



REmap 2030

A Renewable Energy Roadmap



REmap 2030 – Global Renewable Energy Outlook

Lecture series: Towards a Sustainable Energy Future

Bonn, 9 April 2015

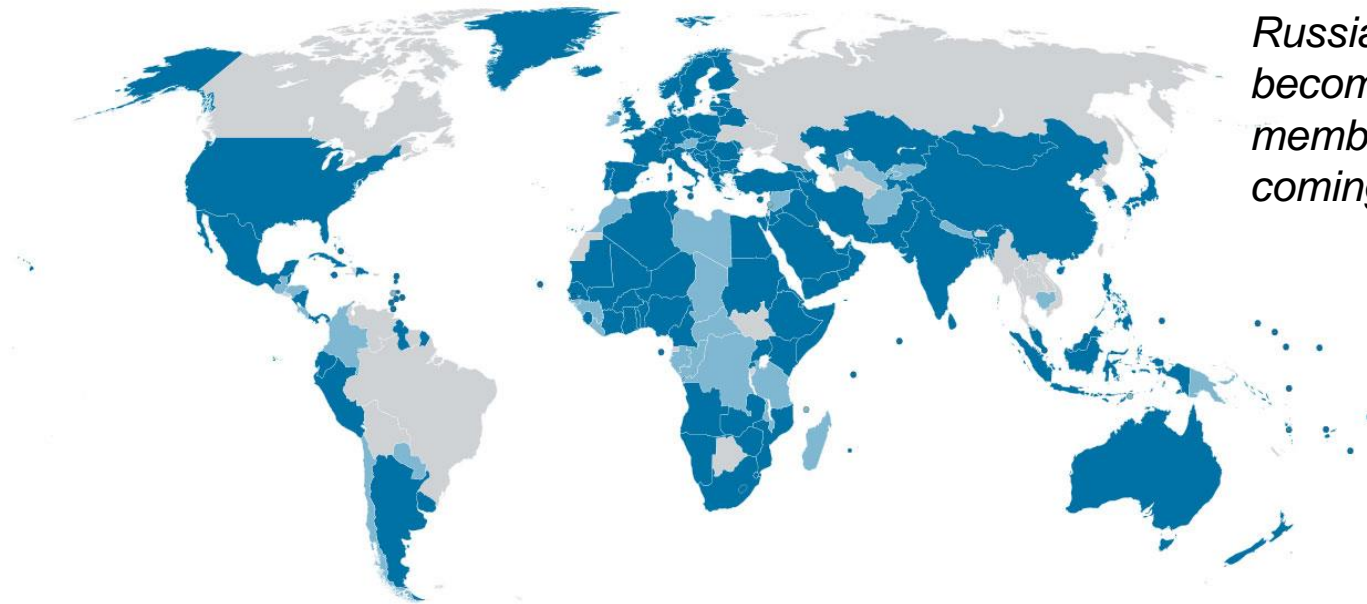
- **April 9: REmap – Global Renewable Energy Outlook**
- April 23, Renewable Energy Technologies and Innovation
- May 7, Renewable Energy: The True Costs
- May 21, The Transformation of Power Systems with the Integration of Renewable Energies
- June 11, Island Lighthouses – Renewable Energies on Islands
- June 25, Energy Planning and Renewable Energies in Africa

All lectures at Uni-Bonn, Main Building, Lecture Hall III and between 6-8pm

A certificate of attendance can be earned upon participation to the whole lecture series

(all 6 lectures)

The Voice, Advisory Resource and Knowledge Hub for 171 Governments



*Russia will
becoming a
member in the
coming weeks*

Renewable energy can:

- Meet our goals for **secure**, **reliable** and **sustainable** energy
- Provide **electricity access** to 1.3 billion people
- Promote **economic development**
- At an **affordable cost**

Structure and Membership

Headquarters:
**Abu Dhabi,
United Arab Emirates**

Three Programmes:

- **Innovation and Technology Centre (IITC) in Bonn, Germany**

- **Knowledge, Finance and Policy Centre in Abu Dhabi**

- **Country Support Programme in Abu Dhabi**

Foundation

**26 January 2009 in Bonn
International Agency since April 2011
The only international RE agency
worldwide**

Scope

**Hub, voice and source of objective
information for renewable energy**

Mandate

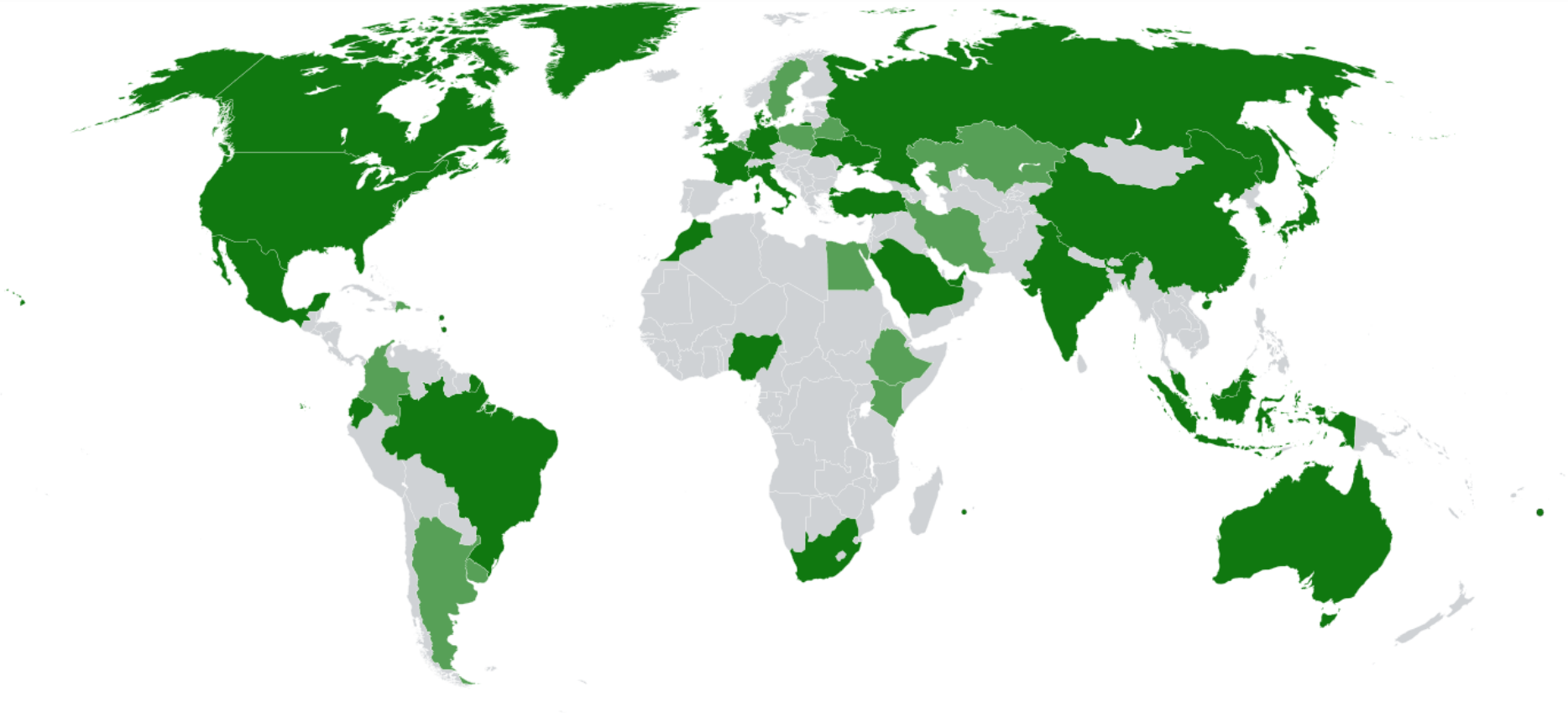
**Sustainable deployment of the six
forms of renewable energy
resources
(Biomass, Geothermal, Hydro,
Ocean, Solar, Wind)**

- Official opening of IITC on October 2011
- Location: Bonn, Robert-Schuman Platz (BMU building)
- 40 staff
- Knowledge, advice, creating and supporting networks
 - **Renewable energy roadmaps (REmap) (*this lecture*)**
 - Energy planning (for Africa)
 - Technology information
 - Grids and storage
 - Standards and quality control
 - R&D advice
 - Bankable project preparation (navigator)
 - Island transition planning (grid studies, transition plans)

REmap 2030 - A roadmap for doubling the RE share

- Originates from the United Nations global Sustainable Energy for All (SE4ALL) initiative
- Three objectives, all to be achieved by 2030:
 - Universal energy access (rural electrification, modern forms of renewables)
 - Doubling the rate of energy intensity improvements
 - **Doubling the share of renewables in the global energy mix (compared to 2010 level)**
- Each objective has its own hub; IRENA is the thematic hub for renewables
- 2014-2024: UN decade of Sustainable Energy for All

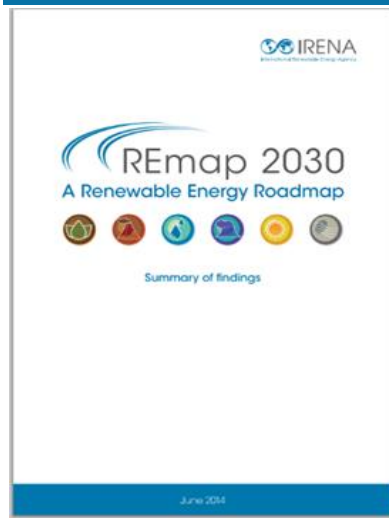
- REmap explores the **potential**, **cost** and **benefits** of doubling the renewables share in the global energy mix
- **Technology options**
 - No target setting; options characterised by their cost and potentials
 - Technology options can be combined into scenarios and translated into policy action
- Focuses on power, district heat and end-use sectors
- Coverage: **40 countries**; 80% of the global energy use
- Developed together with & validated by country experts



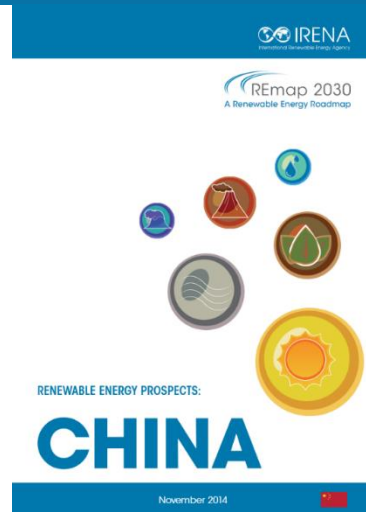
Dark green: Completed country analysis in June 2014 (26 countries)

Light green: Ongoing country analysis end of 2015 (14 countries)

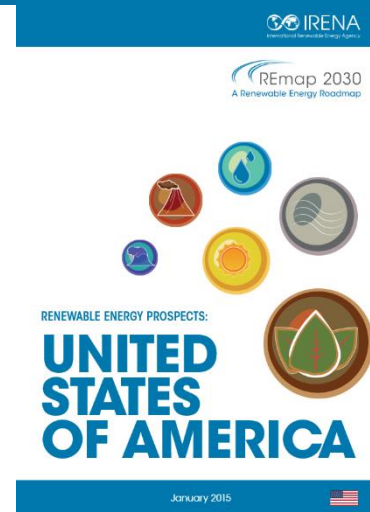
Comprehensive REmap country reports



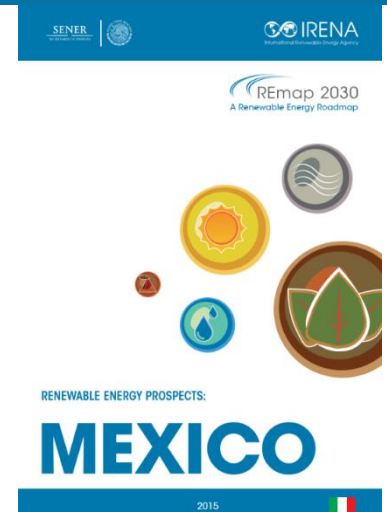
June 2014



November 2014



January 2015



May 2015

- Purpose: Translate analysis into actionable options
 - Areas for joint action to accelerate RE deployment
- China, Mexico, UAE, United States, Ukraine **completed**
- India, Poland, South Africa reports **in preparation**
- Discussion on-going with other countries

New high-level work planned for 2015

Policy messaging building on REmap

- Contribution to G7 (energy security work)
 - REmap is a cornerstone of the analysis
 - **Timeline:** May 2015

- G20 REmap
 - Energy Sustainability Working Group - RE discussion support
 - **Timeline:** October 2015

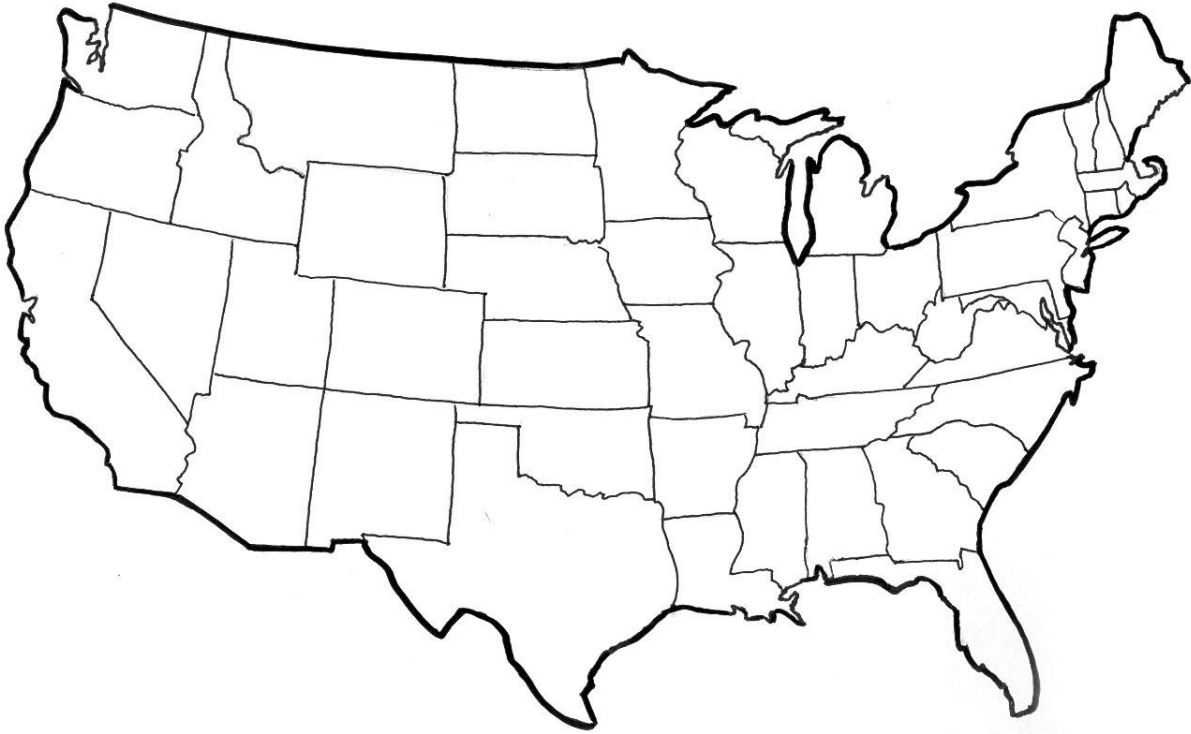
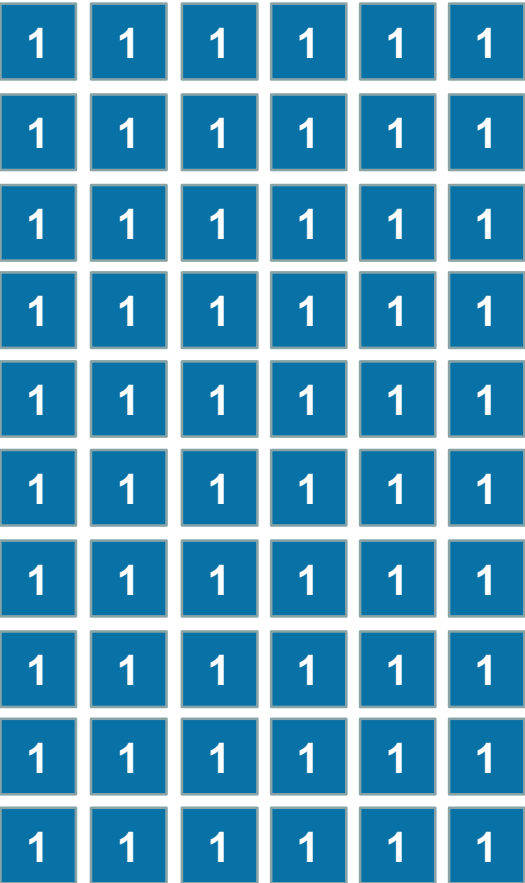
- Climate change (INDC), COP 21
 - Request for support ADP, TEC processes
 - **Timeline:** December 2015

Remap as analytical basis for a strategic policy discussion

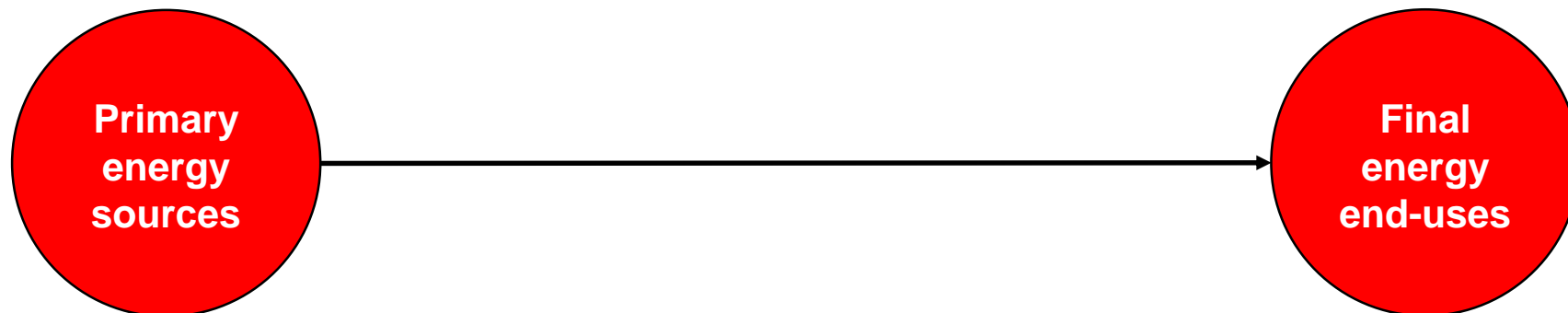
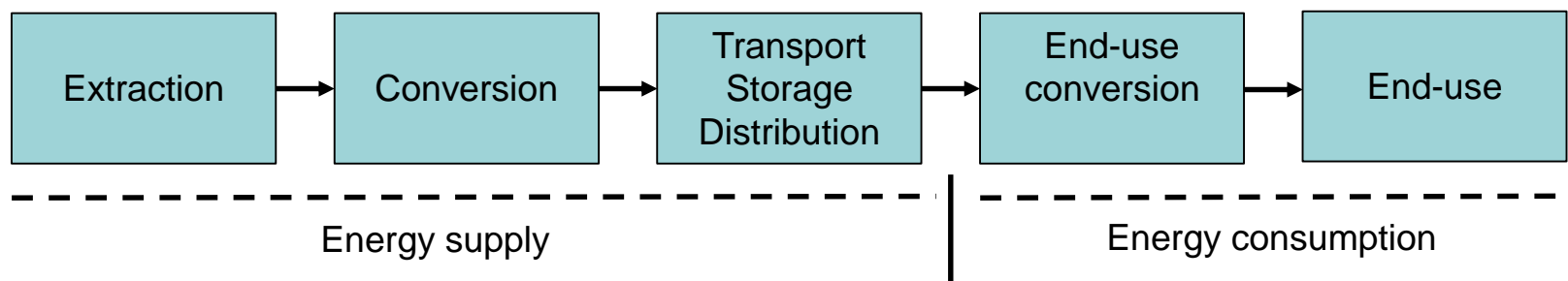
Exajoule (EJ), 10^{18} joules

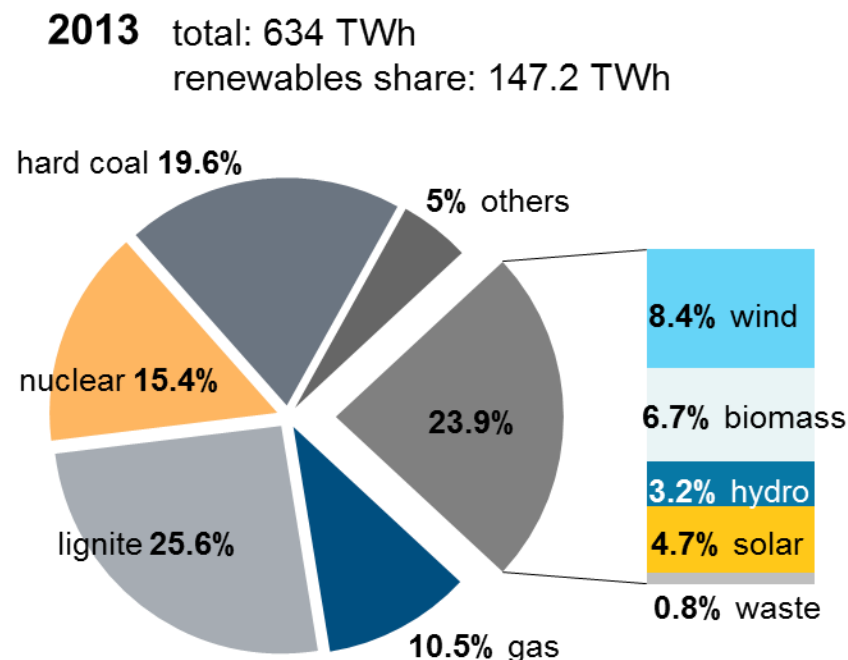
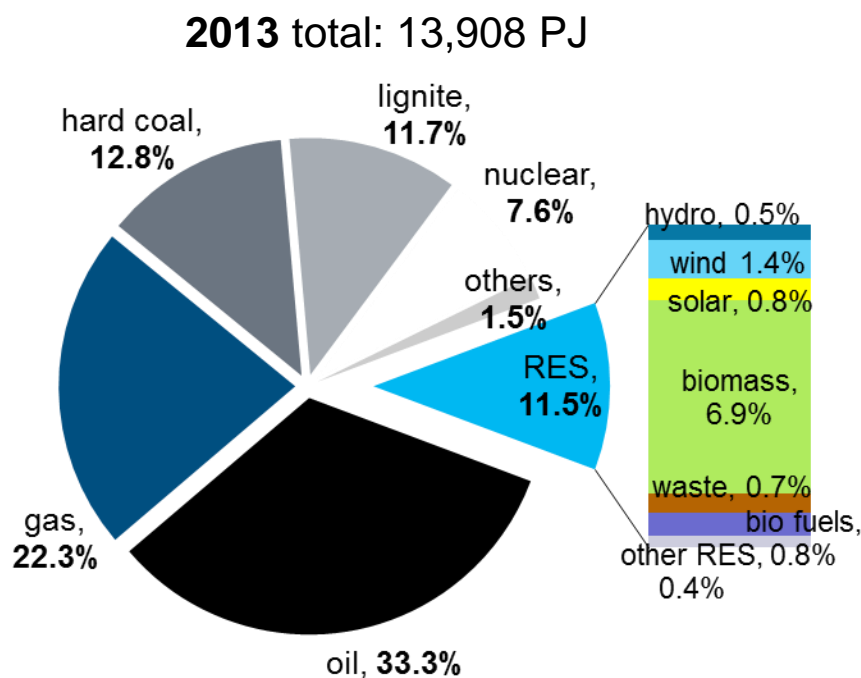
1 1 NRW consumes about 2 EJ

1



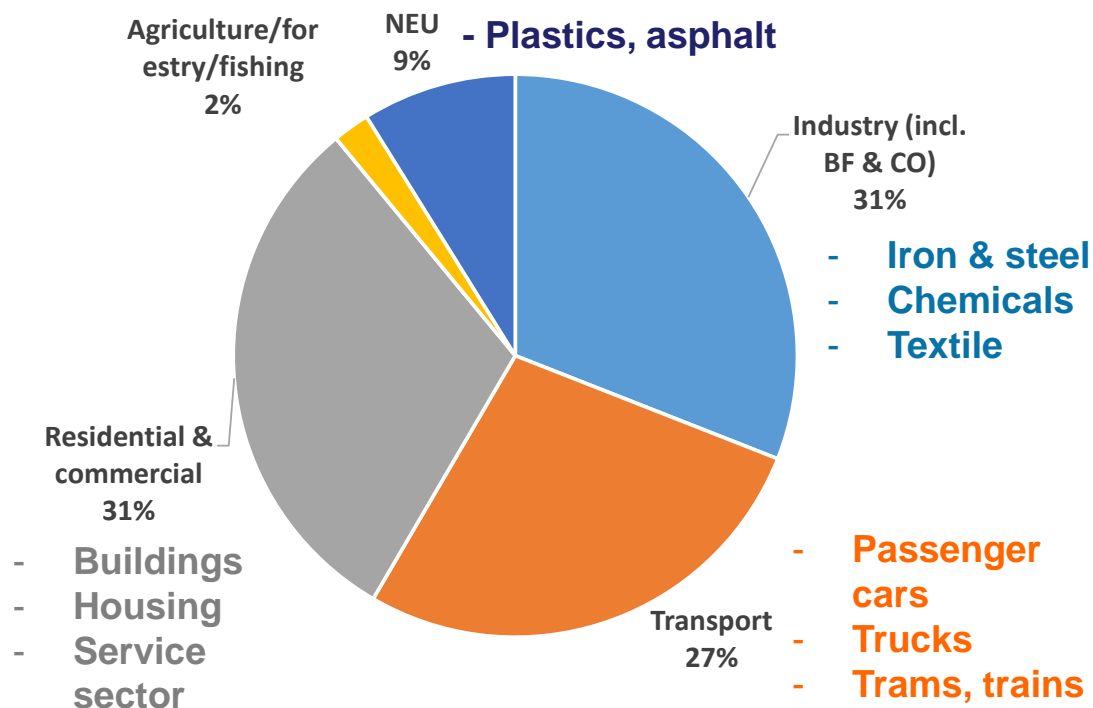
Primary versus final energy





- Germany's peak demand is around 80 GW
- Total installed capacity has reached 177 GW in 2014
- Total solar PV 38 GW, wind onshore 35 GW, biomass 8.2 GW; hydro 5.6 GW

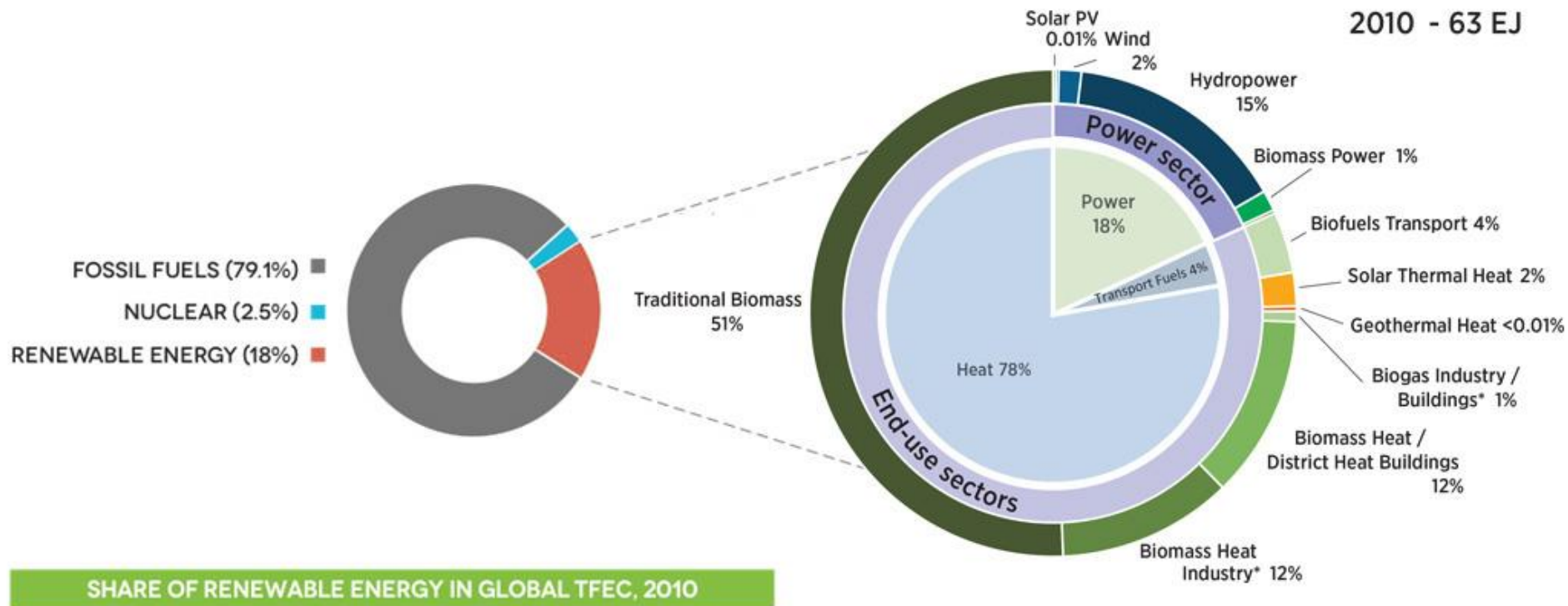
Breakdown of global energy use (**380 EJ**)



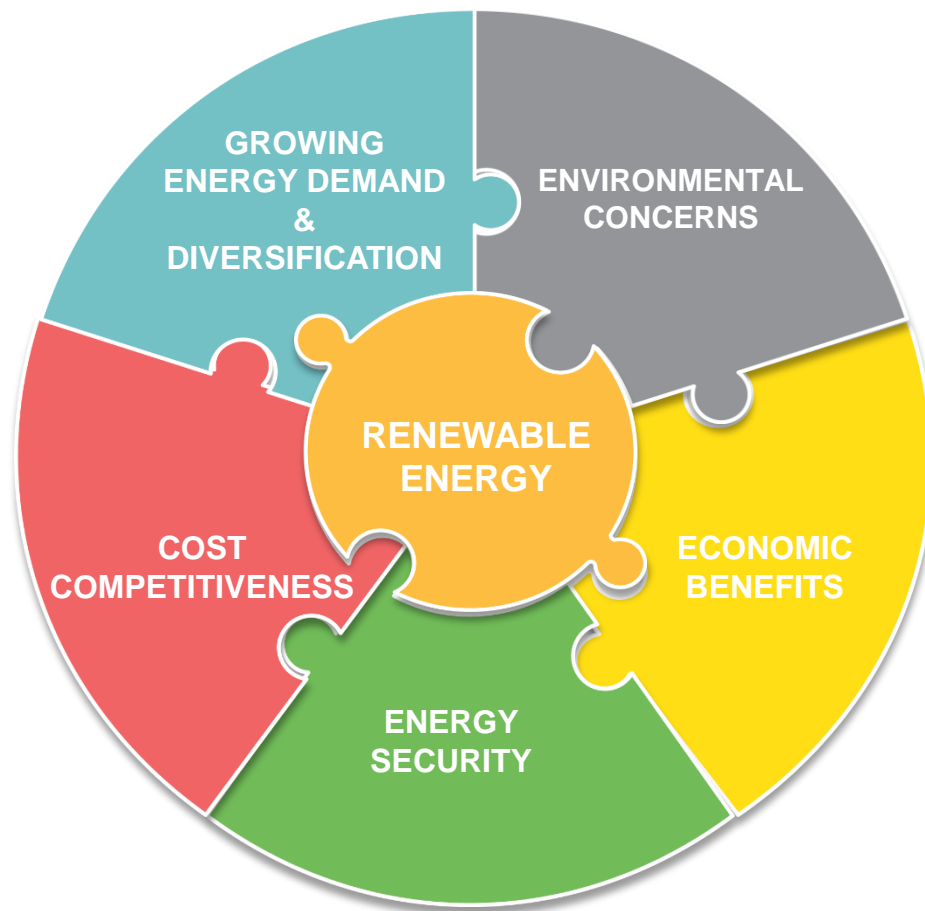
- In final energy terms, end-use sectors about 1/3 each
- In primary energy terms, 40% of total fuel is for power generation

Breakdown of Global Renewable Energy Use in 2010

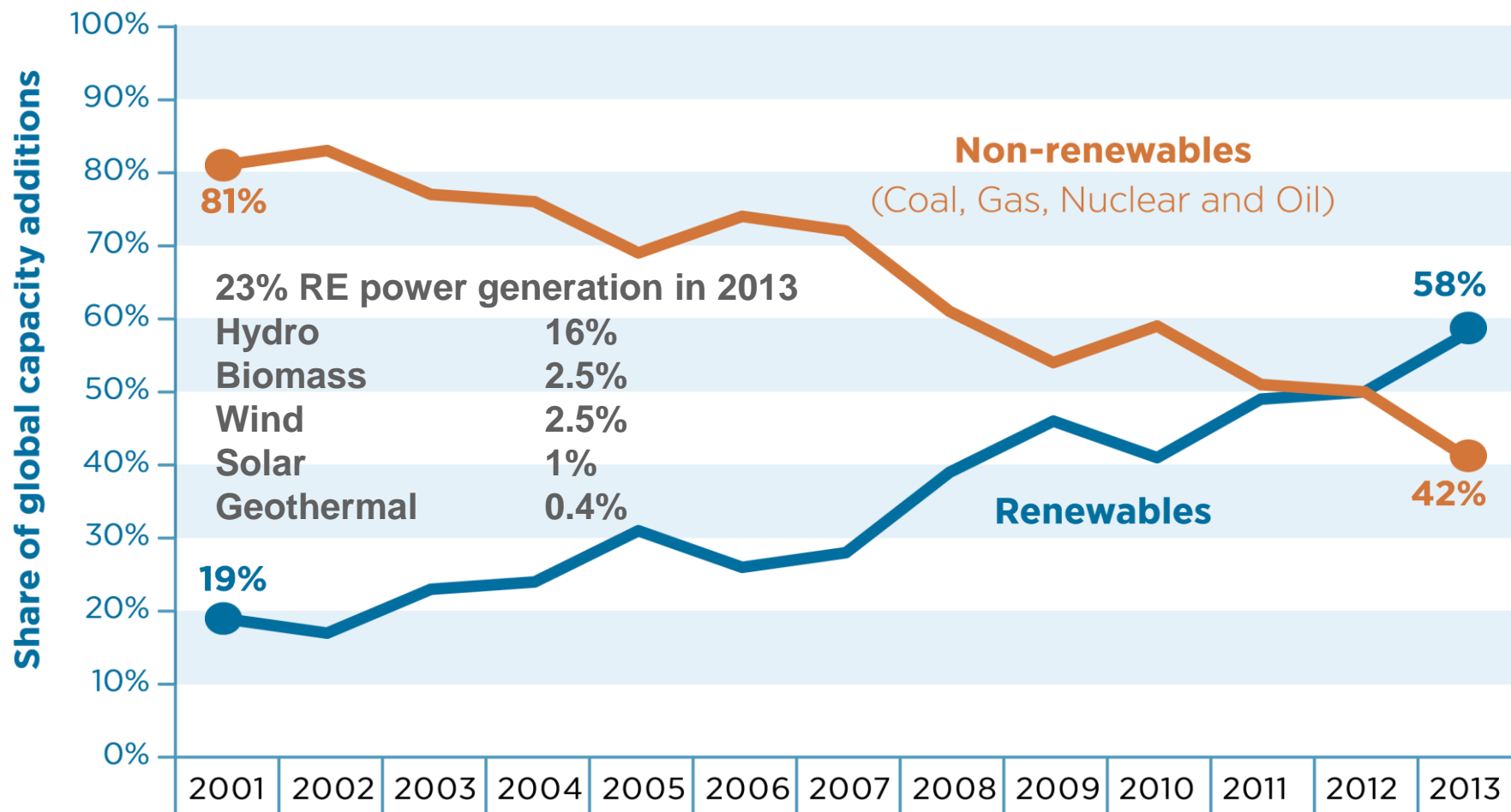
**Globally 18% RE in Total Final Energy Consumption (TFEC)
Half is traditional biomass, 8.4% modern renewables**



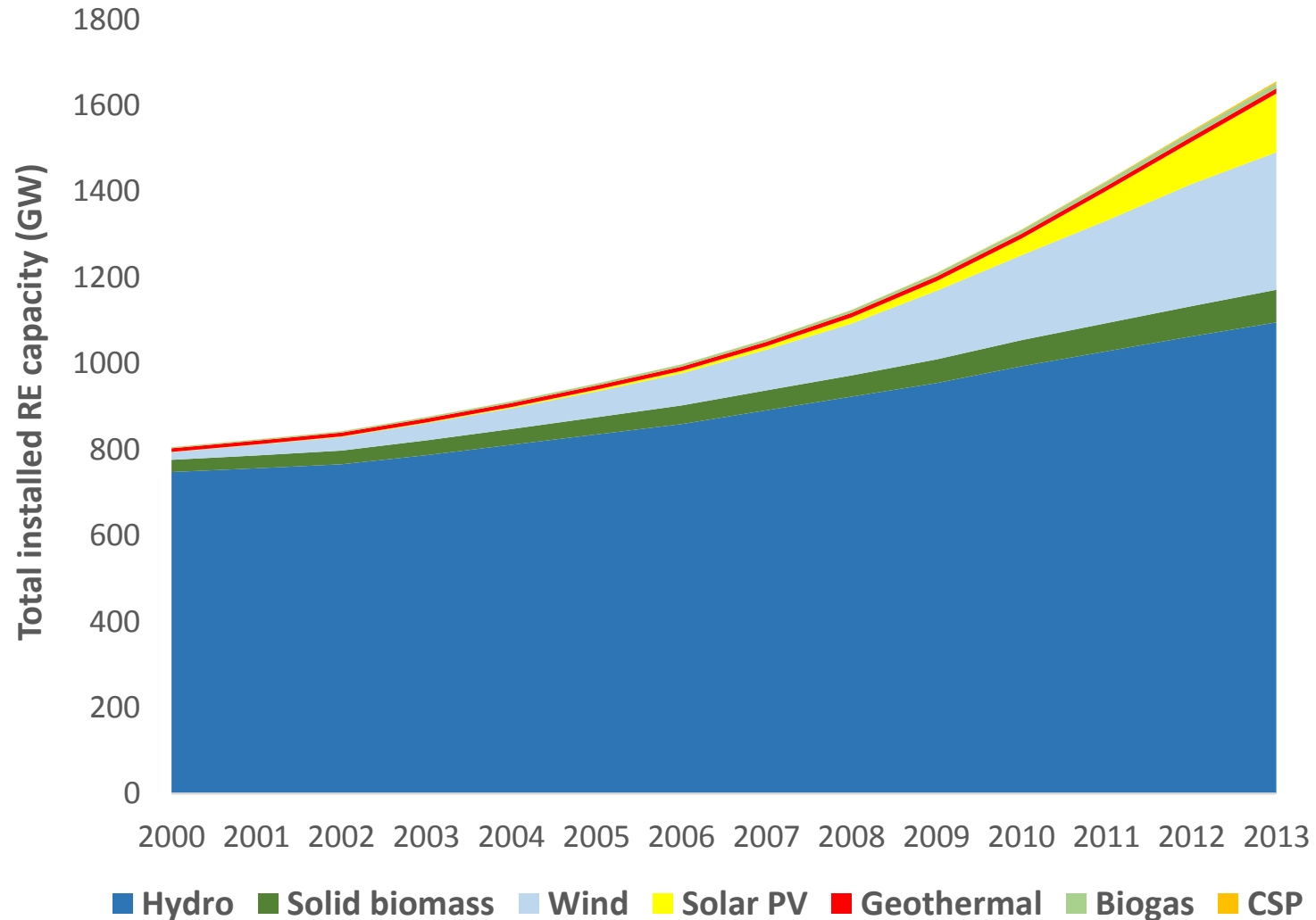
Drivers for this energy transition



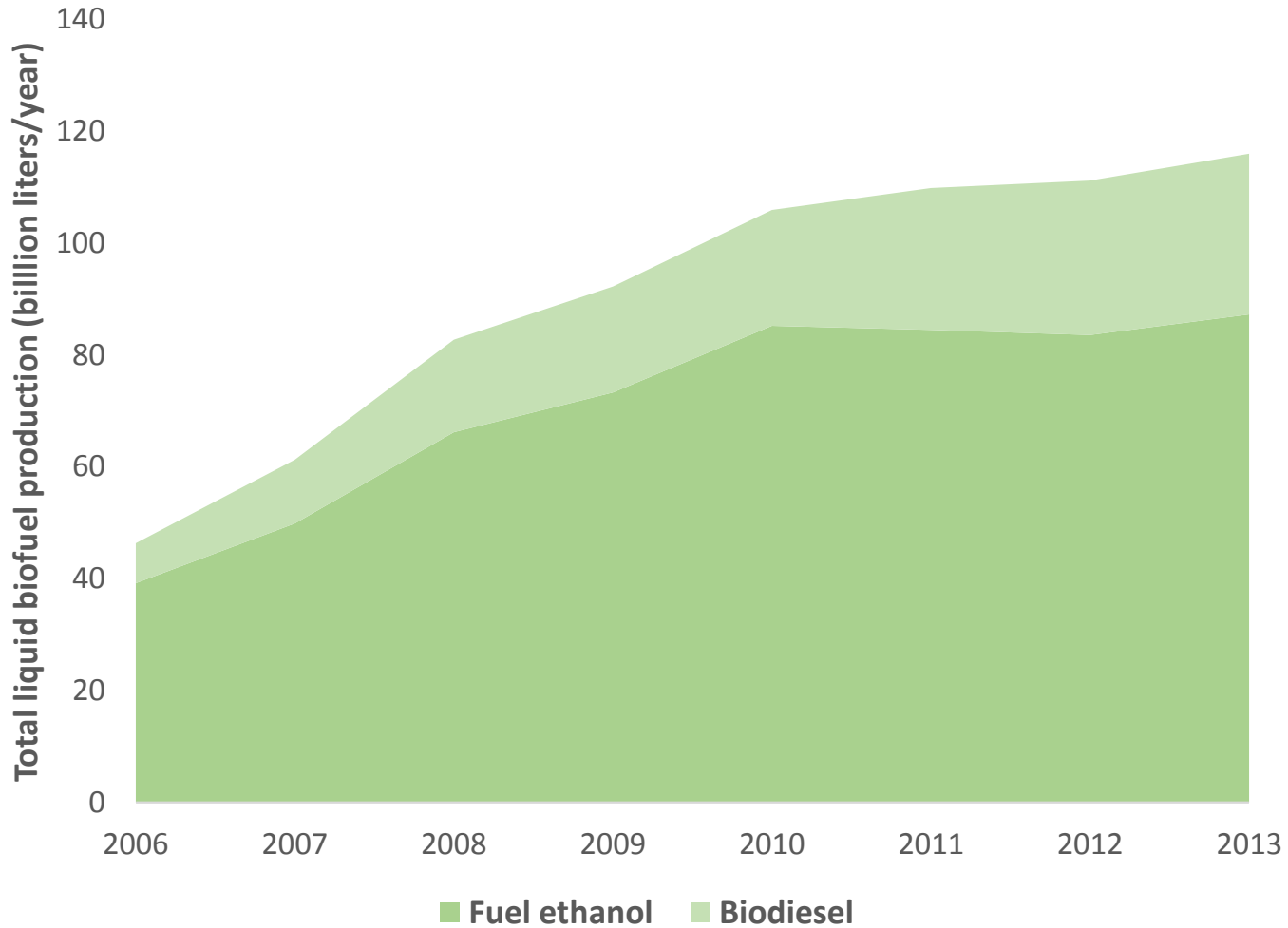
Renewables Dominate New Power Sector Capacity Additions



Renewable power generation capacity

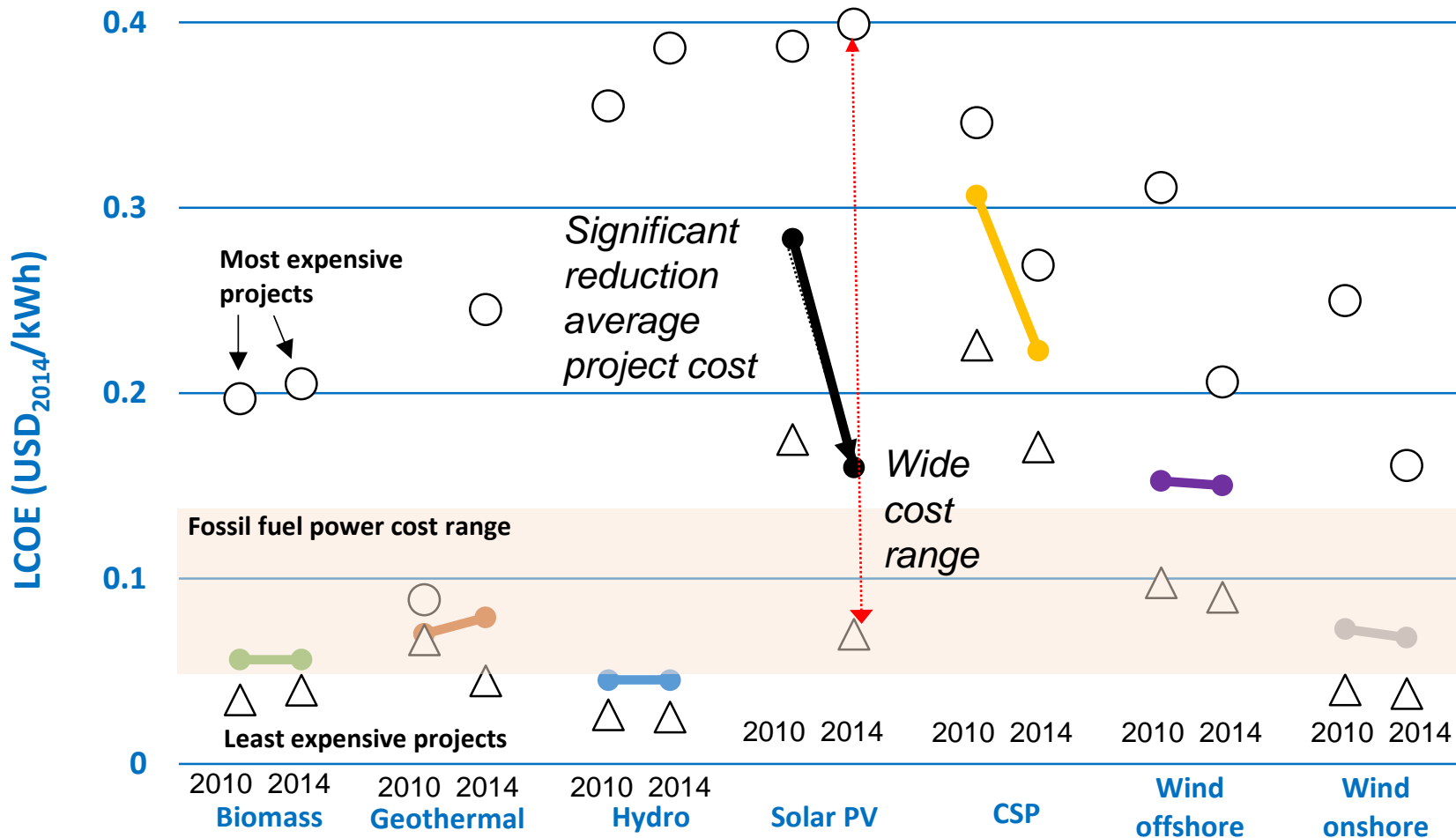


Liquid biofuels production



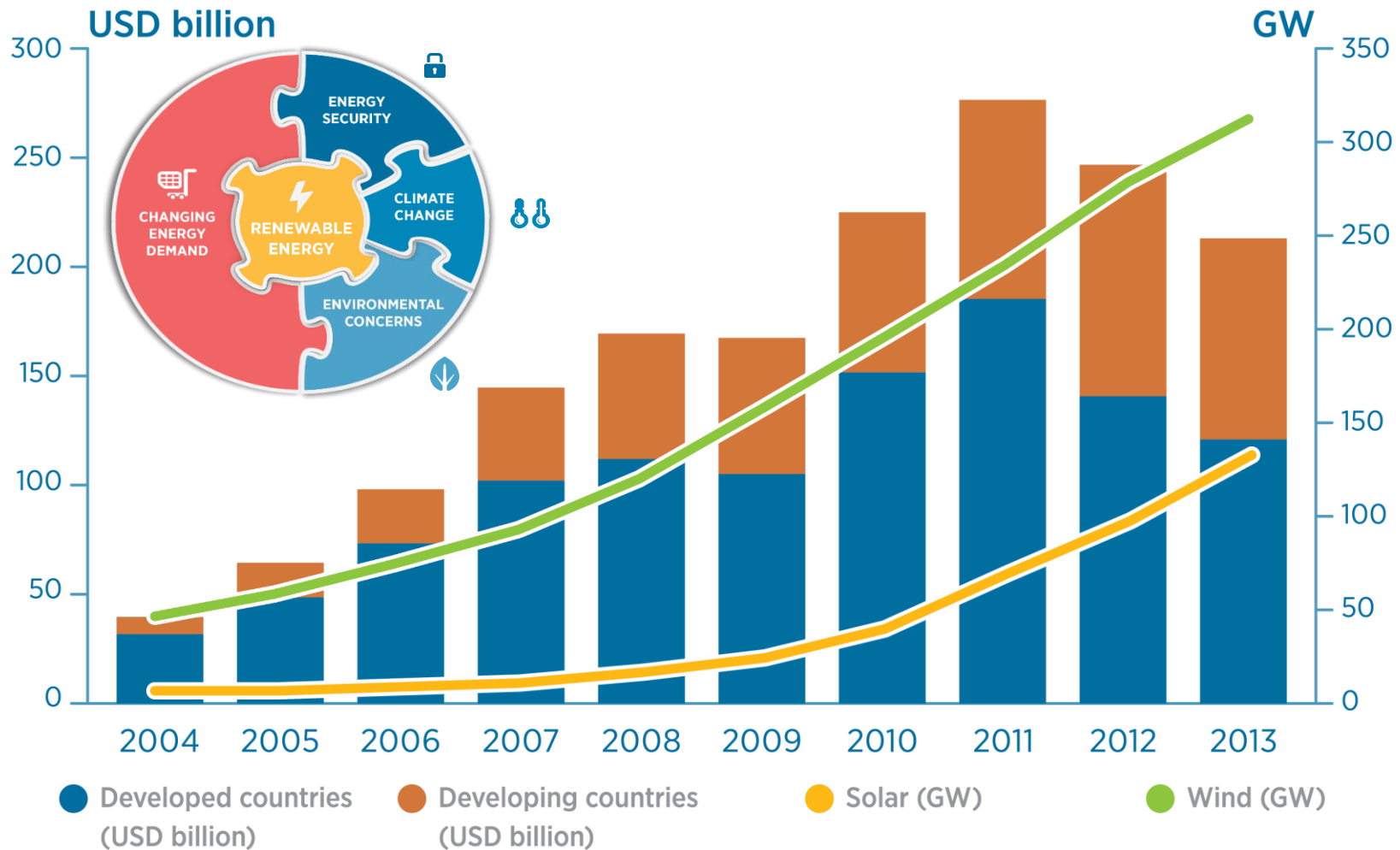
Significant cost differences persist

An opportunity to accelerate deployment



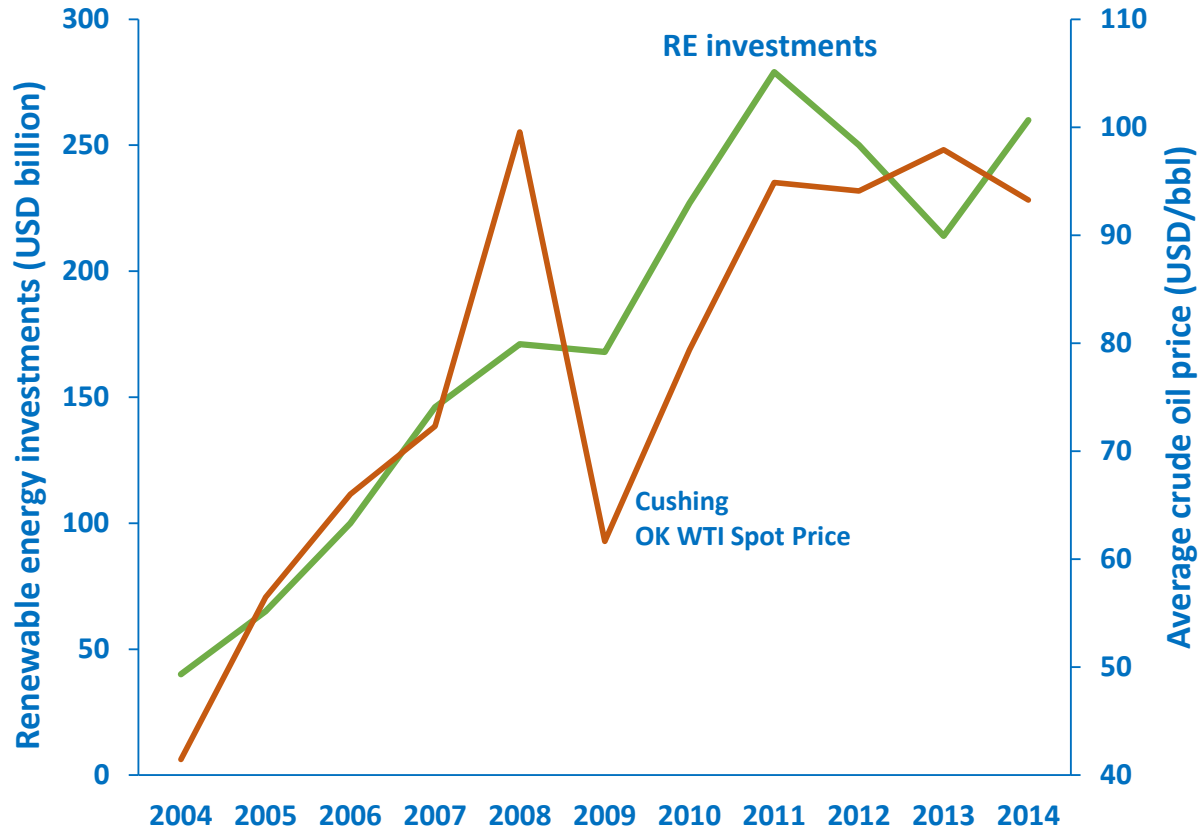
Left side: 2010
Right side: 2014

Global Investment in Renewable Energy Capacity additions rise, unit cost fall



In 2014, 103 GW new RE capacity added, USD 270 billion investments (excl. large hydro)

Renewable energy investments and crude oil prices



- Weak relationship between crude oil prices and renewable energy investments
- Only 5% of oil use in power generation, the main modern RE market
- Coal and gas prices are only weakly related to oil prices

REMAP OUTLOOK

- **Base year** – 2010
- **Reference Case** – current policies and under consideration
- **REmap 2030** – addition of **REmap Options** on top of Reference Case for an accelerated RE deployment (in 2020 & 2030)

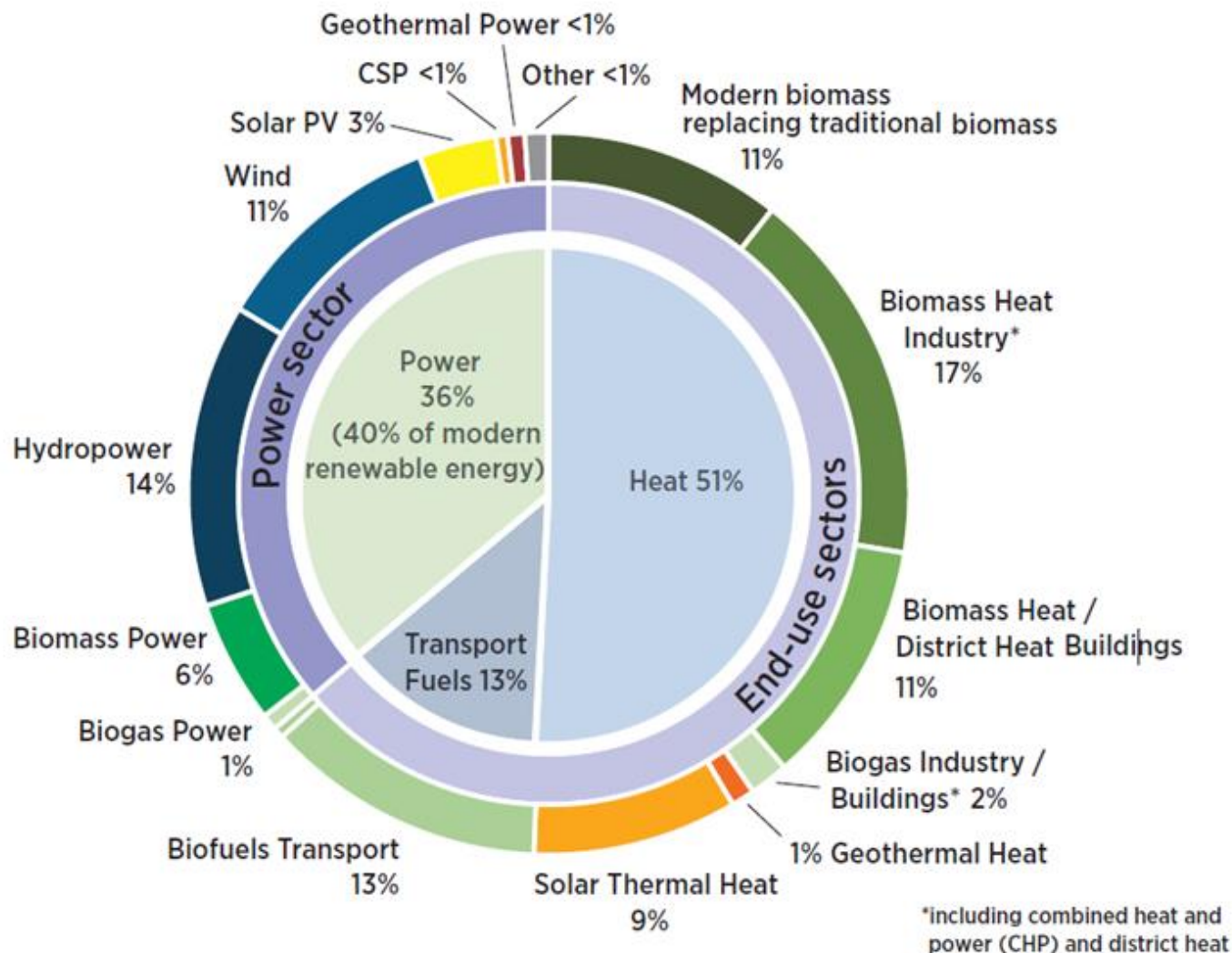
Data sources include, for example the following:

- **2010**, AG Energiebilanzen, International Energy Agency, Eurostat
- **Reference Case**, National Renewable Energy Action Plans of EU
- **REmap Options**, *Energiewende*, DLR/Fraunhofer ISE Leitstudie
- **Costs of RE and energy prices**, real project data combined with experience curves, country & IRENA estimates

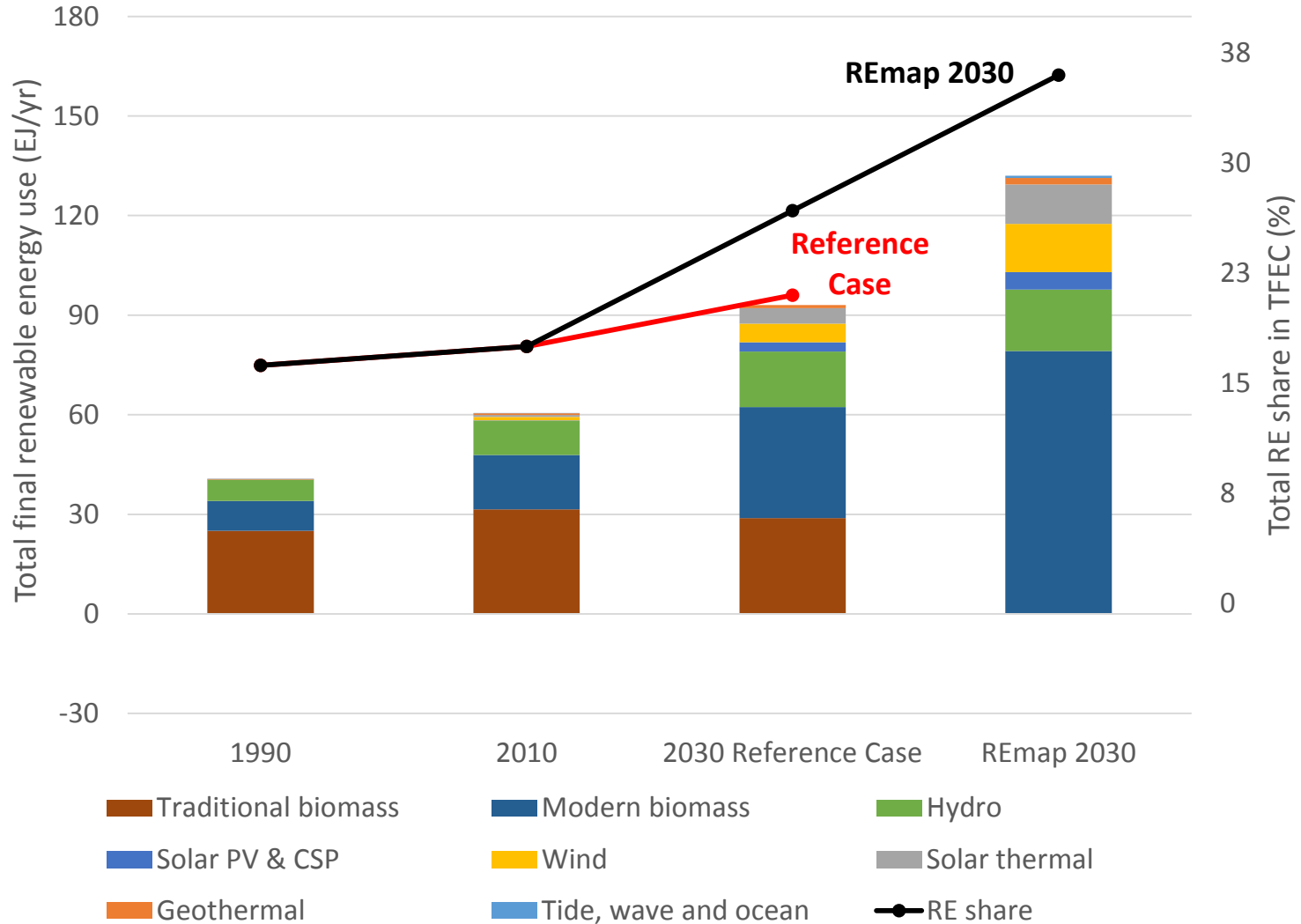
- **Doubling the RE share from 18% in 2010 to 36% in 2030 is technically achievable with existing technologies**
 - Higher shares in power generation
 - More attention needed for heating and transportation fuels
- **Doubling is affordable when externalities are accounted for**
 - However these are not reflected in today's prices and markets are distorted because of energy subsidies
 - Macro-economic benefits include more jobs; economic activity; health benefits; a cleaner environment; a higher level of energy security
- **Biomass is key resource**
- **Potential exists in all countries, and differentiated action**

Global RE Use in 2030 including REmap Options

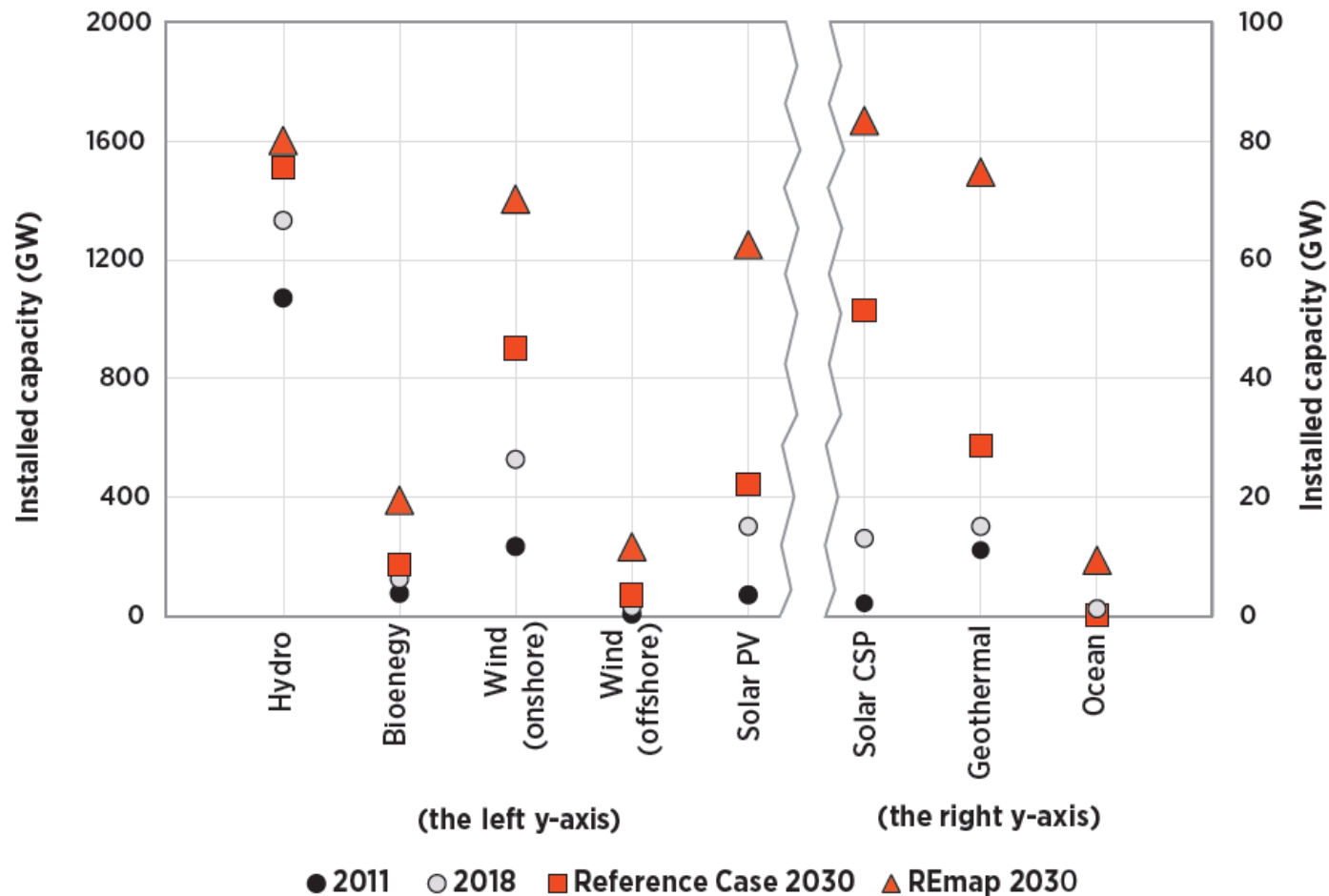
Remap 2030 – 132 EJ (final energy) 60% is biomass



Global Renewable Energy Use Change



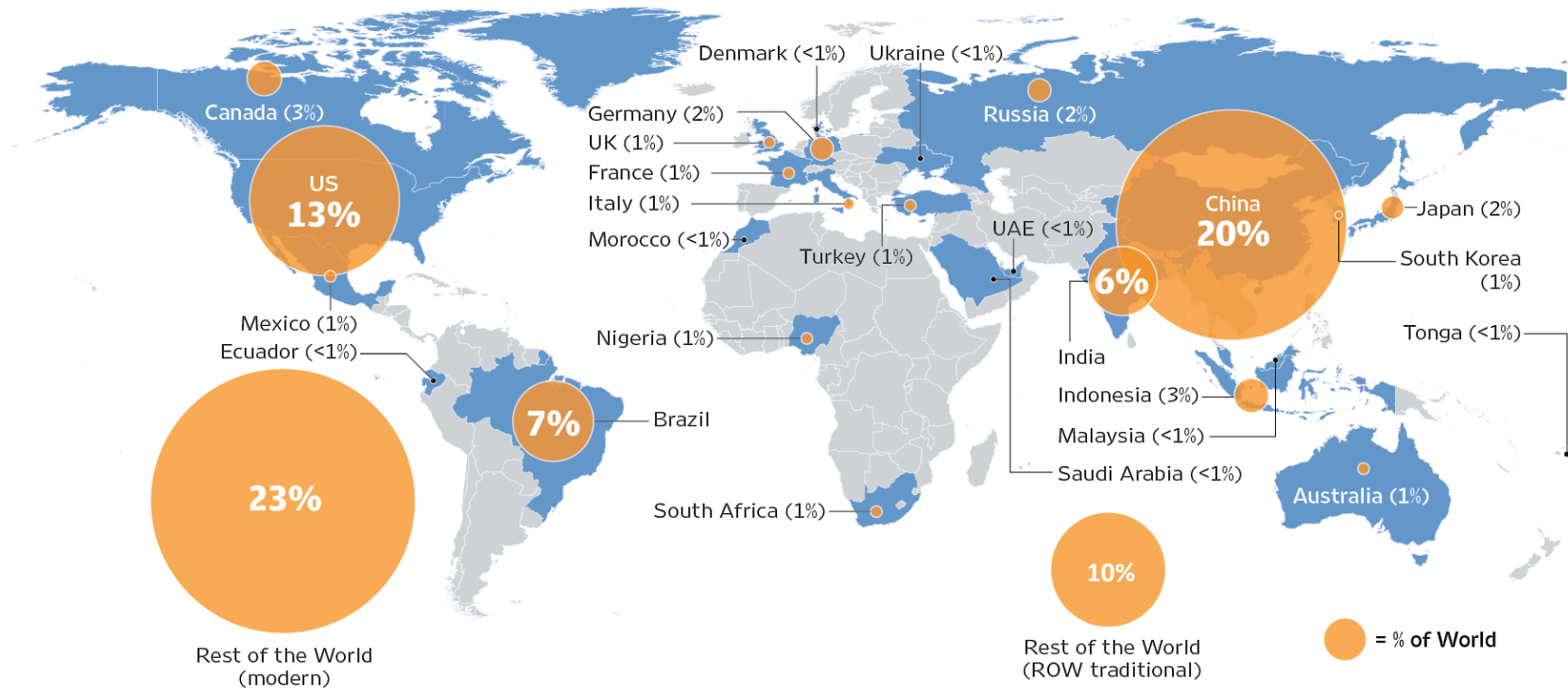
Opportunities in power generation growth potential is under-estimated



- Renewable energy share in power generation increases to 44%
- Variable renewable energy share in total generation 17% (solar PV & wind)

Mapping Out the Renewable Energy Transition

Breakdown of Total Global Renewable Energy Use in 2030 (%)

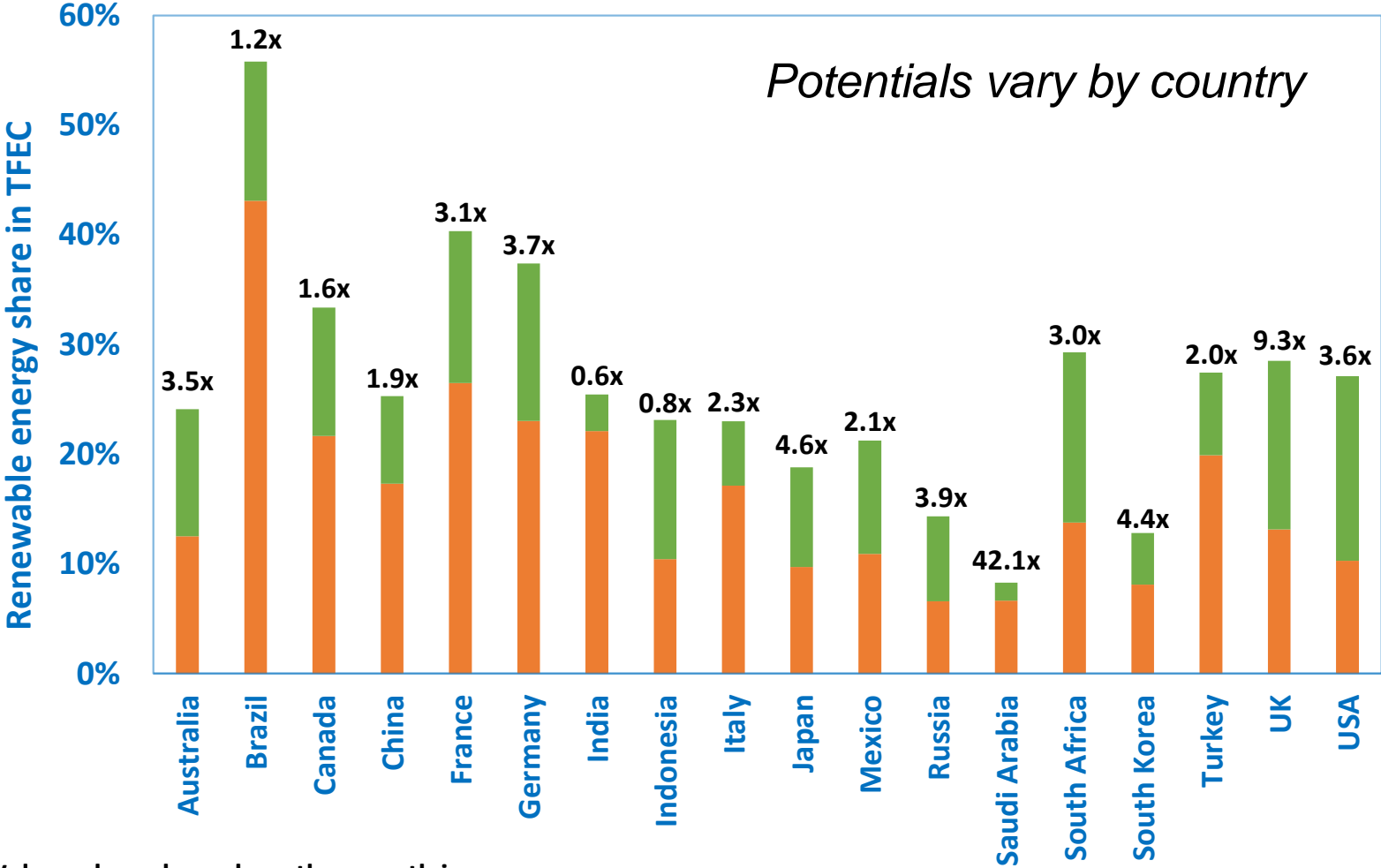


26 countries – 75% of global energy consumption

China is the largest single market for global renewable energy use

Renewable energy prospects

Important untapped economic potentials

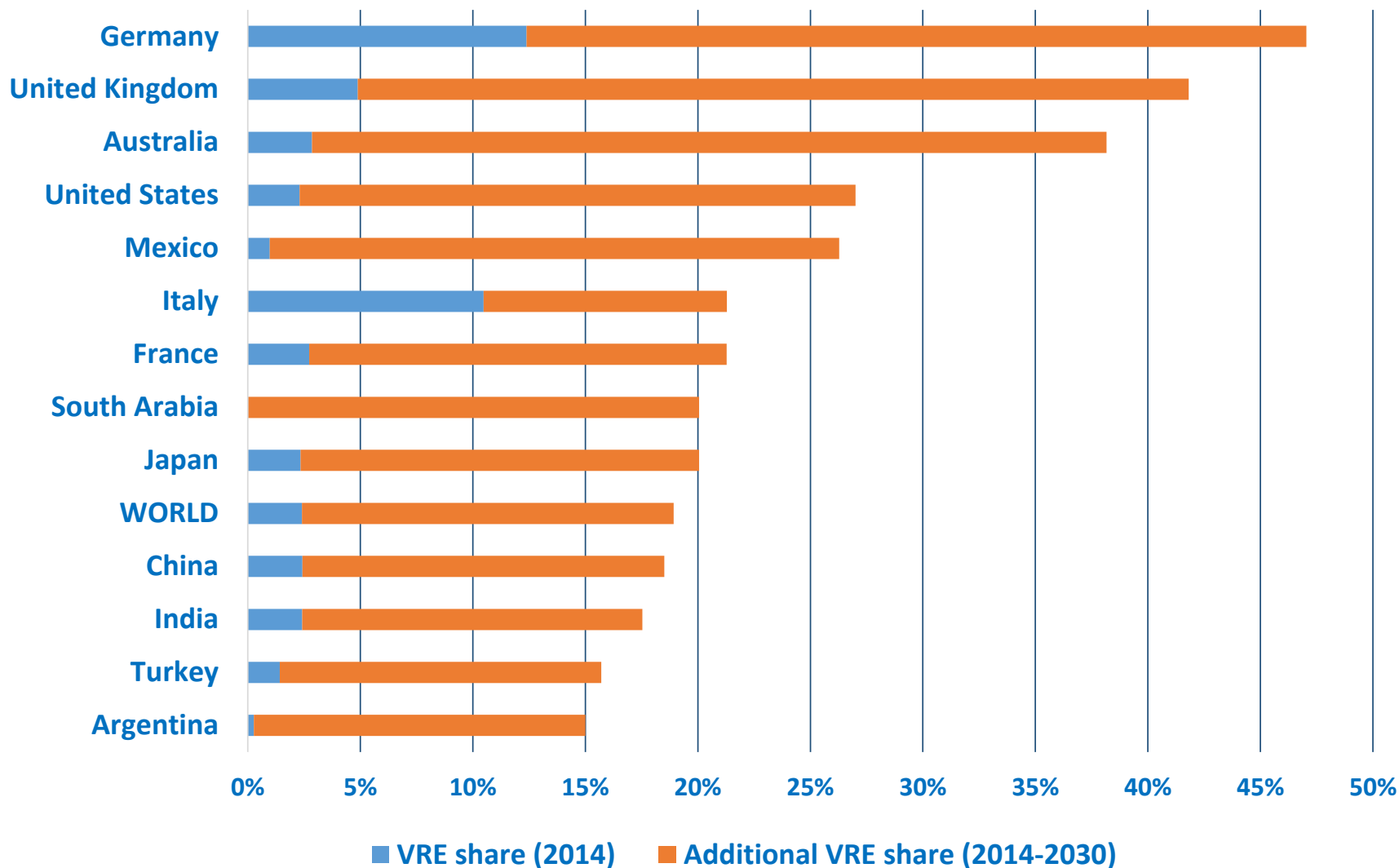


Values above bars show the growth in RE share between 2010 and REmap 2030

2030 Reference Case REmap 2030

Variable renewable energy shares rising

A need for comprehensive grid integration strategies



- Represents 60% of the total global renewable energy use in 2030 (about 80 EJ per year)
- Used in different end-use applications
- 65-70% of the total supply is agricultural residues and forestry products

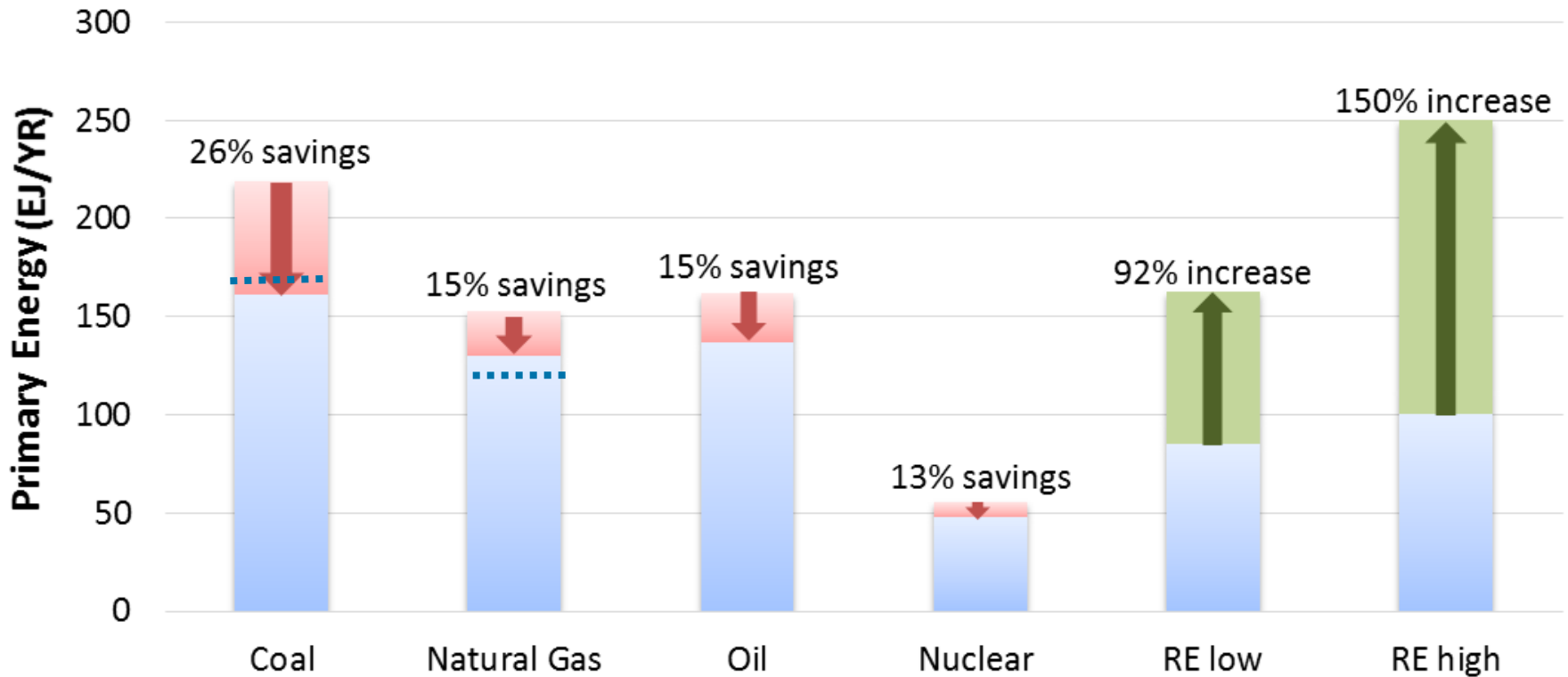
- International biomass trade accounts for 20-35% of the demand in 2030
- An international trade market of USD 100-400 billion per year

- 480 GW rooftop worldwide (out of 1250 GW)
- In some countries, distributed generation plays a key role (example from India)
 - 55 GW solar PV rooftop
 - 22 GW off-grid/mini-grid applications
 - >10 GW telecom towers
 - 1.3 GW small-scale wind
- 160 million electric vehicles worldwide
- 150 GW of energy storage worldwide
- In some countries, electric transportation is key (example from China)
 - 500 million electric two-wheelers (today about 200 million)
 - 35 million electric vehicles

- 1800 GW coal power plant capacity represents today 40% of the total (5250 GW)
- Another 300 GW is under construction, and 900+ GW is planned (three-quarters in China and India)
- About 750 GW coal capacity to retire by 2030 (mainly in Europe and the United States)
- Renewables can substitute about 600 GW of new coal capacity in 2030

Energy Supply Consequences

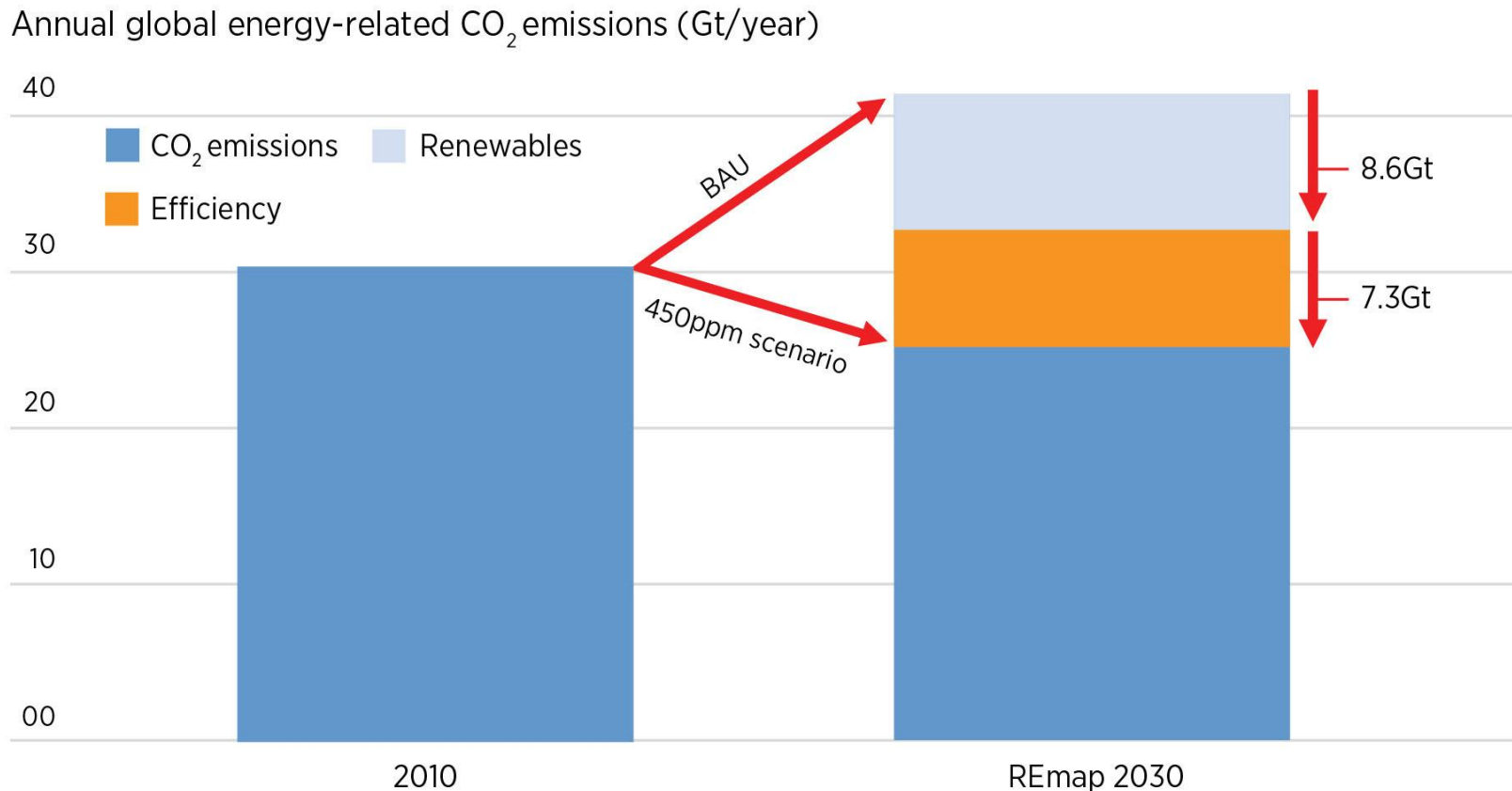
RE can be the largest Energy Source by 2030



..... Indicates 2012 level

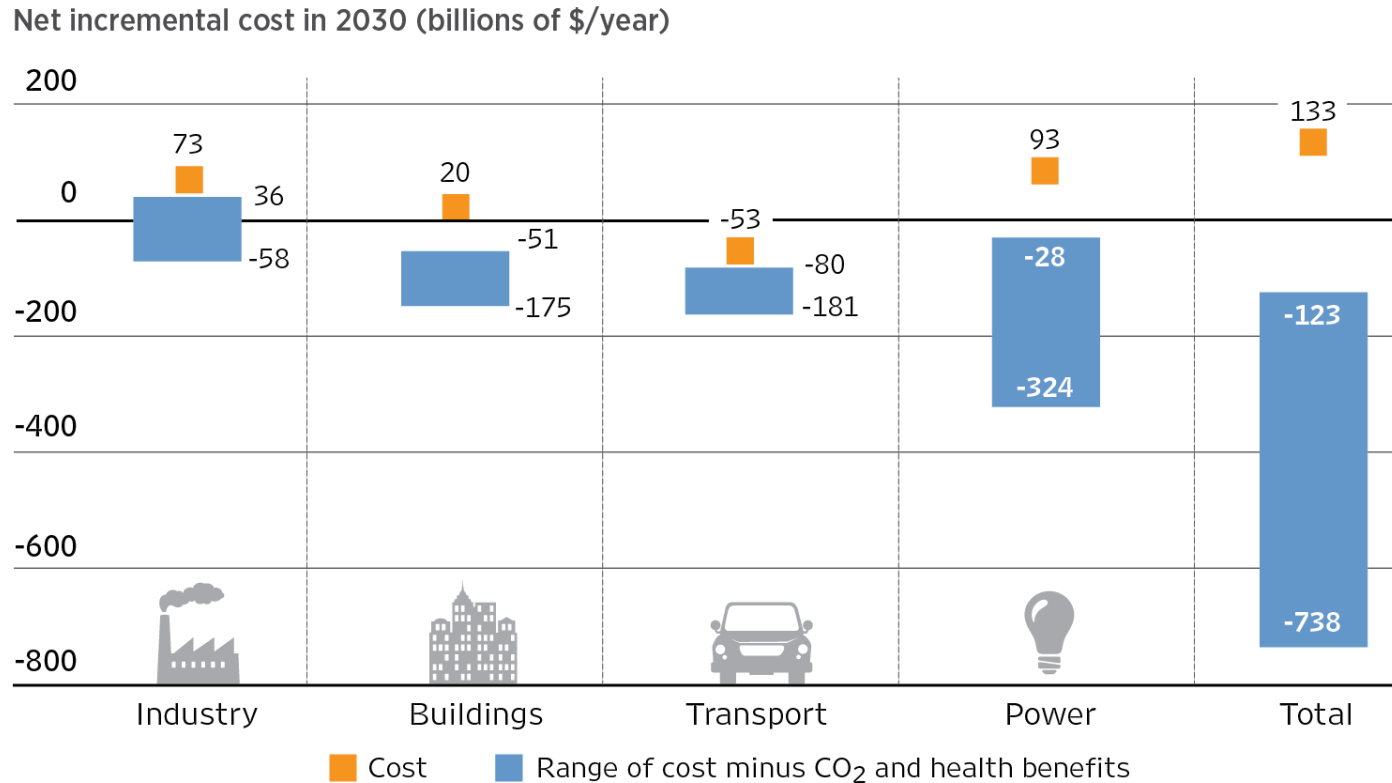
The doubling of renewables will mostly offset coal consumption

With Renewables + Efficiency on a 450ppm Path



Fossil fuel substitution yields 8.6 Gt CO₂ reduction – on par with the role of efficiency

The Energy Transition is Affordable



Renewable energy saves up to \$740 billion per year in 2030

Between now and 2030, USD 675 bln/yr investment needs in RE technologies

Benefits for Health, Environment and the Economy

↓ **\$200bn**



Global health-related costs can be reduced up to \$200 billion annually

↑ **900,000 jobs**



Doubling the global share of renewable energy would create a net gain of 900,000 jobs in the energy sector in 2030

↓ **15%**



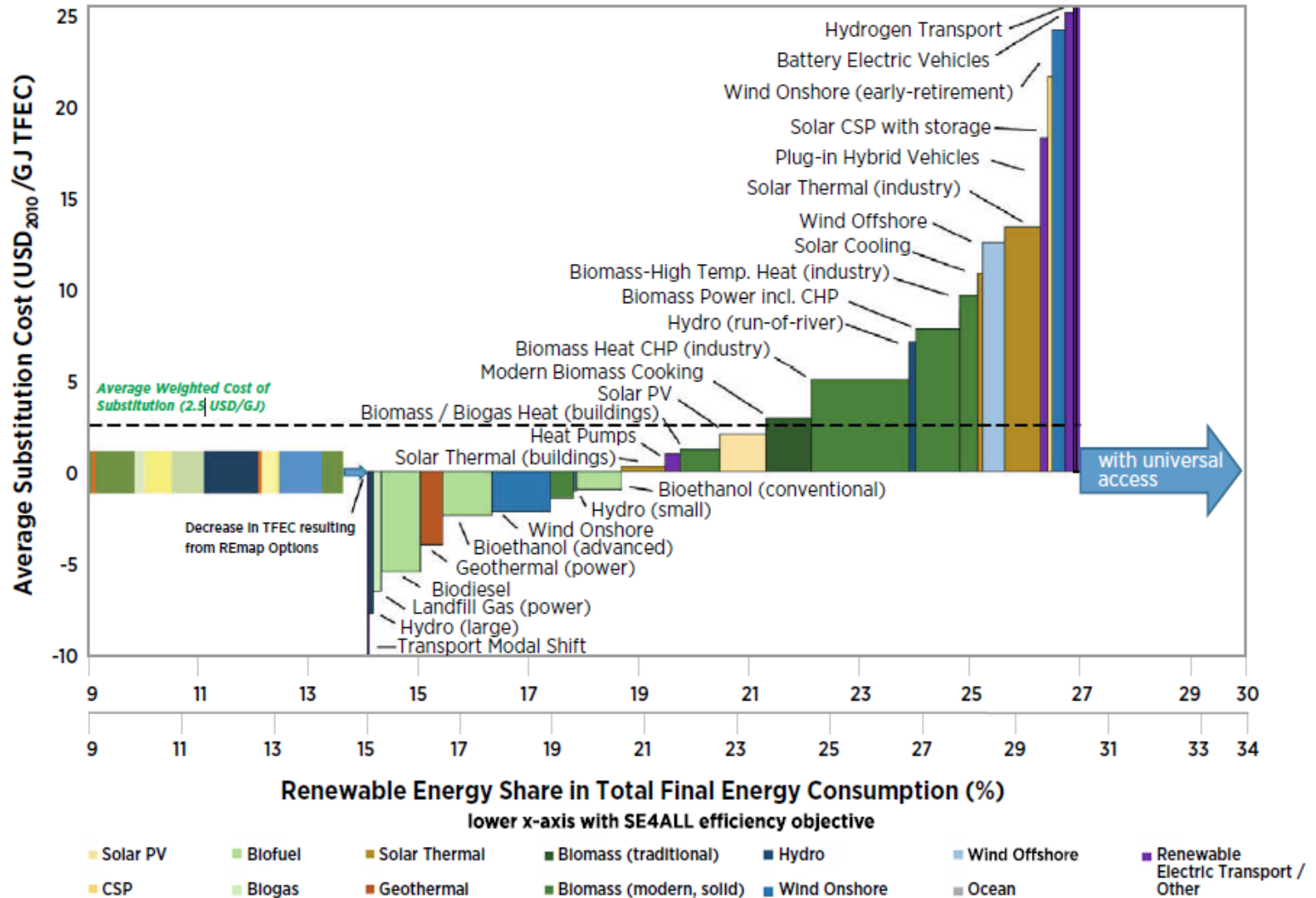
Demand for oil and natural gas can be reduced by around 15%, creating more energy security for fossil-fuel importing countries

↓ **26%**



Demand for coal can decline by 26% resulting in reduced carbon emissions and cleaner air

Global technology cost curve



- Energy issues are rising on the international agenda
- Doubling is technically and economically feasible
- Renewables, together with energy efficiency, are key for significant GHG emission reductions
- Multiple drivers for renewables, and towards a global engagement for renewables
- More attention in end-use sectors is required
- Planning and deployment of enabling technologies will be important
- Some of these topics to be covered in more detail in the next lectures



REmap 2030

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THANK YOU

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