Role of Renewables in IEA Energy Scenarios

Paolo Frankl
Head, Renewable Energy Division
International Energy Agency

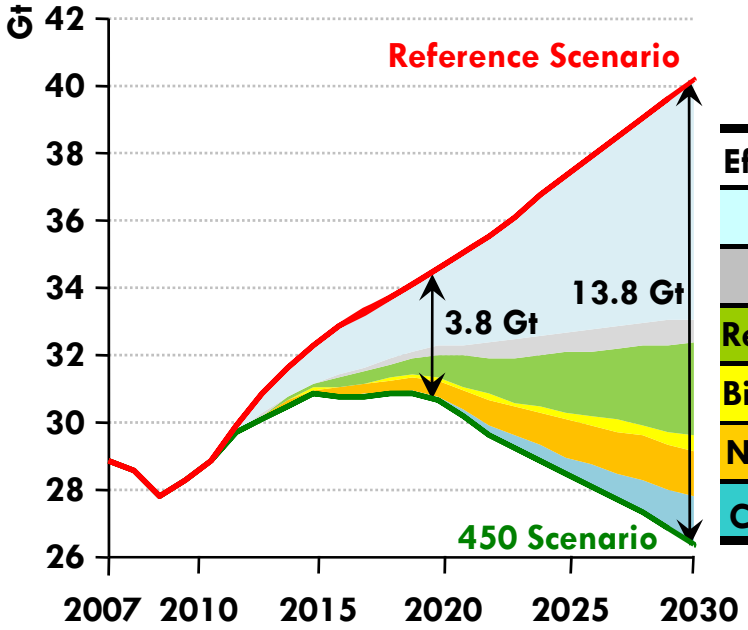
COP 15 IRENA-REN21 Side Event
Copenhagen, 15 December 2009

International Energy Agency

Renewables in IEA Scenarios

- World Energy Outlook 2009
- Energy Technology Perspectives 2010 and Renewable Energy Technology Roadmaps
- Key priority actions to achieve scenario targets

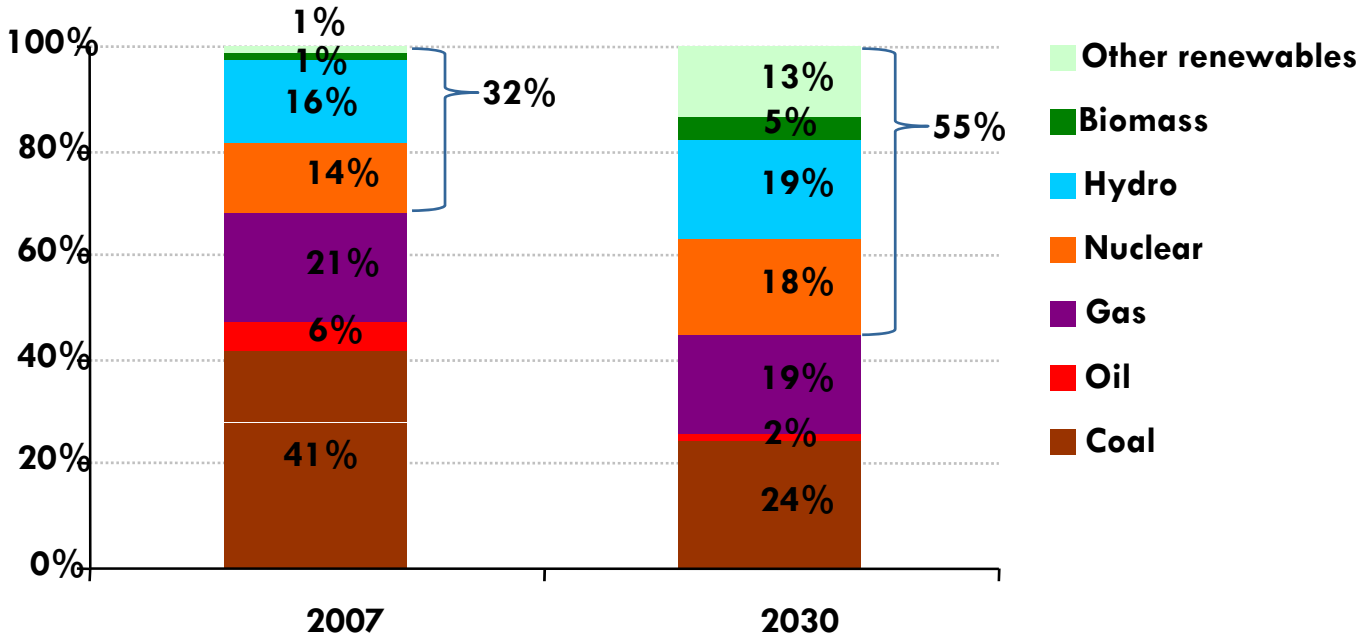
World abatement of energy-related CO_2 emissions in the 450 Scenario



Share of abatement %	2020	2030
Efficiency	65	57
End-use	*59*	*52*
Power plants	*6*	*5*
Renewables	18	20
Biofuels	1	3
Nuclear	13	10
CCS	3	10

Renewable energy is the second largest contributor to CO2 emissions abatement after energy efficiency

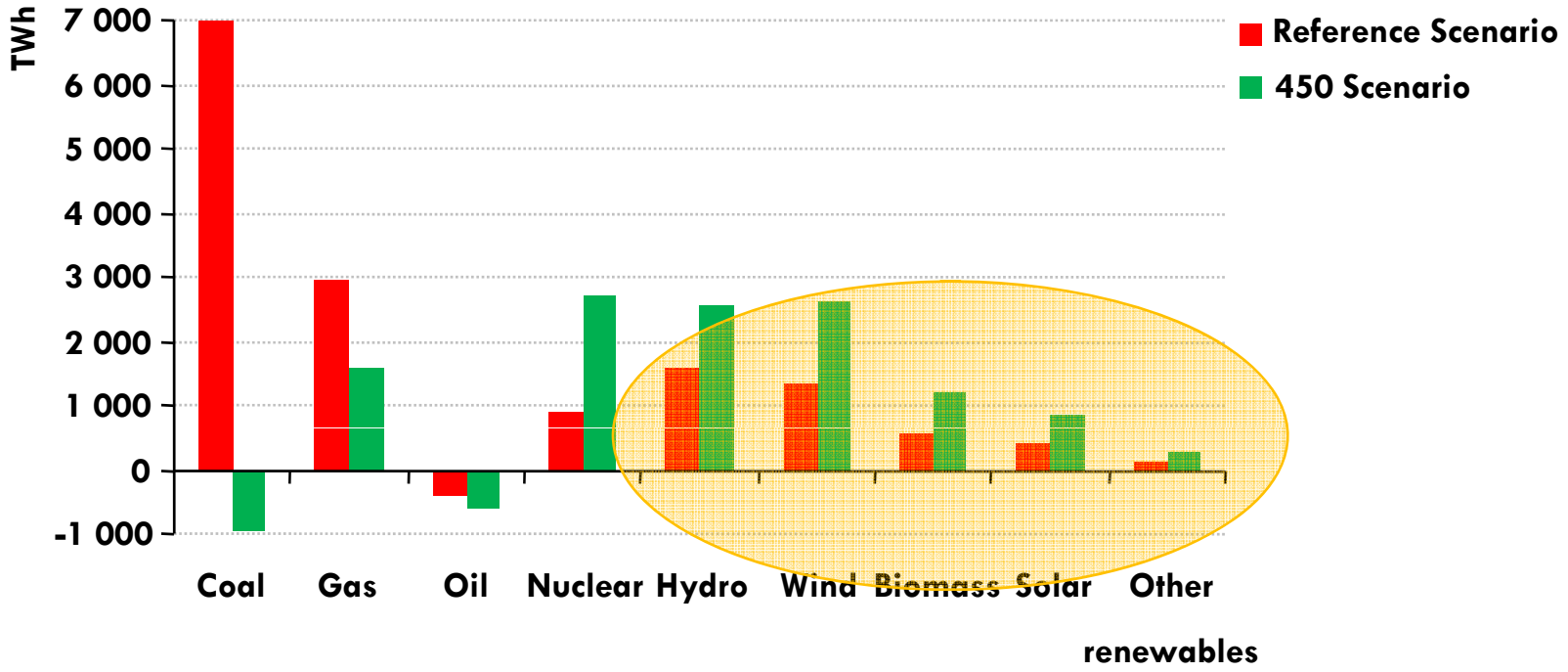
Share of zero-carbon fuels in world electricity generation in 450 Scenario



Renewable electricity share grows from 18% today to 37% in 2030

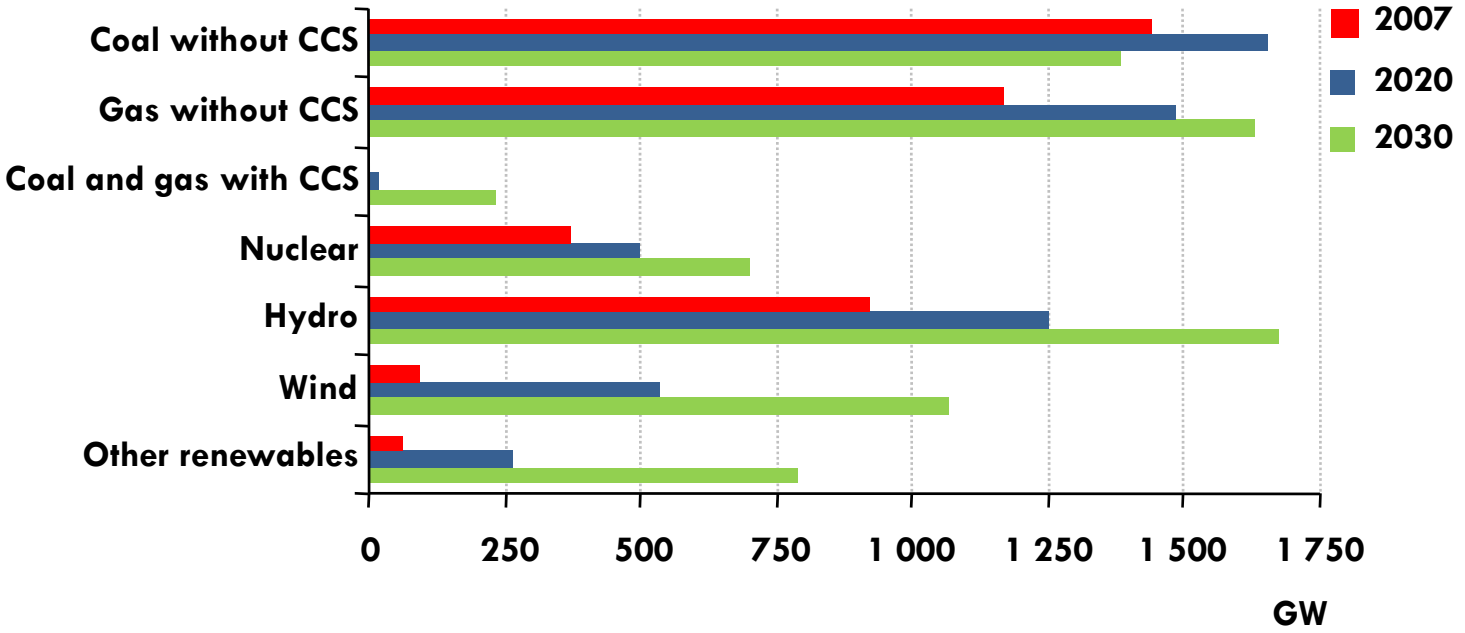
Non-hydro renewable generation increases more than ten-fold in absolute terms

Incremental world electricity production in the Reference and 450 Scenarios, 2007-2030



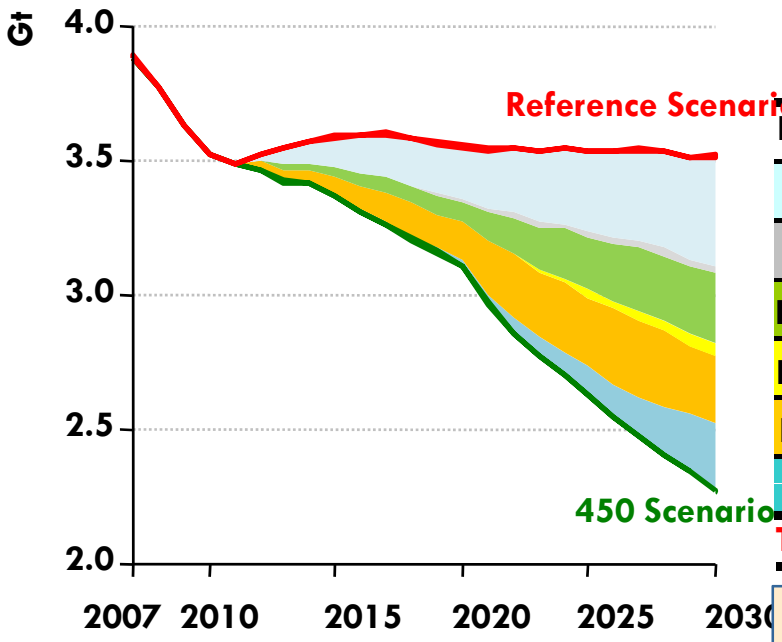
Renewables, nuclear and plants fitted with CCS account for around 60% of electricity generation globally in 2030 in the 450 Scenario, up from less than one-third today

World power generation capacity in the 450 Scenario



Total investment in the 450 Scenario of almost $6 600 billion in low-carbon power generation over 2010-2030 (72% renewables, 19% nuclear, 9% CCS)

European Union energy-related CO_2 emissions abatement



Abatement in 450 vs. Reference Scenario

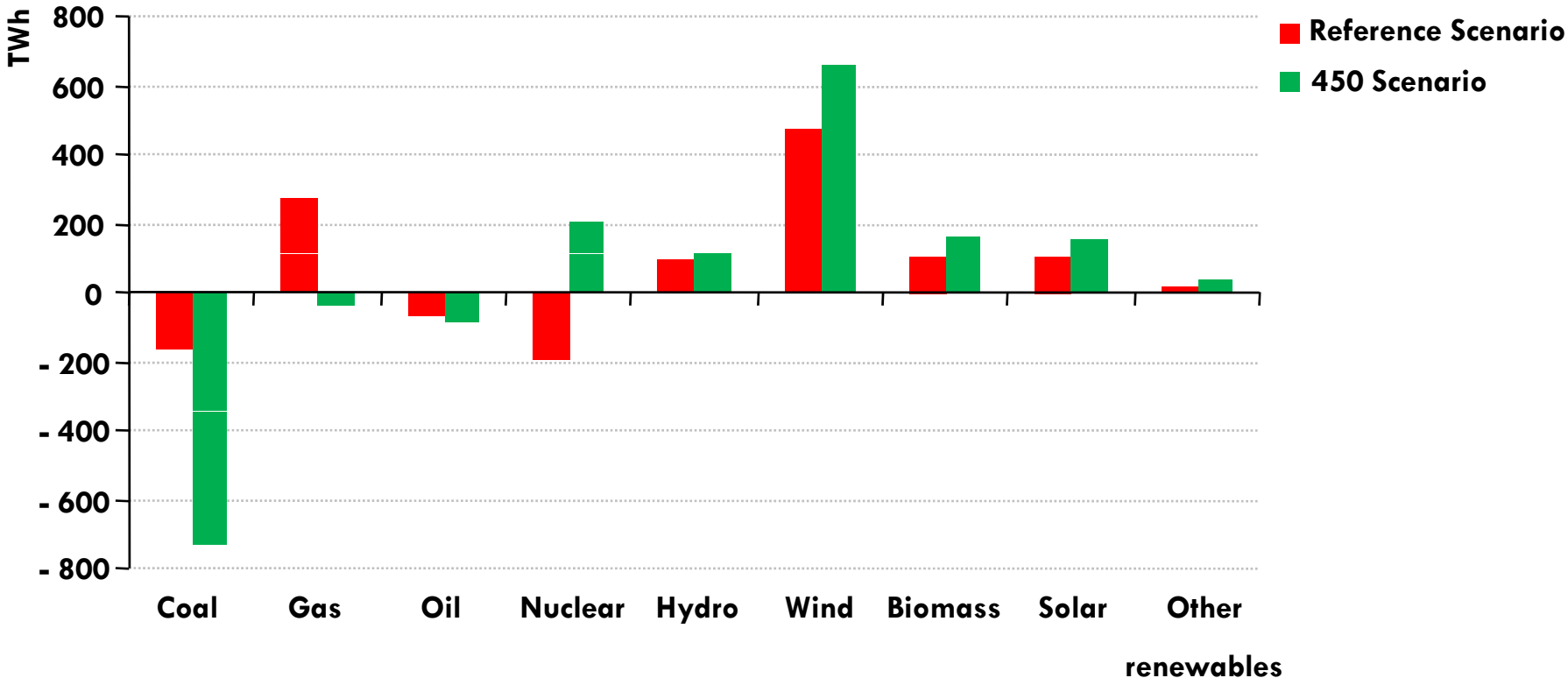
	2020	2030 ($Mt CO_2$)
Efficiency	206	438
End-use	*197*	*414*
Power plants	*9*	*24*
Renewables	80	256
Biofuels	1	50
Nuclear	143	253
CCS	16	250
TOTAL	444	1 247

Cumulative additional investment in 450 vs Reference Scenario	2010-2020	2021-2030
	$480 bn	$1 130bn

Total additional investment in the 450 Scenario of nearly $1 300 billion in low-carbon power generation over 2010-2030 (77% renewables, 16% nuclear, 7% CCS)

World Energy Outlook 2009

Incremental European Union electricity production in the Reference and 450 Scenarios, 2007-2030

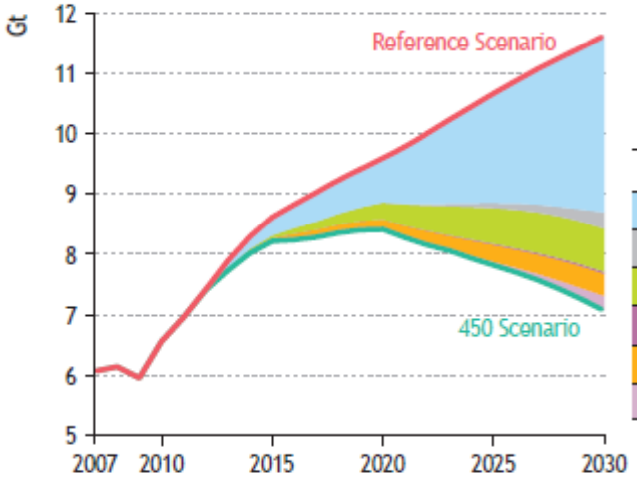


Renewables, nuclear and plants fitted with CCS account for around 80% of electricity generation in EU in 2030 in the 450 Scenario, up from around 45% today

WEO 2009 Excerpt – China

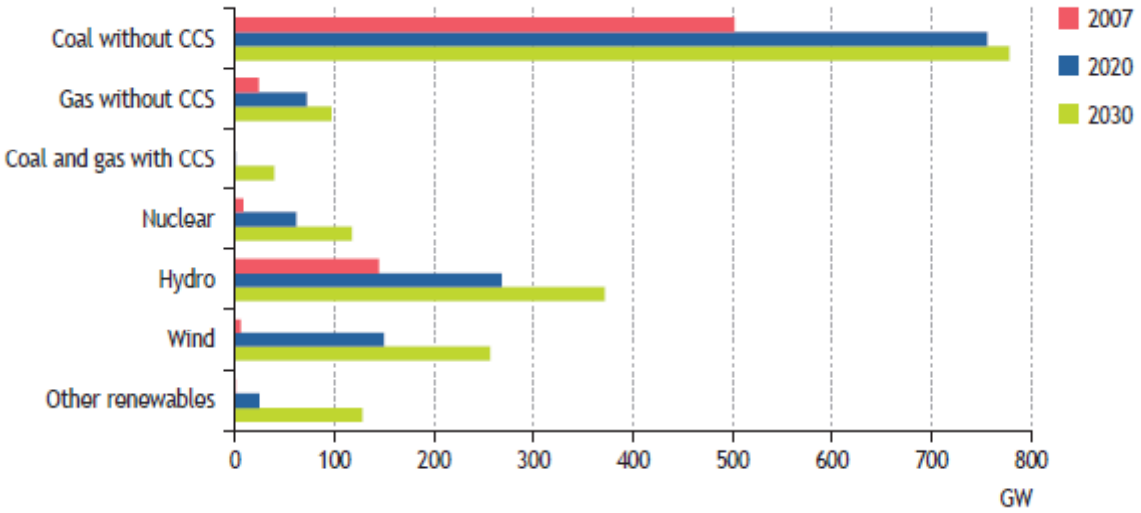
World Energy Outlook 2009

Figure 38: China energy-related CO_2 emissions abatement



	Abatement (Mt CO_2)		Investment ($2008 billion)	
	2020	2030	2010-2020	2021-2030
Efficiency	728	3 195	266	1 210
End-use	728	2 923	257	1 205
Power plants	0	272	8	5
Renewables	279	715	208	485
Biofuels	0	35	1	28
Nuclear	168	366	63	107
CCS	3	243	1	68

Figure 39: China power generation capacity in the 450 Scenario



[Source: WEO 2009 Excerpt]

ETP 2010 - Four Themes

- **Updated scenarios with greater regional detail**
  - **China, India, US, EU**
- **Sectoral deep-dives**
  - **Industry, Transport, Buildings, Electricity Networks**
- **Cross-cutting issues**
- **Roadmaps and transitions pathways**
  - **Wind, PV, *CSP, biofuels, geothermal***

Set of scenarios

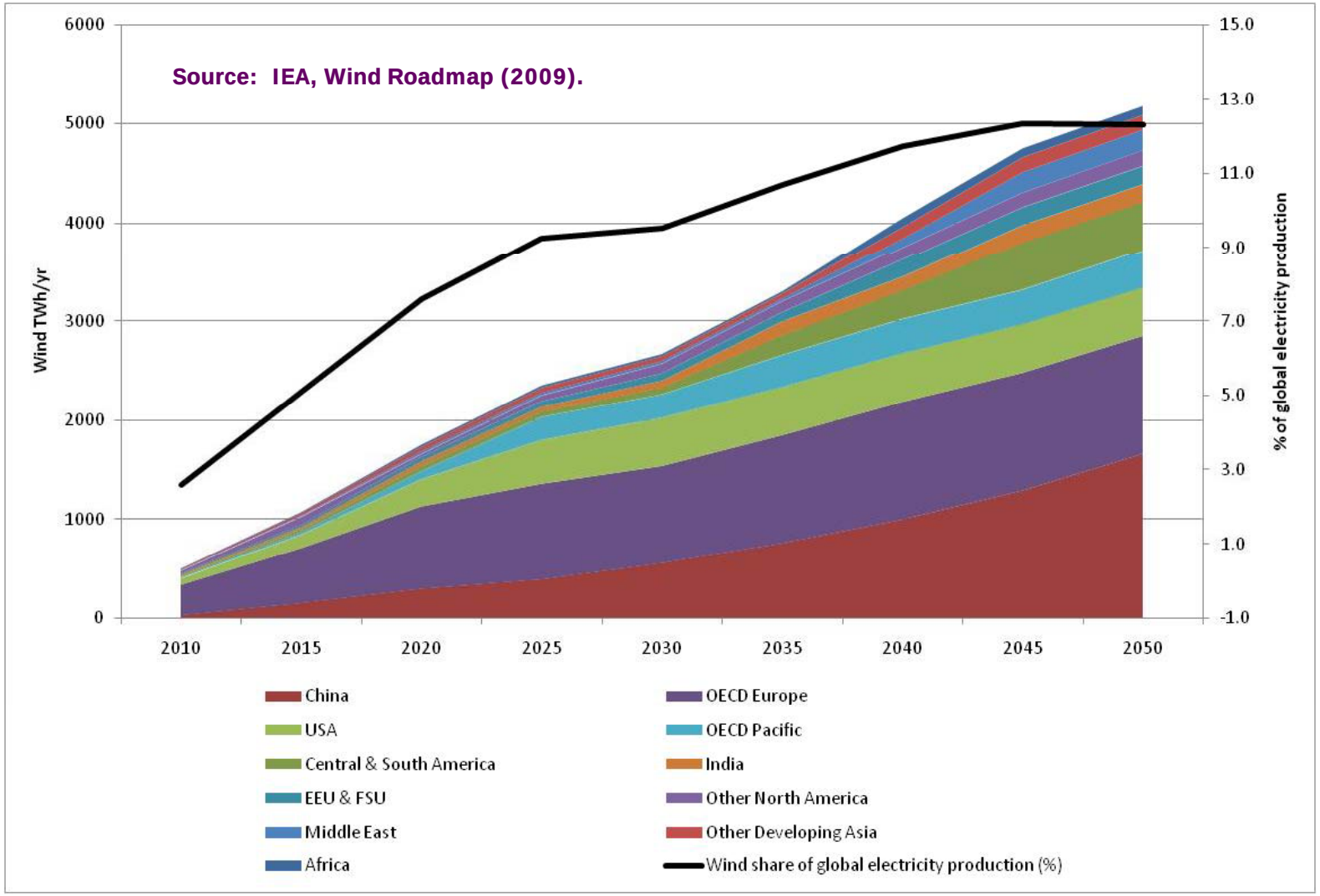
Including High-RE, High-DG

Cross-Cutting Issues

- **Energy RD&D and innovation**
- **Technology diffusion & transfer**
- **Financing**
- **Economic growth and labour market impacts**
- **Environmental co-benefits / conflicts**
- **Consumer impacts and potentials of behavioral change**
- **Materials needs for energy evolution**

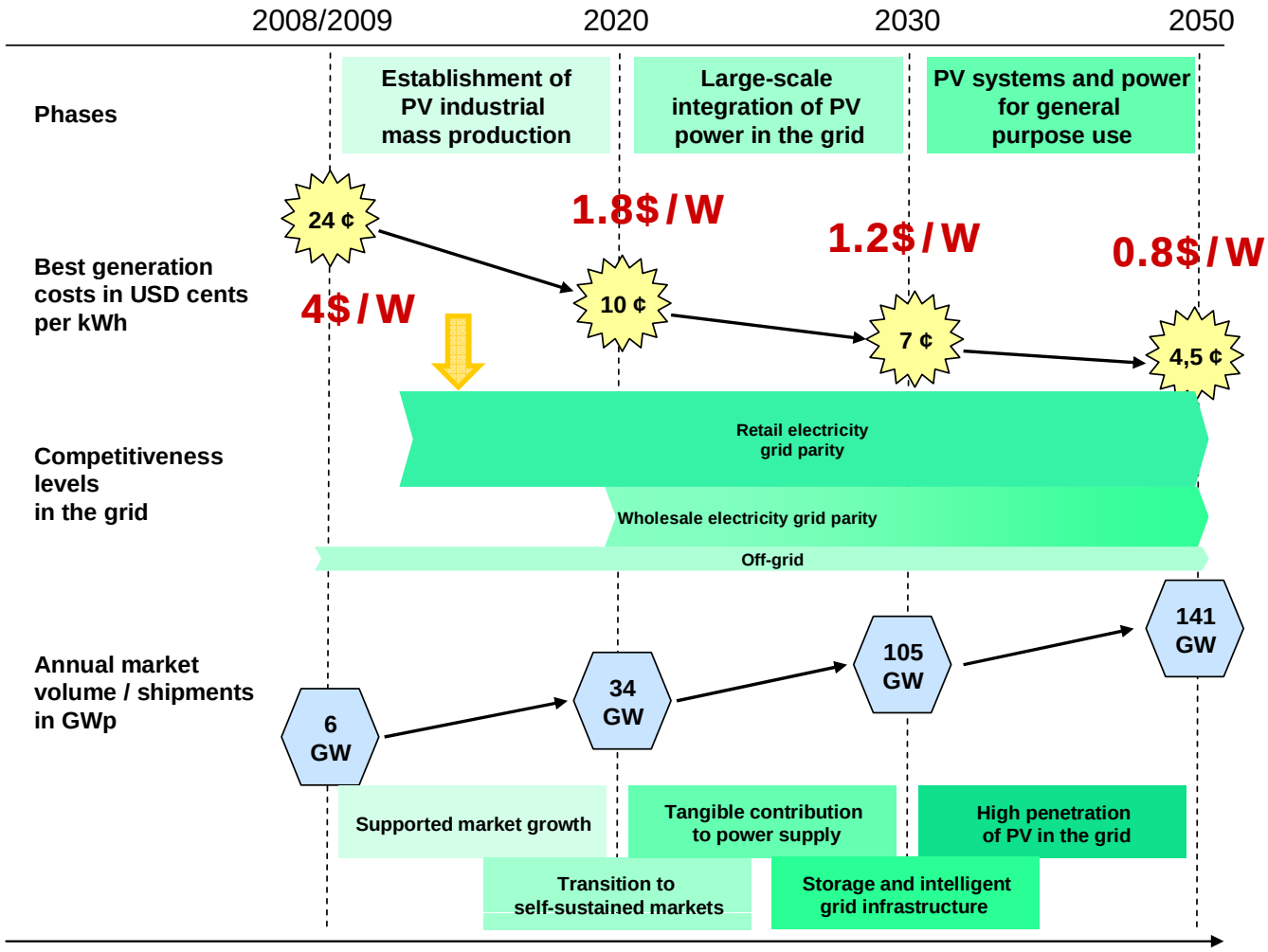
Wind roadmap targets

Regional wind electricity production to 2050 (TWh)



Wind has the potential to provide 12 % of global electricity production and avoid up to 2.8 Gt CO_2/yr in 2050

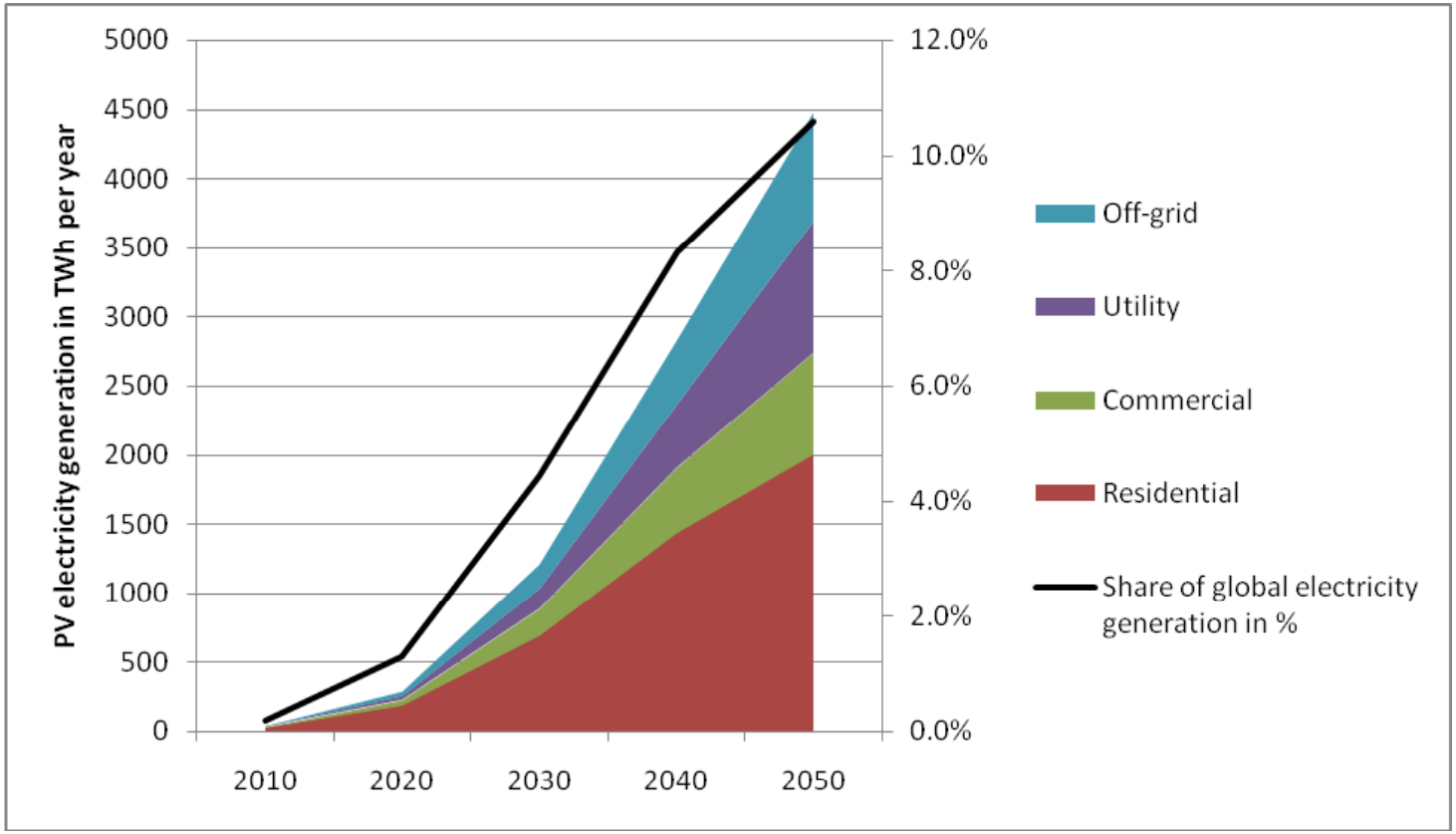
PV deployment and Competitiveness levels



Source: IEA, Solar PV Roadmap (2009).

Solar PV Roadmap Vision

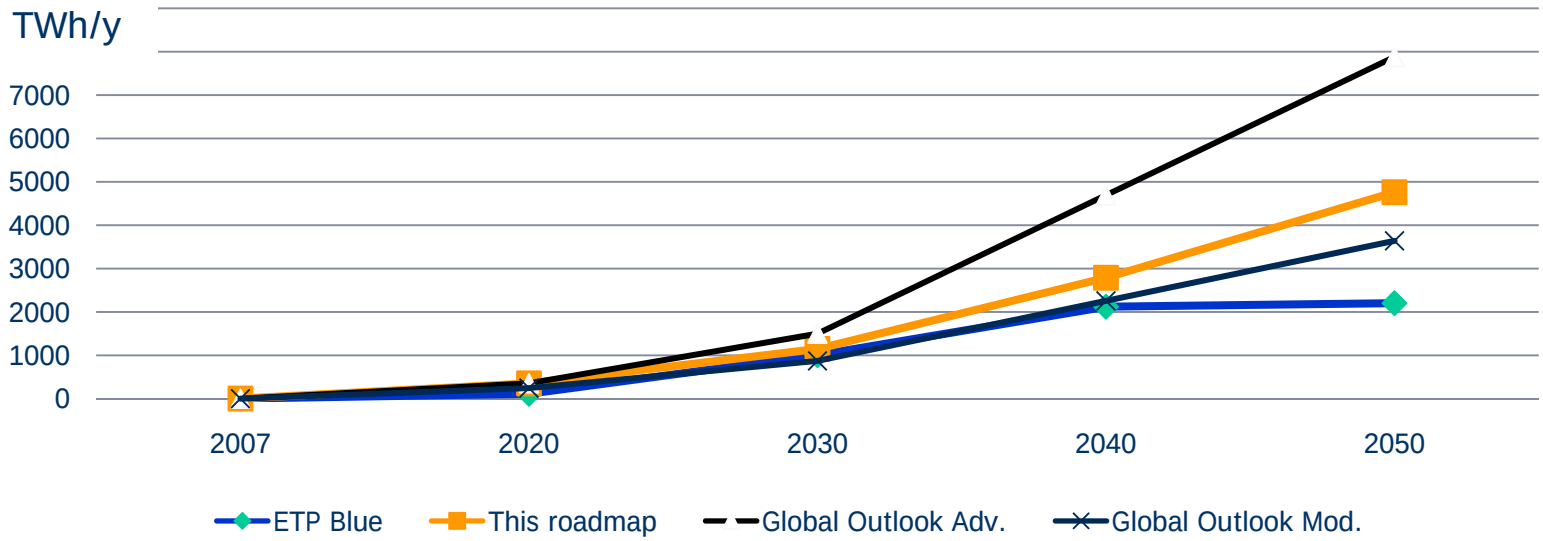
Solar PV electricity production by end-use sector (TWh/yr)

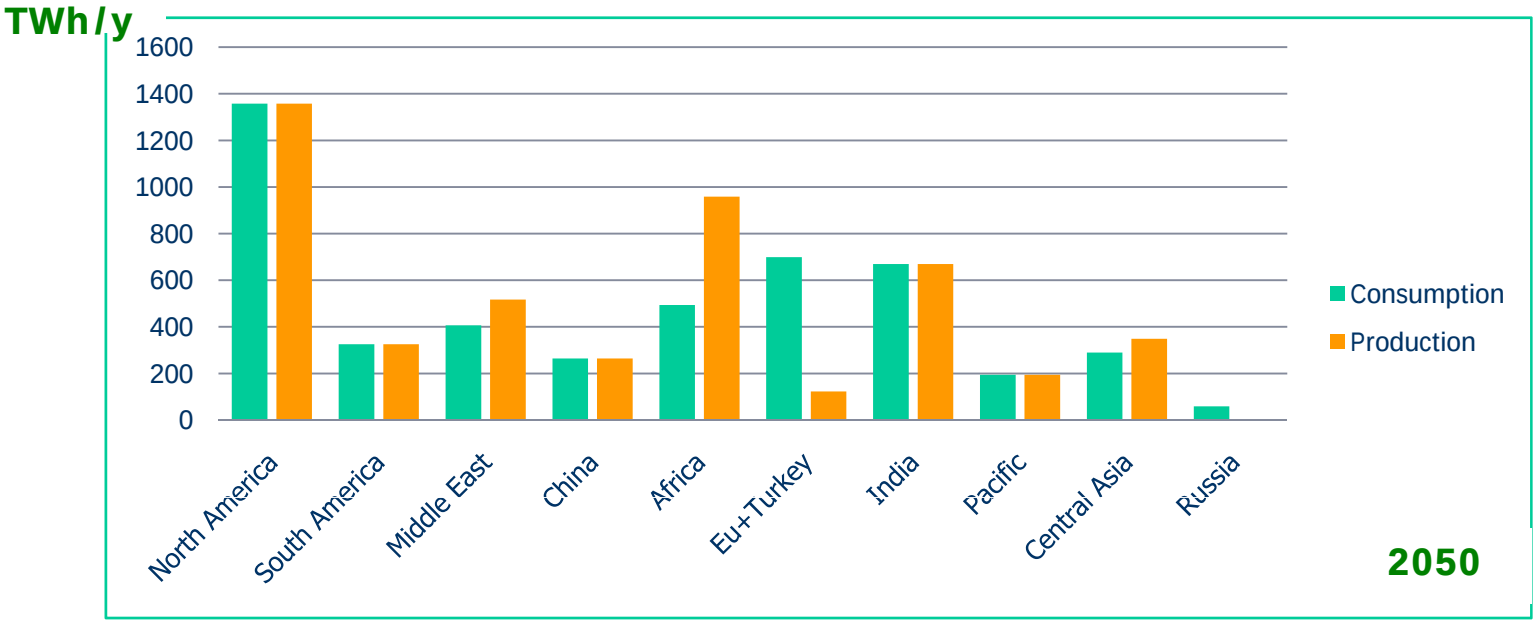


Source: IEA, Solar PV Roadmap (2009).

PV expected to provide 5% of global electricity generation in 2030, 11% in 2050 and to avoid 2.3 Gt CO_2/yr in 2050

CSP Roadmap preliminary results

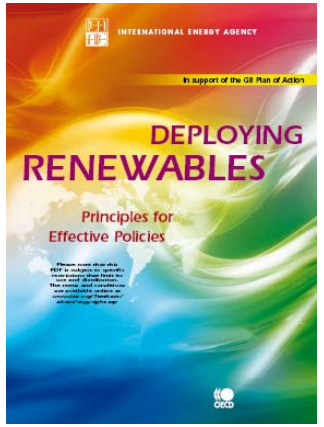


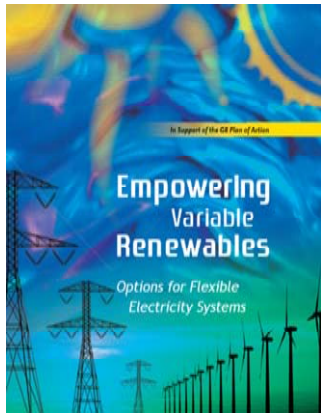


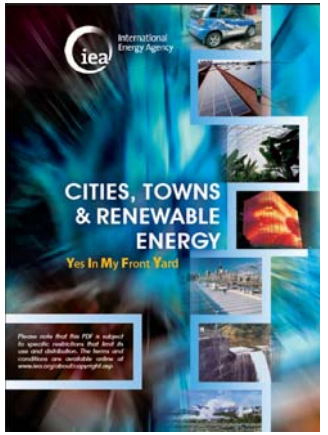
Key Requirements for large-scale RE Deployment

- Long-term oriented yet effective and efficient policy framework and implementation
- Consistent and sustained R&D support
- Improving flexibility of energy networks, in part. electricity grids
  - Smart grids
  - Increased distributed generation
  - RE in Cities & Towns

International collaboration is key
e.g. assessing RE Technology Potentials







Links

- www.iea.org
- www.worldenergyoutlook.org
- RE Technology Roadmaps
  - Home > By Topic > Technology Roadmaps
  - http://www.iea.org/roadmaps/wind.asp
  - http://www.iea.org/roadmaps/CSP.asp
  - http://www.iea.org/roadmaps/PV.asp
- Cities, Towns & Renewable Energy – Yes in My Front Yard
  - Home > Publications
- Contact

  paolo.frankl@iea.org