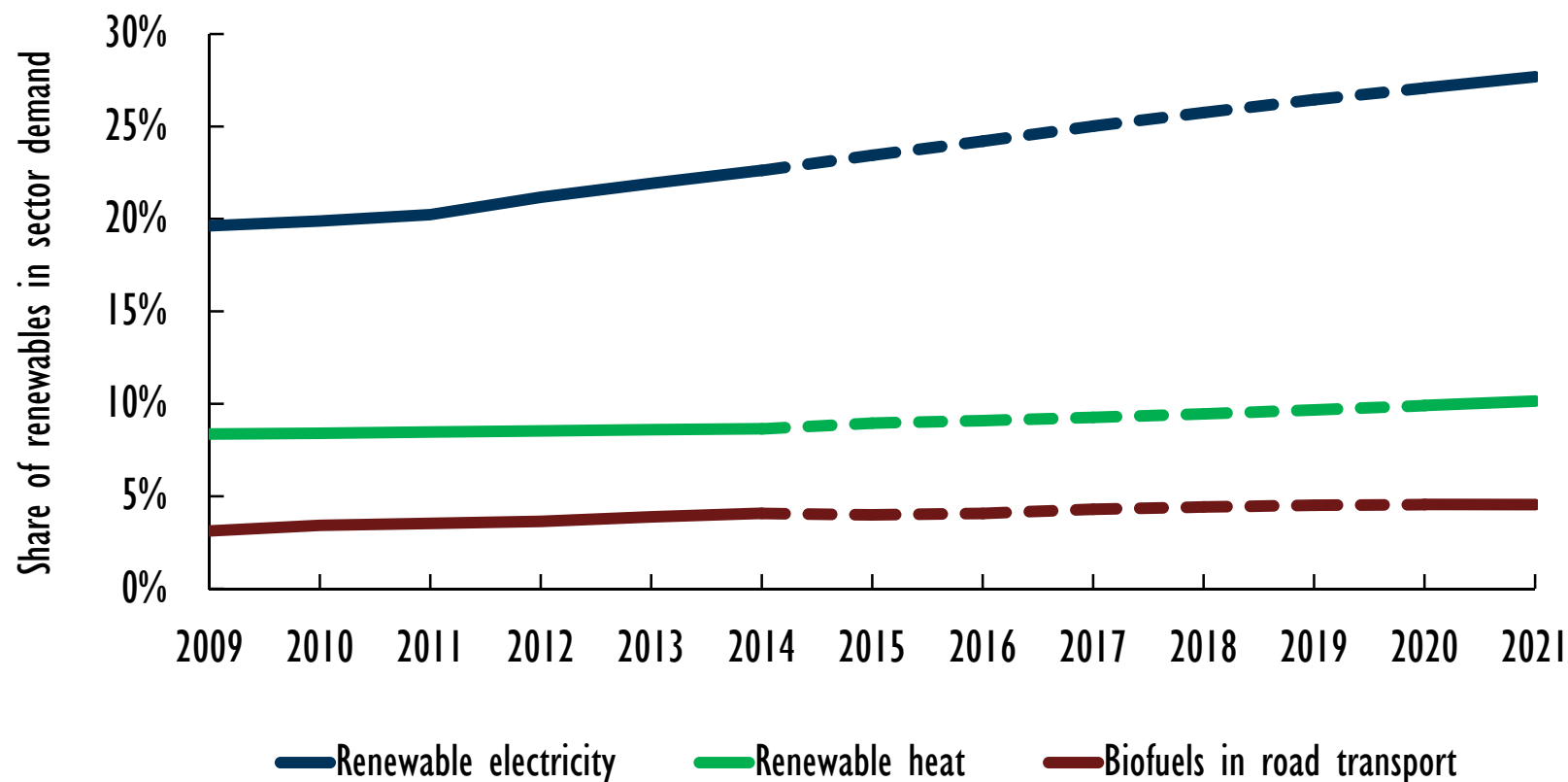
**Cumulative renewable capacity surpassed coal at the end of 2015**

# Renewables to dominate electricity growth, but less progress in heat and transport

RENEWABLE  
ENERGY

Medium-Term  
Market Report  
2016

Share of renewables in electricity, heat and transport sectors



**The share of renewables rises in all sectors, despite persistent challenges in heat & transport; interactions between energy efficiency & renewables become critical**

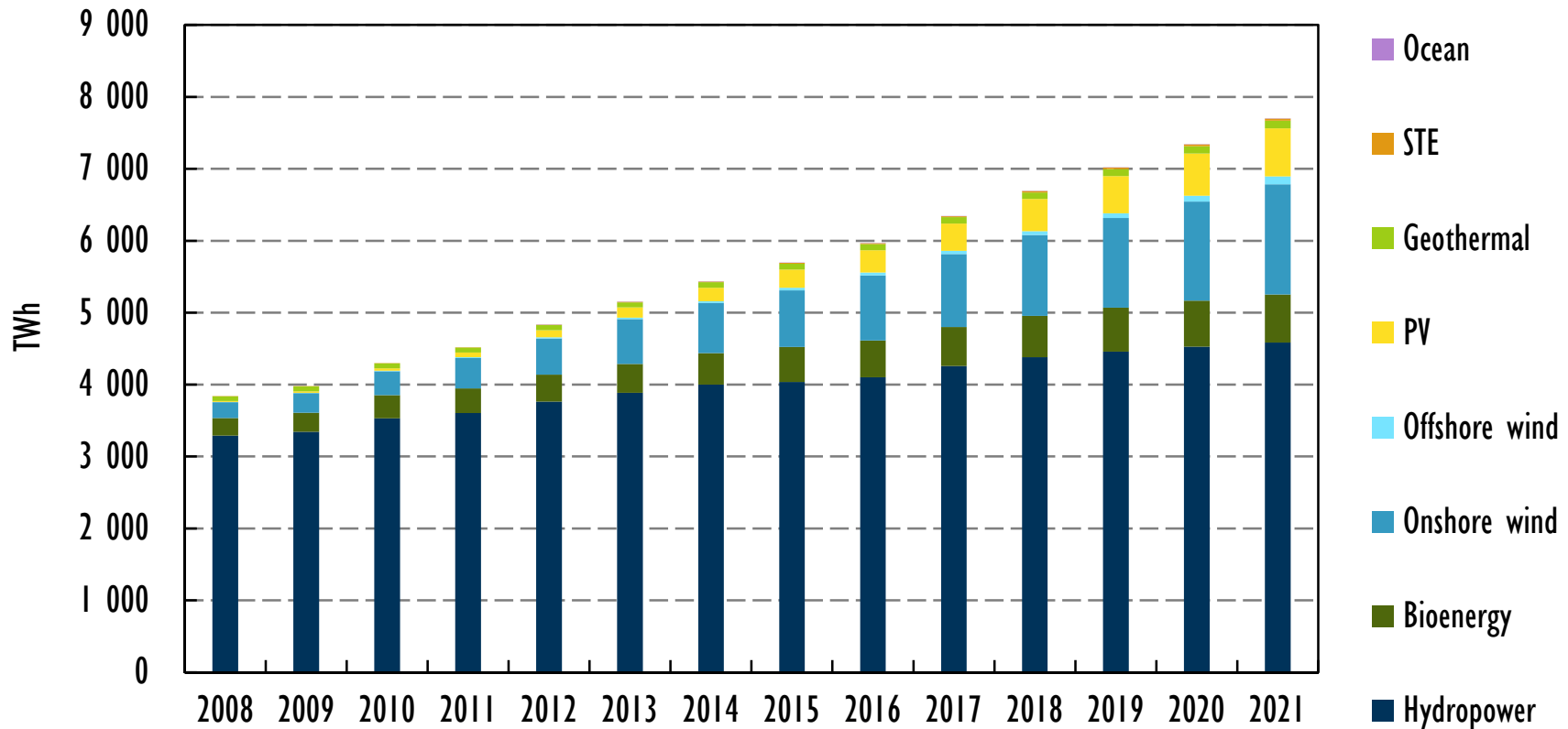


# Renewables fastest source of electricity generation growth

RENEWABLE ENERGY

Medium-Term Market Report  
2016

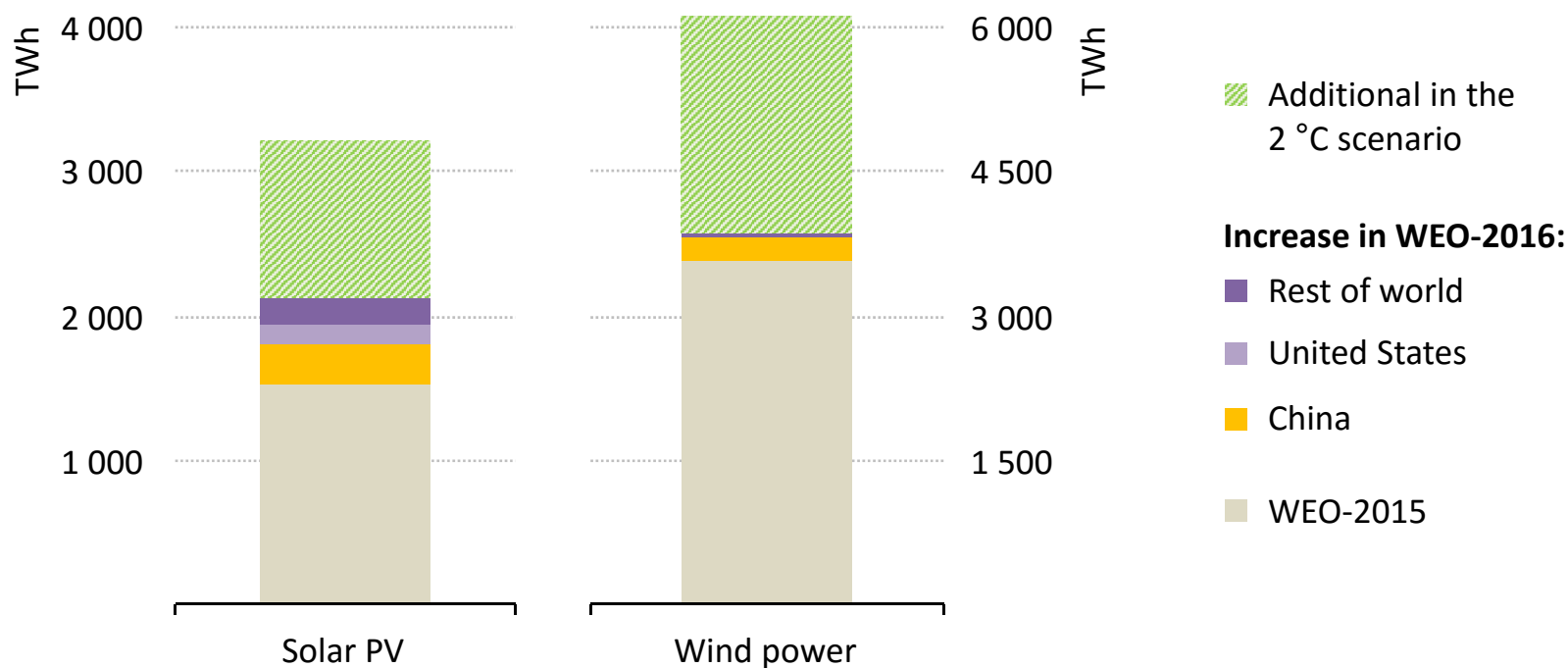
## Global renewable electricity generation



**Between 2015-21 wind generation doubles and solar PV almost triples, with renewables reaching almost 28% of total electricity by 2021**

# Greater policy support boosts prospects for solar PV and wind

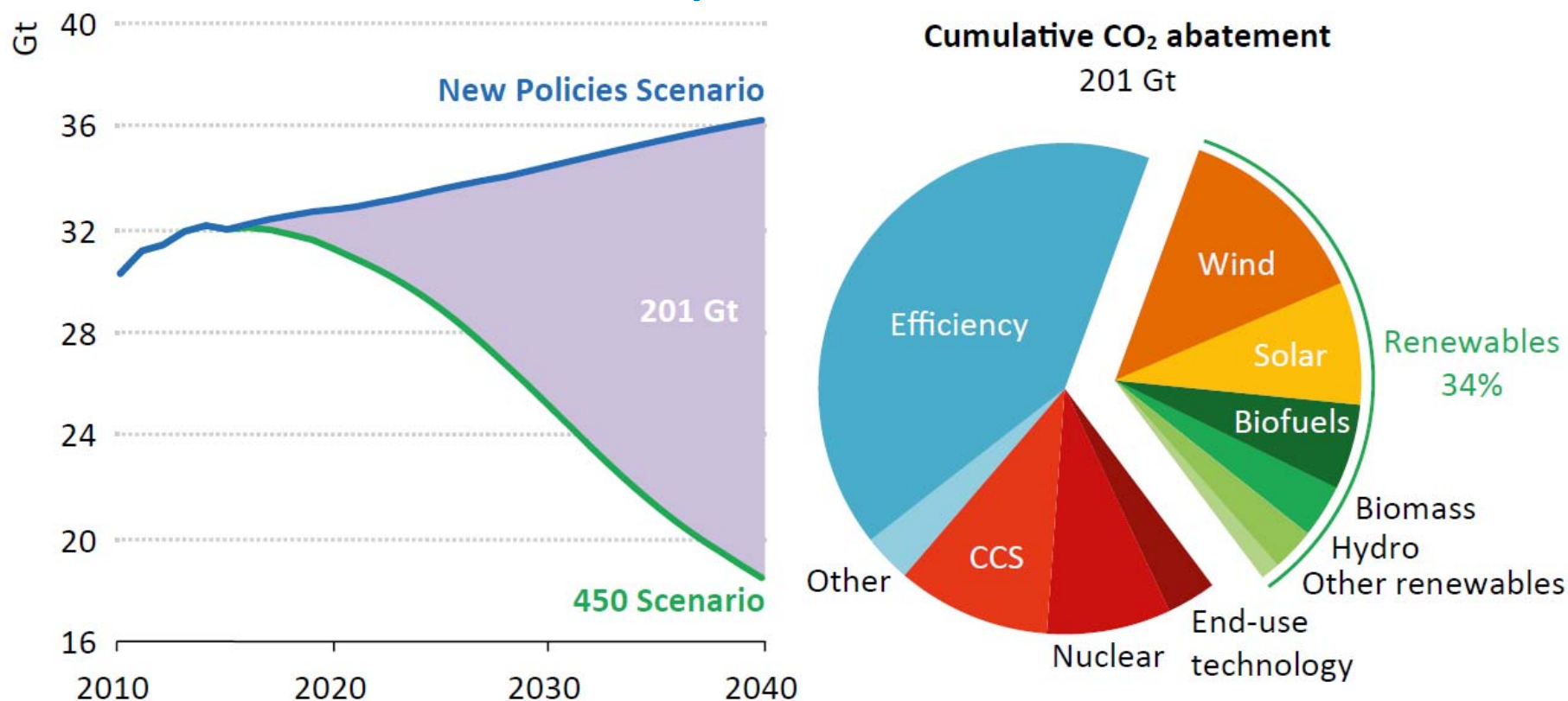
## Solar PV and wind generation, 2040



***Stronger policies on solar PV and wind help renewables make up 37% of electricity generation in 2040 in our main scenario – & nearly 60% in the 2 °C scenario***

# Wind and solar essential in climate change mitigation

Global energy-related CO<sub>2</sub> emissions by scenario and additional CO<sub>2</sub> abatement by measure in the 450 Scenario

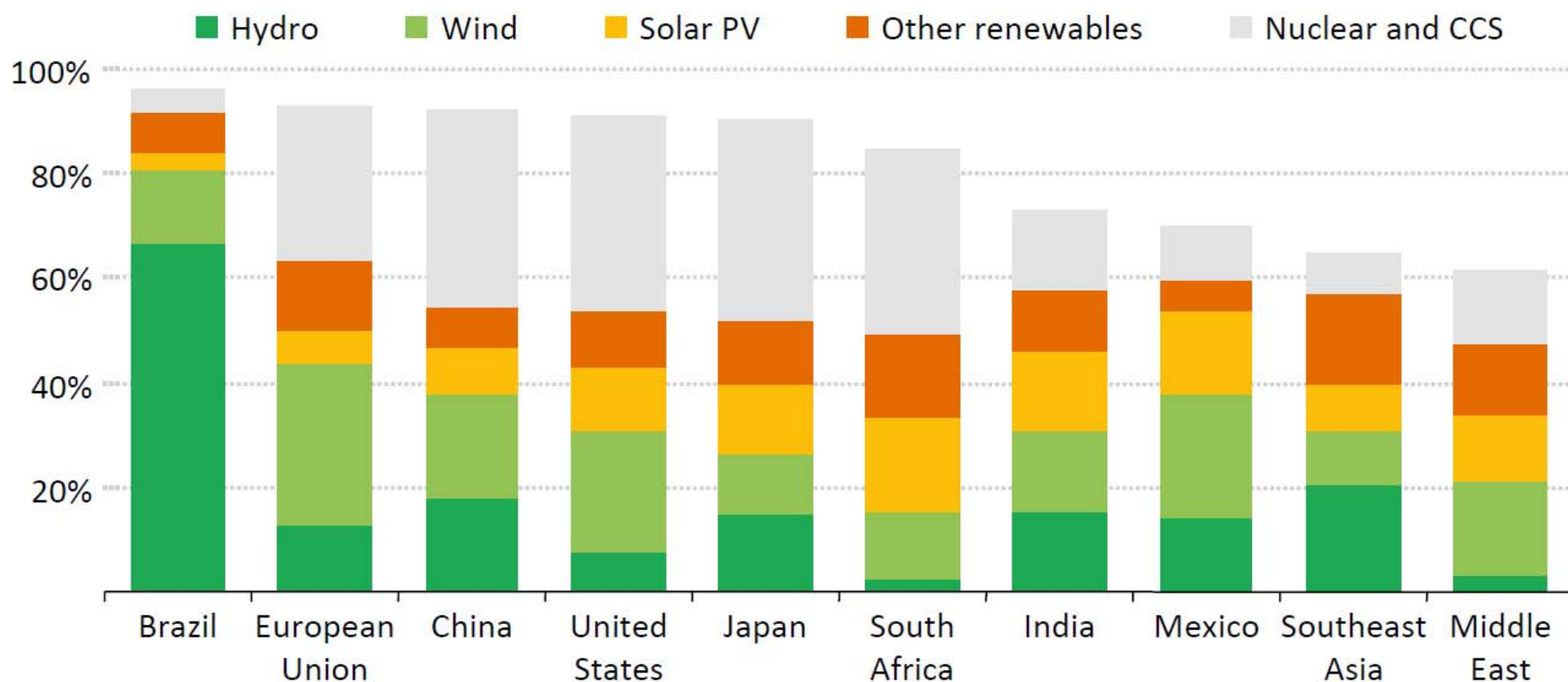


**Renewable energy ramps up faster in the 450 Scenario, abating an additional 69 Gt of CO<sub>2</sub> emissions (2015-2040) relative to the New Policies Scenario**

# Renewables to become the backbone of electricity supply

World  
Energy  
Outlook  
2016

Share of electricity supply from low-carbon sources  
in selected regions in the 450 Scenario, 2040

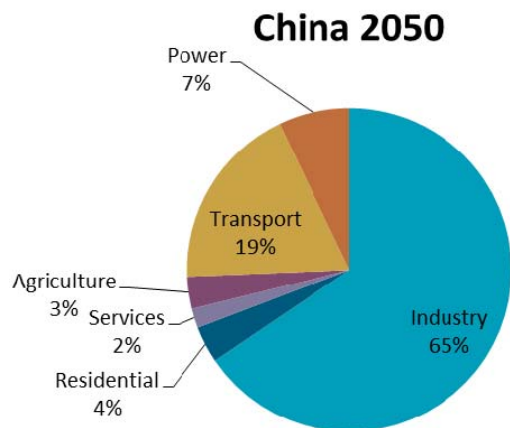
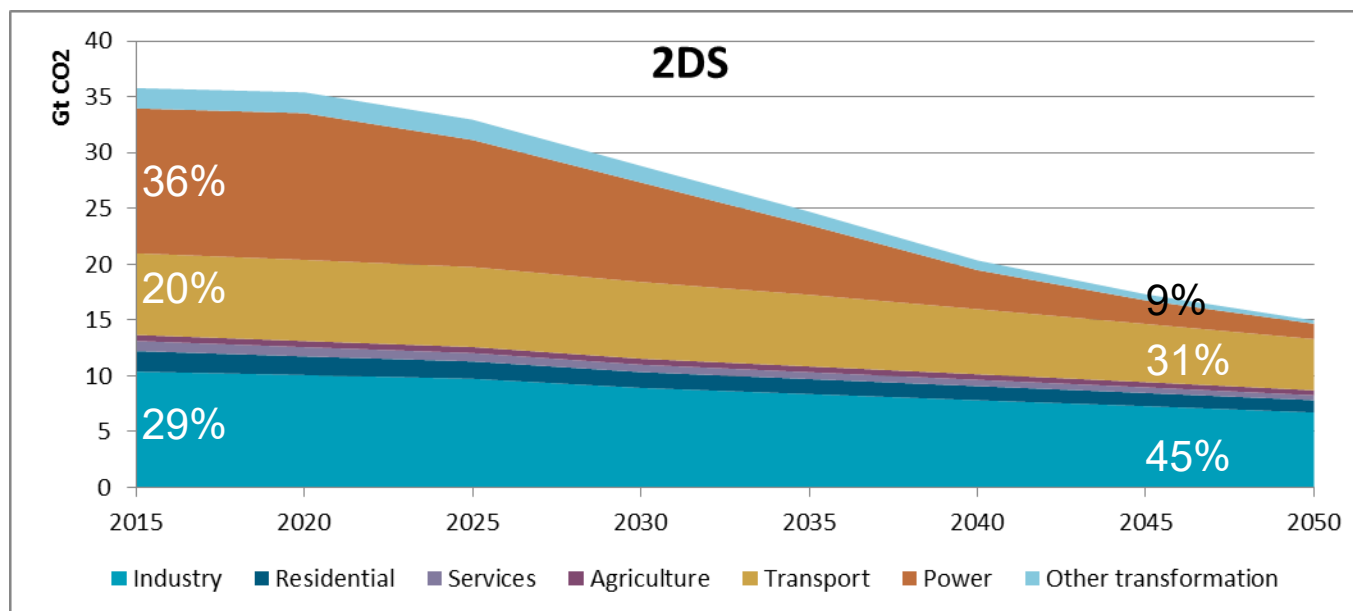


***In the 450 Scenario, the share of low-carbon electricity supply exceeds 80% in many markets around the world, with renewables playing the largest role***



# Industry, led by iron & steel, cement and chemicals, becomes 1<sup>st</sup> CO<sub>2</sub> source

ETP  
2016



# How to increase the use of RE in industry?

ETP  
2016

- **As in the 2DS or beyond (« well below 2° scenarios »)**
- **For energy, feedstock, process agents...**
- **Using biomass, solar heat, geothermal...**
- **Hydrogen from renewables**
- **Renewable power, self-generated or from the grid**
- **Electrification of industry helps integrate more variable RE**

# Renewables in industry: An IEA technology roadmap

- **Inception workshop, Paris, 10 May 2015**  
<https://www.iea.org/workshops/renewable-energies-for-manufacturing-industries.html>
- **China workshop, as part of SGCC's GEI Conference, Beijing, 31 March 2016**
- **US workshop, co-hosted by US EPRI, Washington DC, 29-30 November 2016**
- **IEA-RETD case studies under progress**
- **Publication in 2017 in parallel with ETP 2017 « well below 2° scenario »**

# Inputs from...

- IRENA
- Tsinghua University
- AEE/SHC
- Italcementi
- Chalmers University of technology
- Roquette Group
- Bioenergy TCP
- EDF
- Schneider Electric
- SolarReserve
- Confederation of European Paper industries
- Eurelectric
- Fraunhofer ISE
- State Grid Corp of China
- Energy Pool
- European Copper Institute
- China National Center for Climate Change
- China National Renewable Energy Center
- RWE
- BASF
- US EPRI
- Australian Renewable Energy Agency
- GlassPoint
- Pacific Northwest National Lab
- Swedish Energy Agency
- International Finance Corp.
- Southern Company
- NREL
- National Rural Electric Cooperative
- World Resource Institute
- NEDO
- US DOE
- IEA RETD TCP
- IDDRI/LCTPi