Renewable Energy

MARKETS & POLICIES

Deploying Renewables 2011

Best and Future Policy Practice

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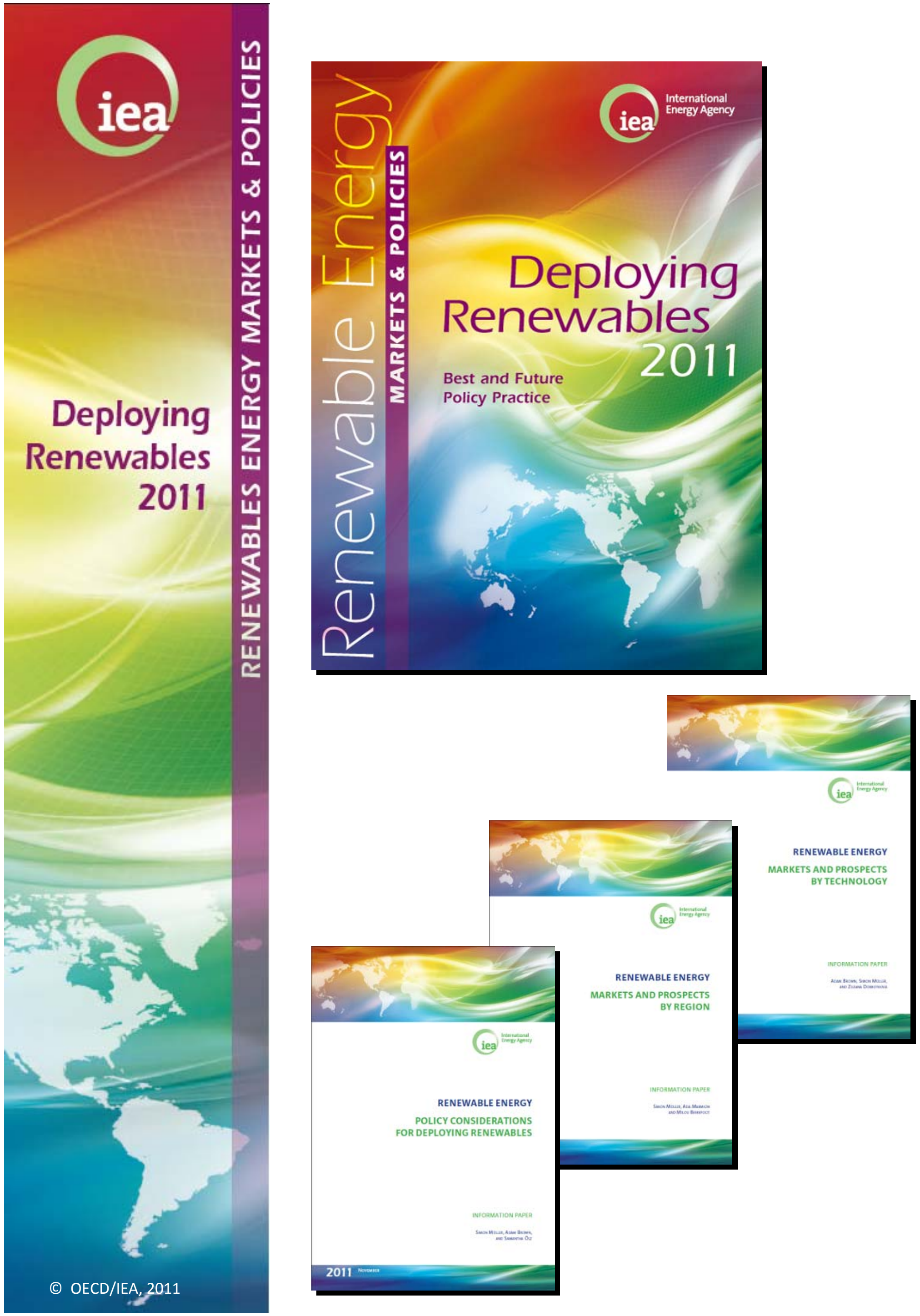
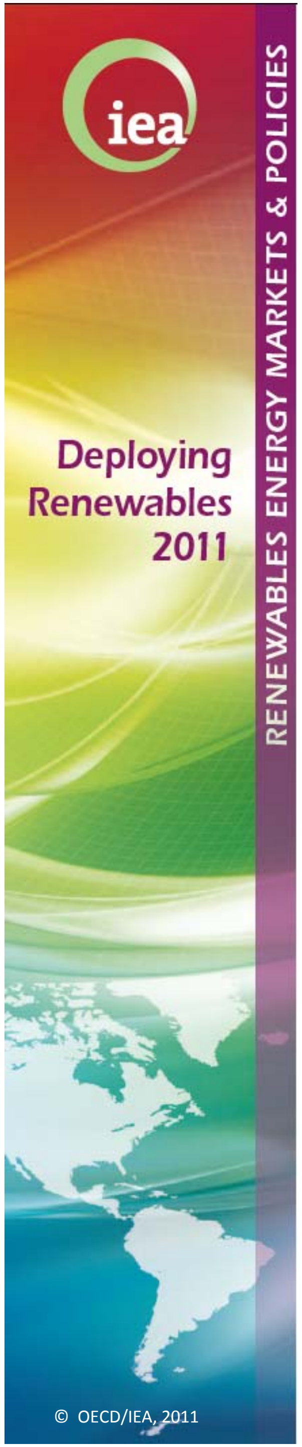
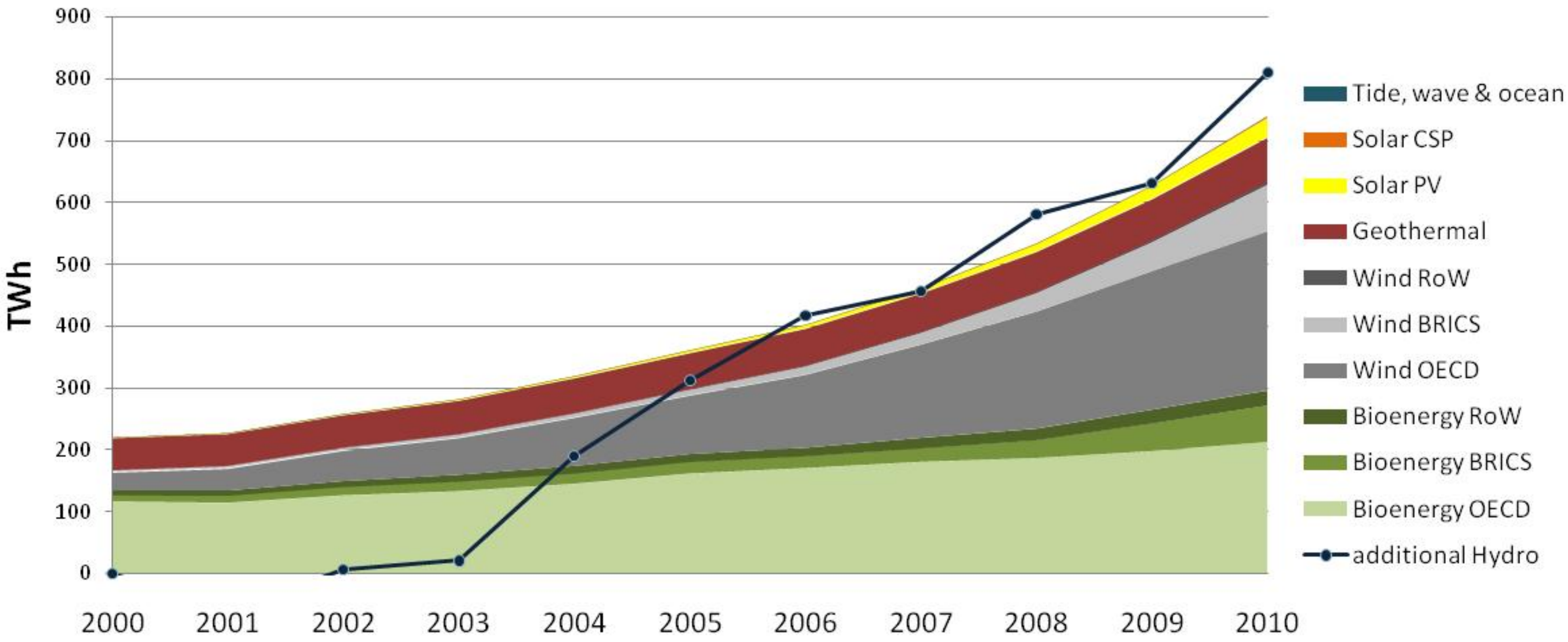


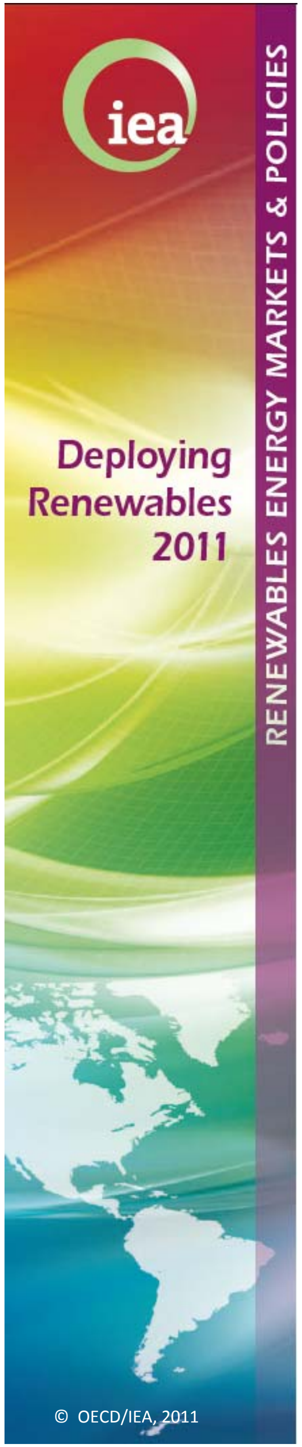
- Analyses market and policy trends for electricity, heat and transport
- Investigates the strategic drivers for RE deployment
- Benchmarks the impact and cost-effectiveness of economic support policies
- Provides best practice policy principles
- Covers **56 countries** and all world regions
- Book and 3 supporting information papers



Strong Growth in RE Electricity … and shift to Asia

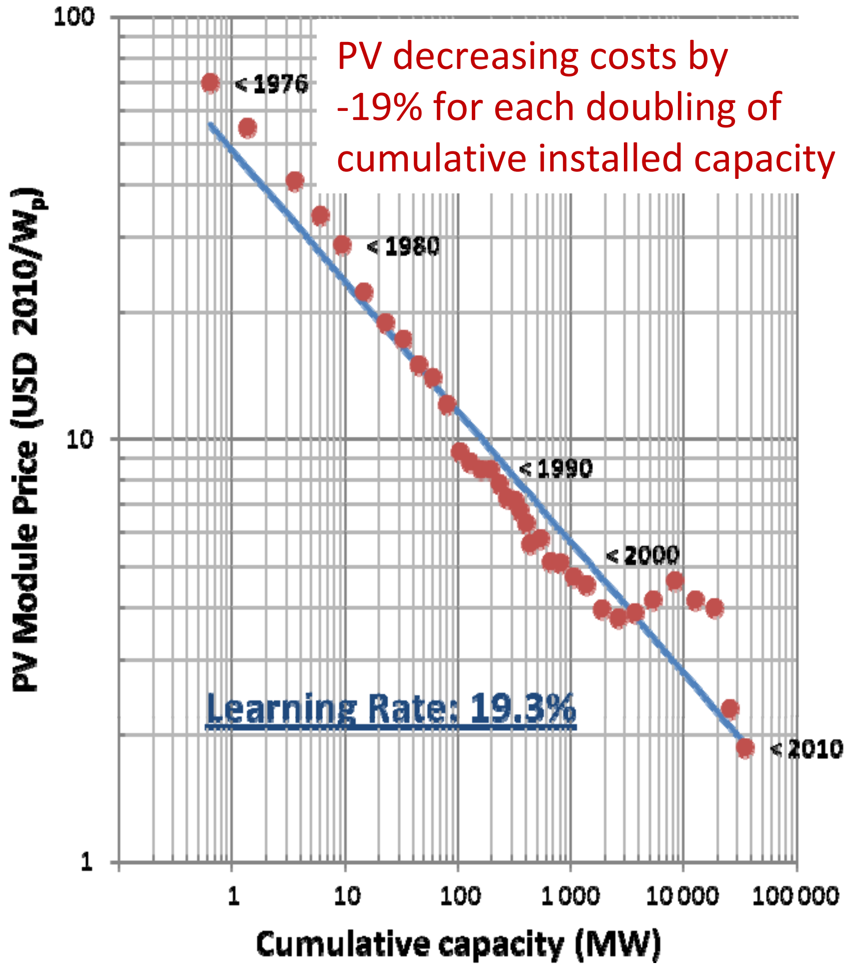


	Wind	Bioenergy	Solar PV	Hydro	other
Generation 2010 [TWh]	338	296	31	3503	74
CAGR 2005-2010 [%]	26.5%	8.8%	50.8%	3.1%	4.6%



Costs are Reducing

- Hydro and some biomass and geothermal already cost-competitive
- Additional technologies getting **competitive in a broader set of circumstances**
- Opens up **new deployment opportunities**

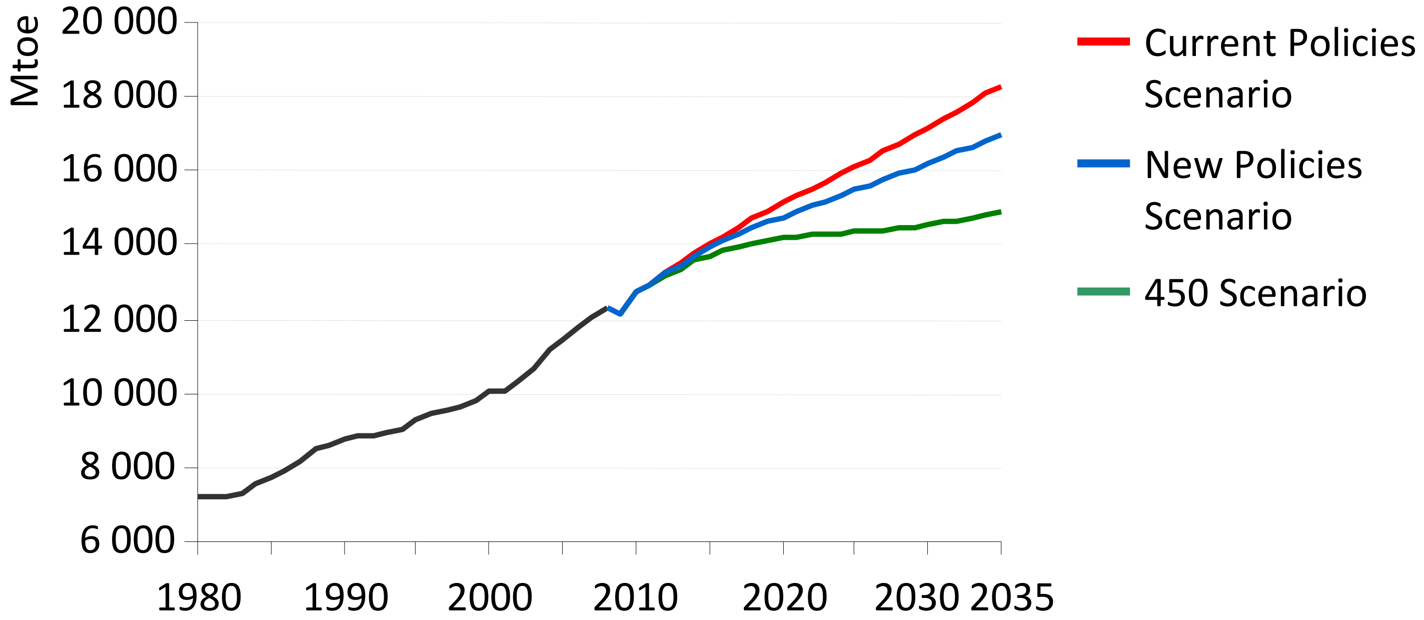


Data from Breyer and Gerlach, 2010

Policies could radically alter the long-term energy outlook

WORLD ENERGY OUTLOOK 2011

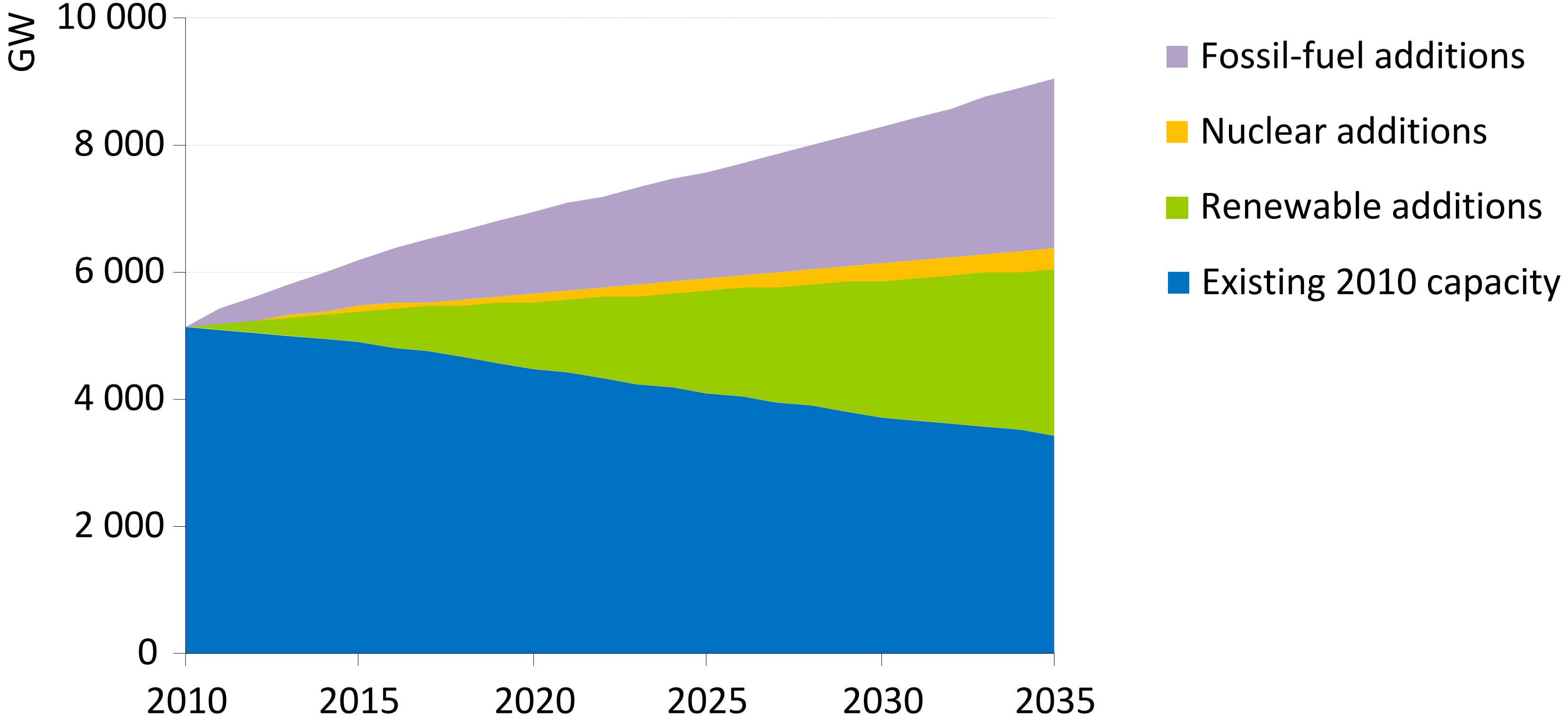
World primary energy demand by scenario



In the New Policies Scenario, demand increases by 40% between 2009 & 2035

Low-carbon power technologies come of age

Global installed power generation capacity in the New Policies Scenario

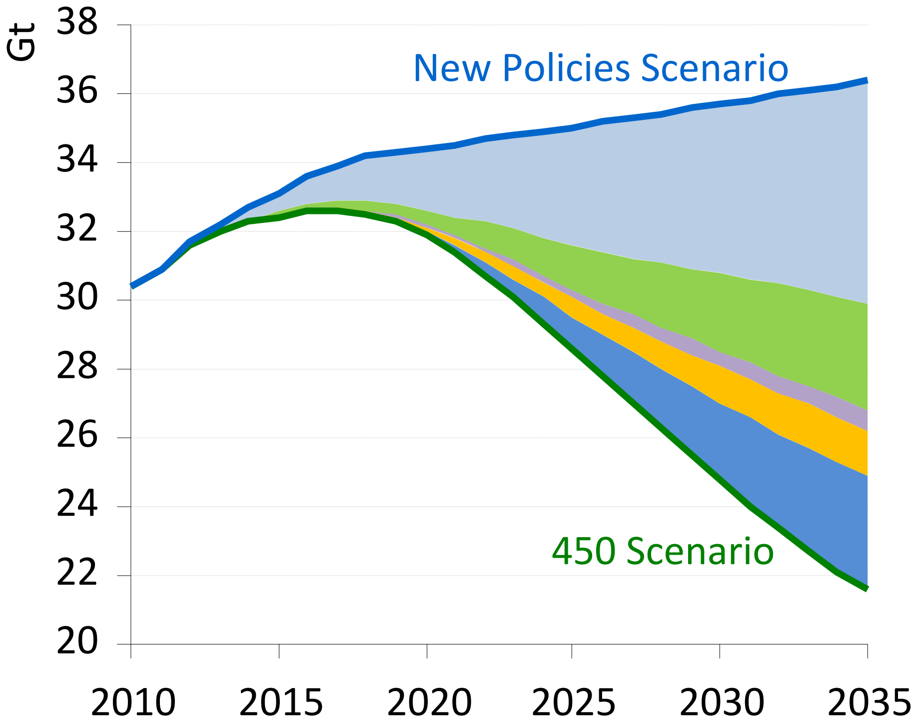


Renewables & nuclear power account for more than half of all the new capacity added worldwide through to 2035

Efficiency gains can contribute most to emissions reductions

WORLD ENERGY OUTLOOK 2011

World energy-related CO_2 emissions abatement in the 450 Scenario relative to the New Policies Scenario



	Abatement	
	2020	2035
Efficiency	72%	44%
Renewables	17%	21%
Biofuels	2%	4%
Nuclear	5%	9%
CCS	3%	22%
Total (Gt CO_2)	2.5	14.8

Energy efficiency measures – driven by strong policy action across all sectors – account for 50% of the cumulative CO_2 abatement over the Outlook period

Moving towards cleaner forms of electricity generation

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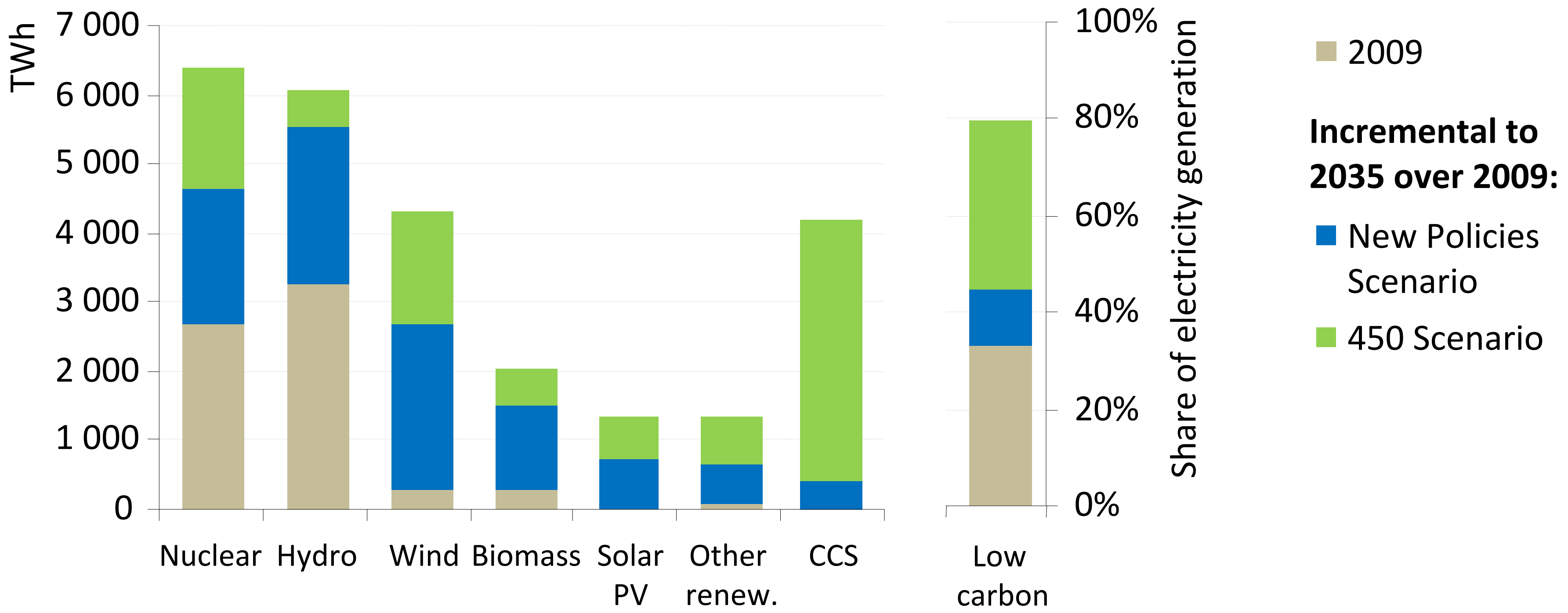
Electricity generation by selected low carbon technology & share of electricity generation by scenario, 2009 and 2035



Low-carbon generation increases 2.5 times between 2009 & 2035 in the New Policies Scenario & almost quadruples in the 450 Scenario

Less nuclear means more of everything else

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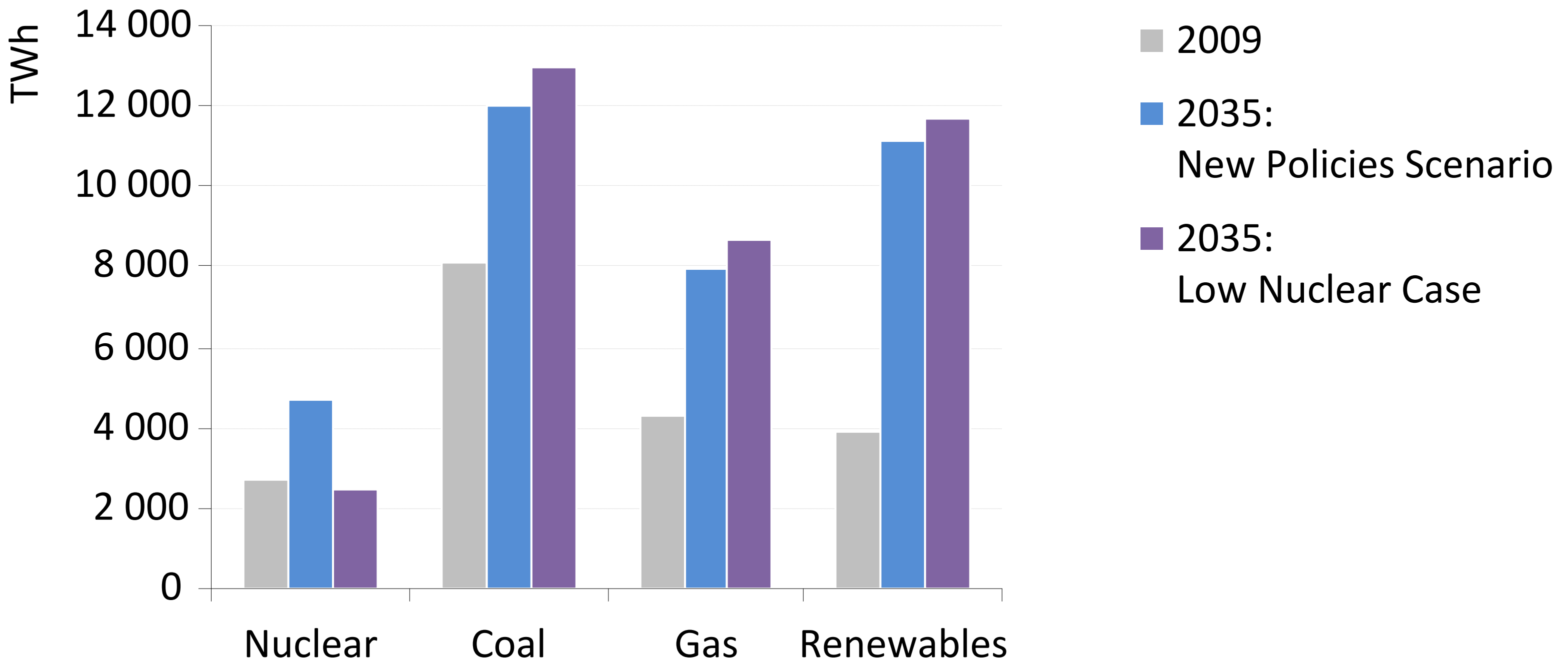
Power generation by fuel in the New Policies Scenario and Low Nuclear Case

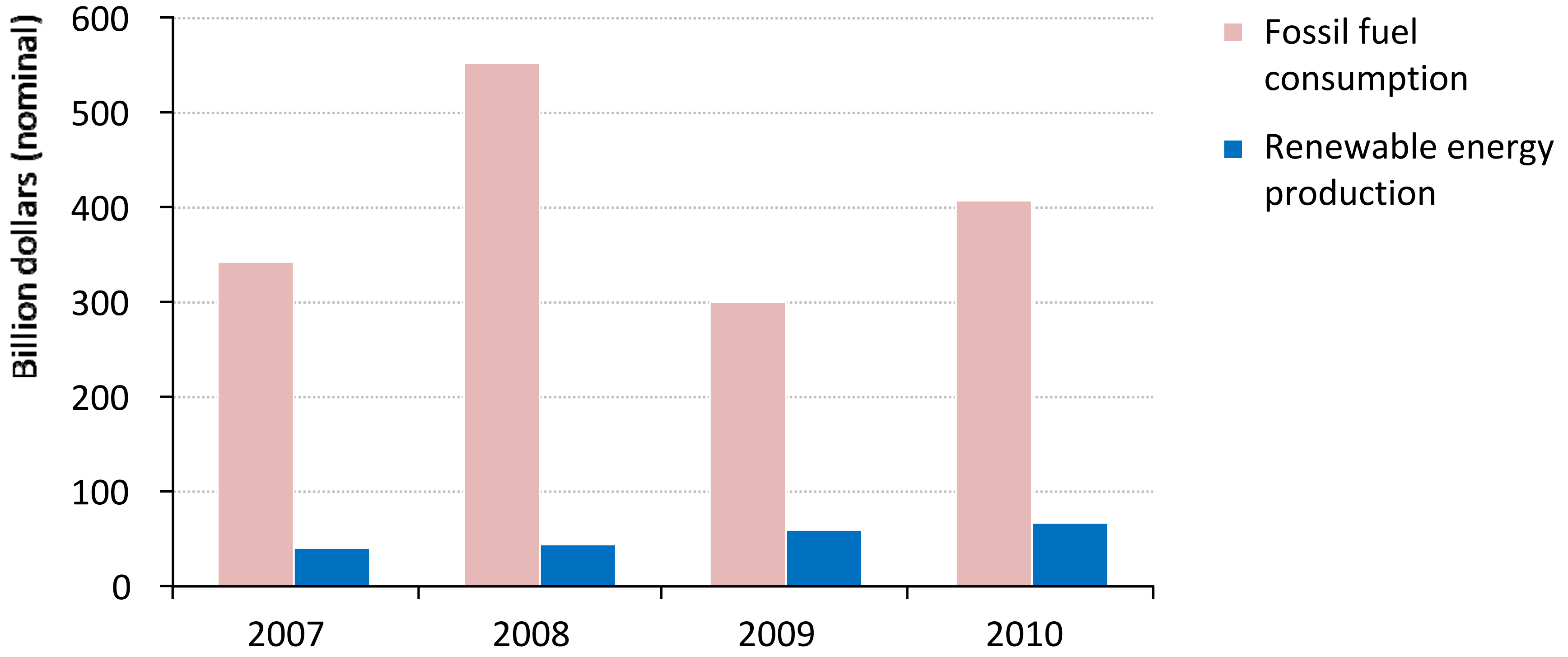


The biggest chunk of the lost nuclear generation is replaced by power generation from coal, leading to a 6% increase in CO_2 emissions in the power sector

The majority of energy subsidies still go to fossil fuels

WORLD ENERGY OUTLOOK 2011

World subsidies to fossil fuels consumption & renewable energy



Fossil-fuels subsidies amounted to $409 billion in 2010 – down from the peak of $550 billion in 2008 but still much larger than subsidies to renewables, which reached $66 billion in 2010

The overall value of subsidies to renewables is set to rise

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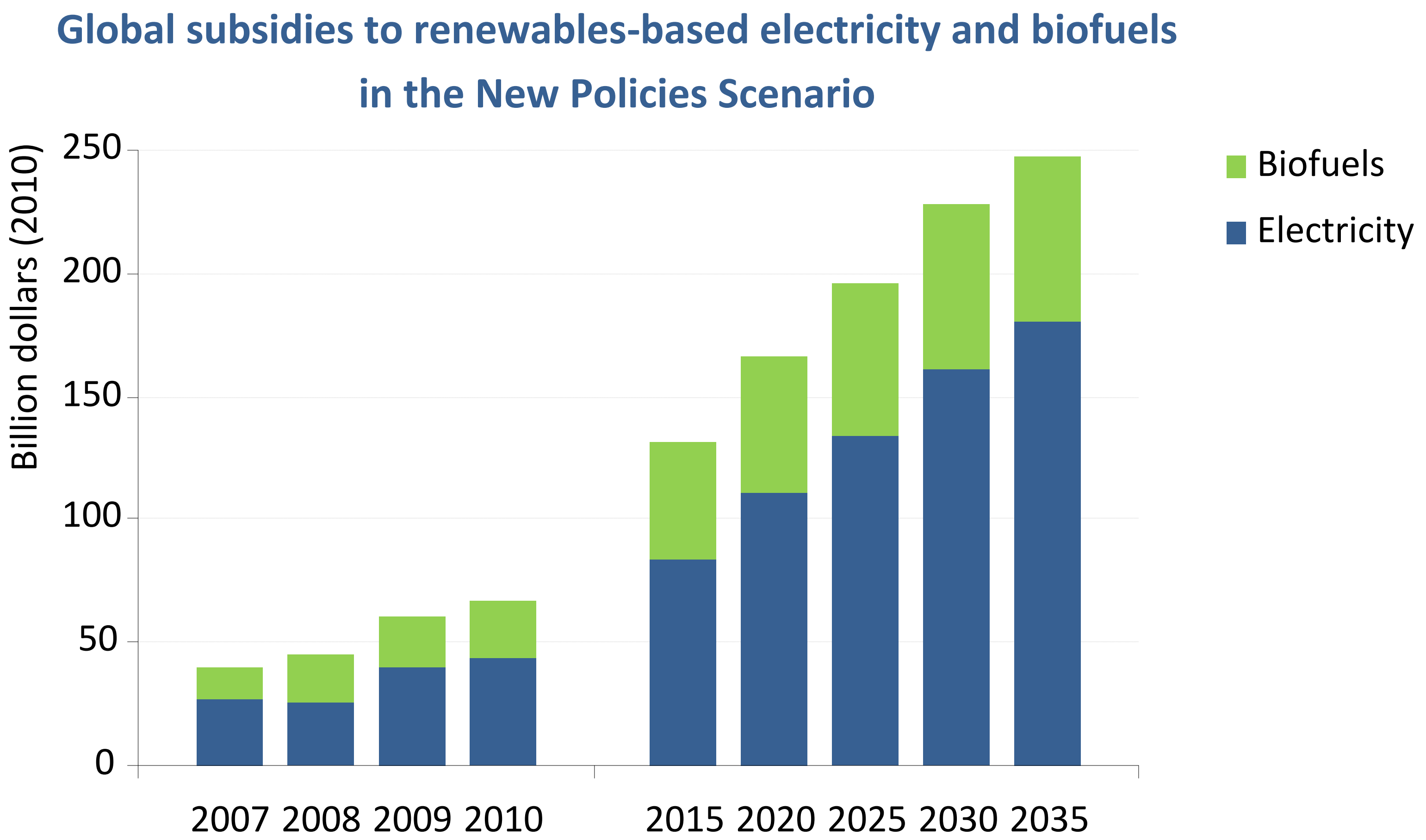
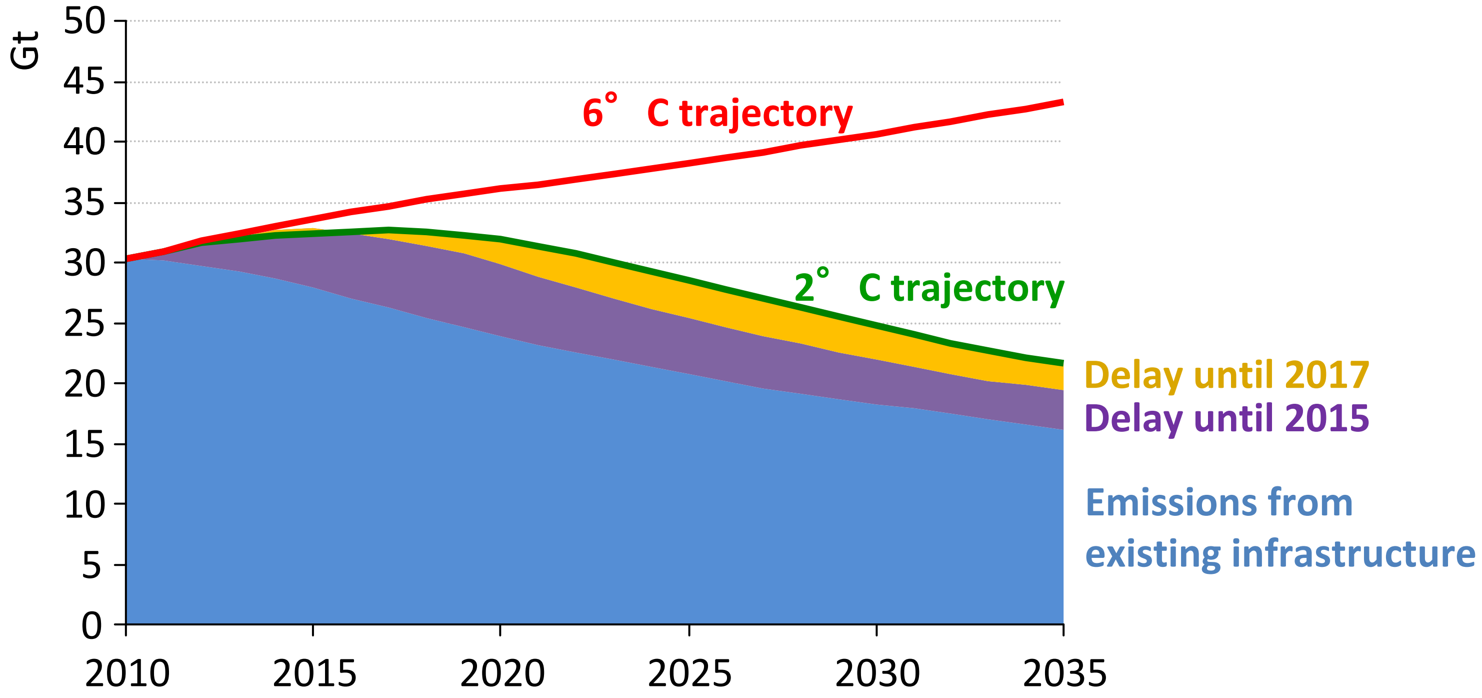


Renewable subsidies of $66 billion in 2010 (compared with $409 billion for fossil fuels), need to climb to $250 billion in 2035 as rising deployment outweighs improved competitiveness

The door to 2°C is closing, but will we be "locked-in"?

WORLD ENERGY OUTLOOK 2011

World energy-related CO_2 emissions in the Current Policies and 450 Scenarios and from locked-in infrastructure in 2010 and with delay



Without further action, by 2017 all CO_2 emissions permitted in the 450 Scenario will be "locked-in" by existing power plants, factories, buildings, etc.

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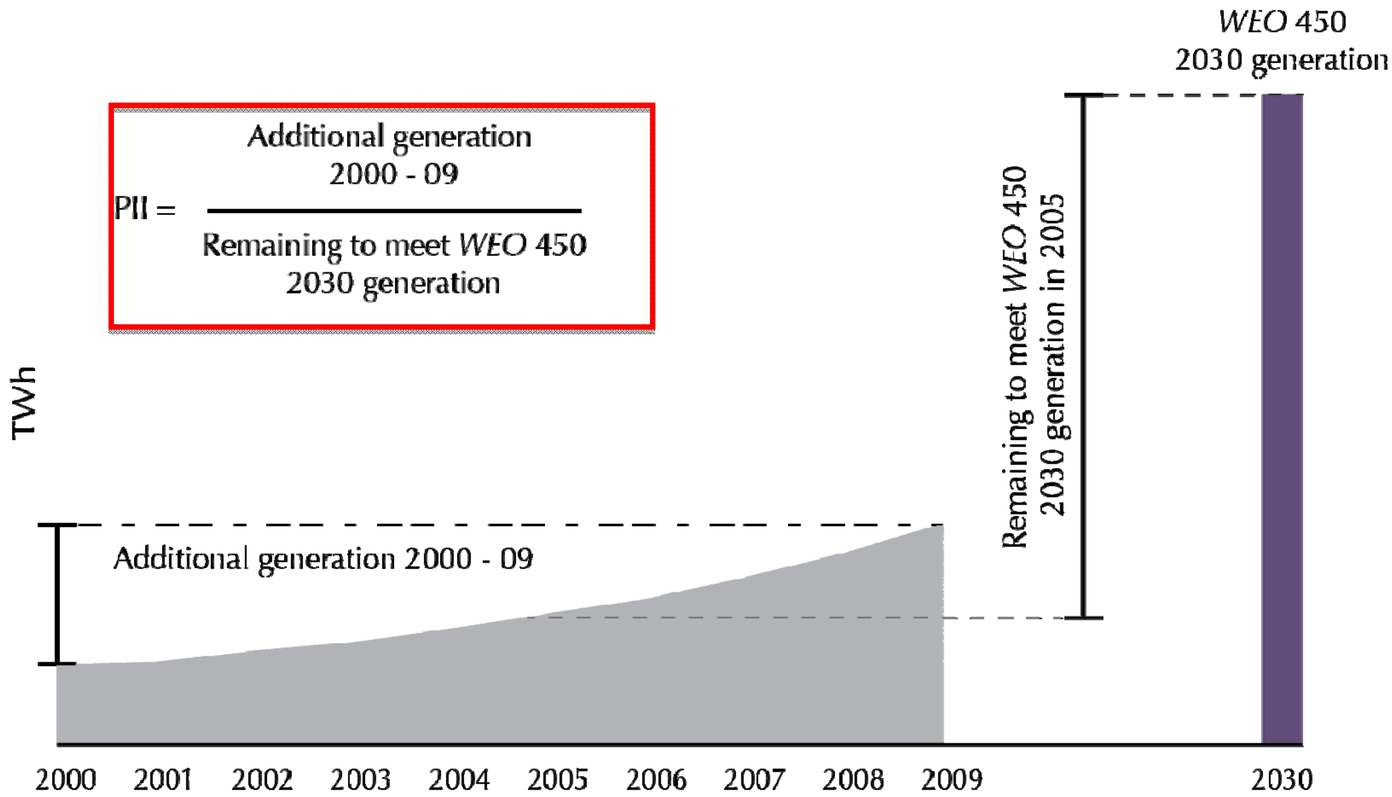
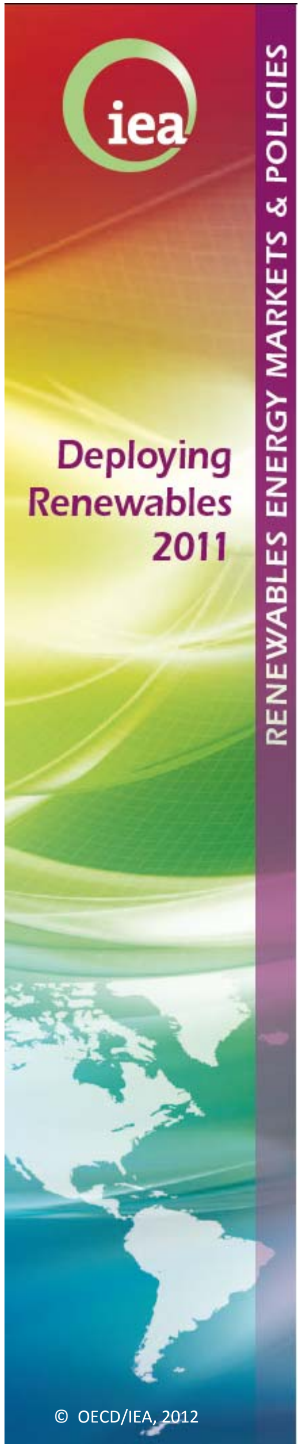
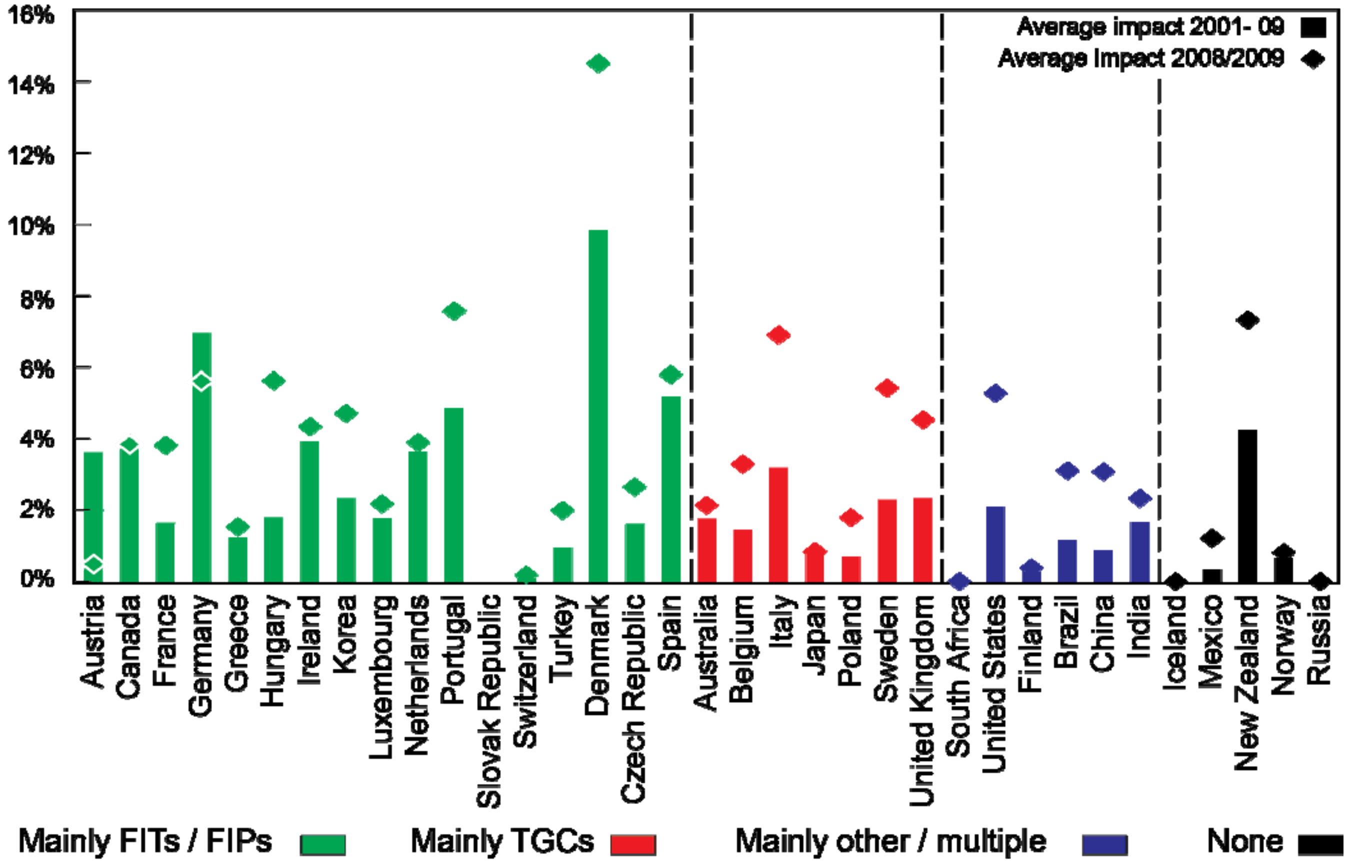
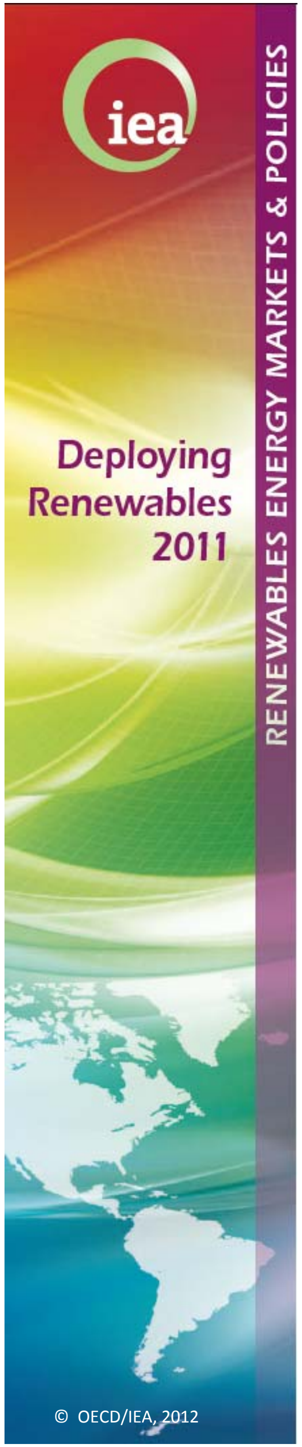
Measuring Policy Impact - Methodology



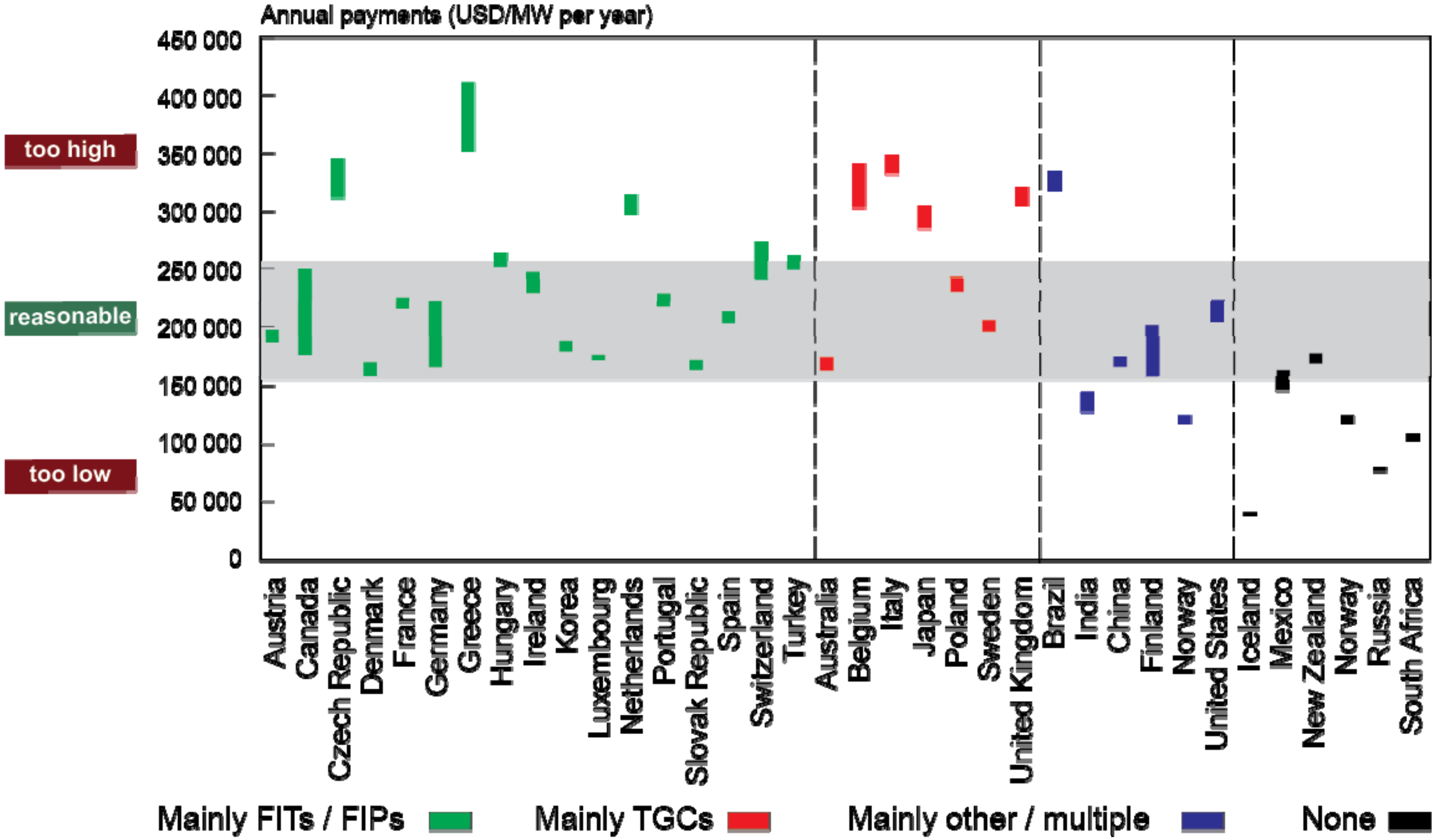


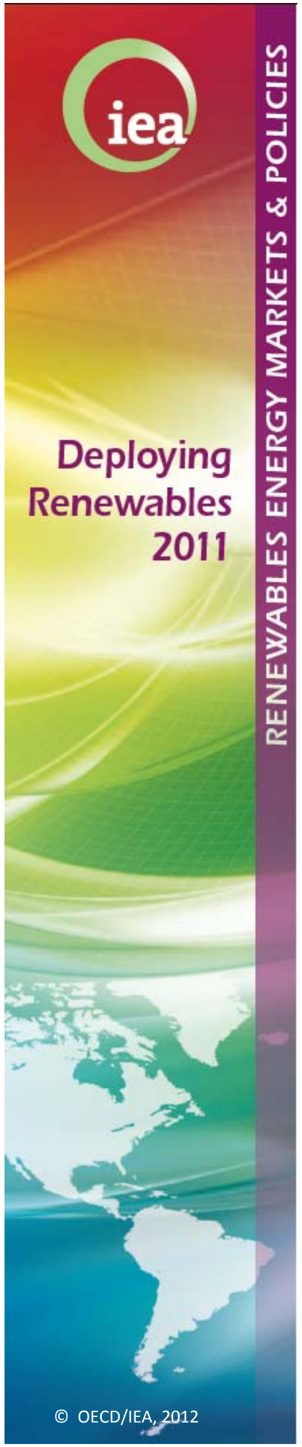
Are Policies Successfully Encouraging Deployment? *Example: Onshore Wind*





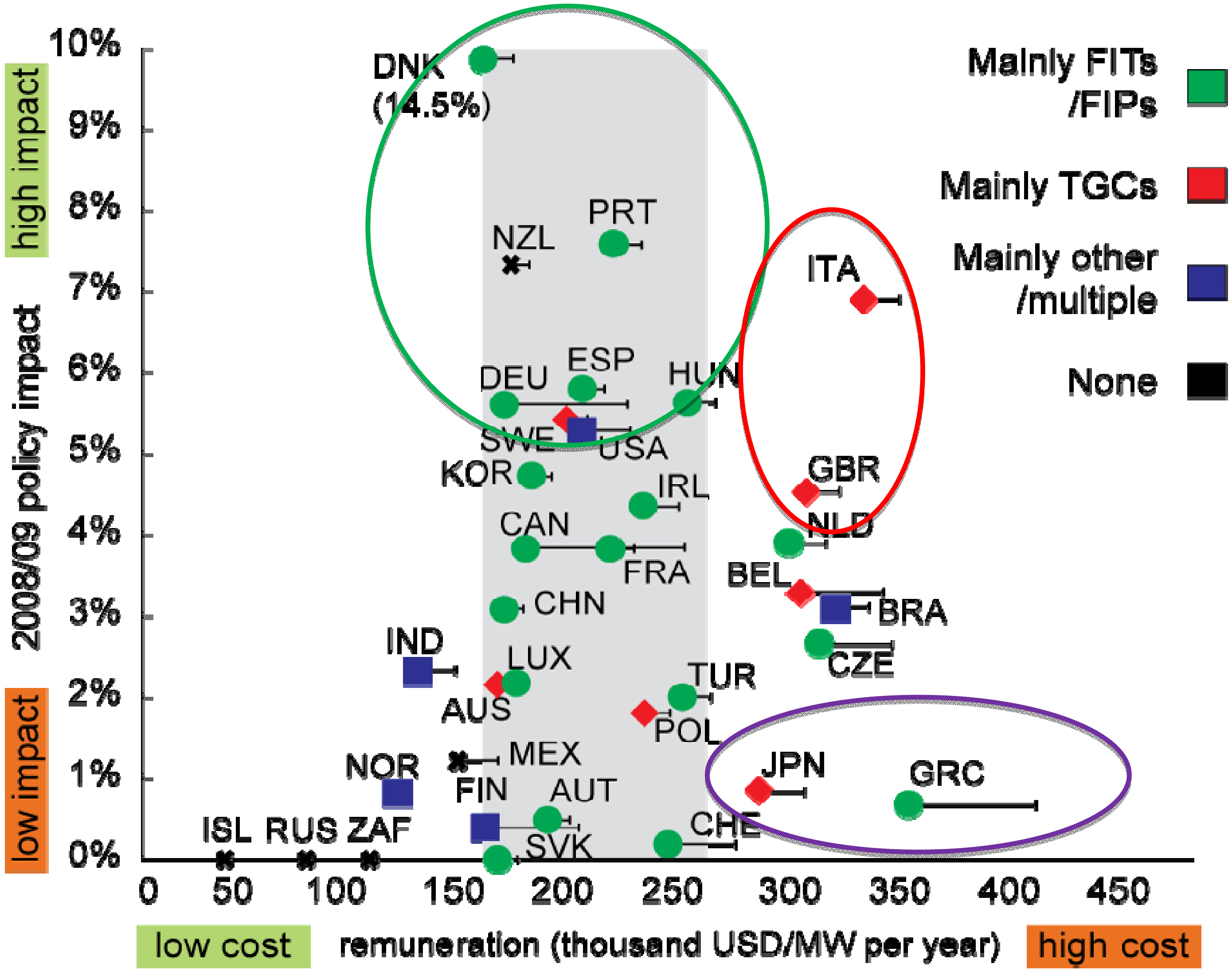
Are payments for Generators in a Reasonable Range? *Ex: Onshore Wind 2009*

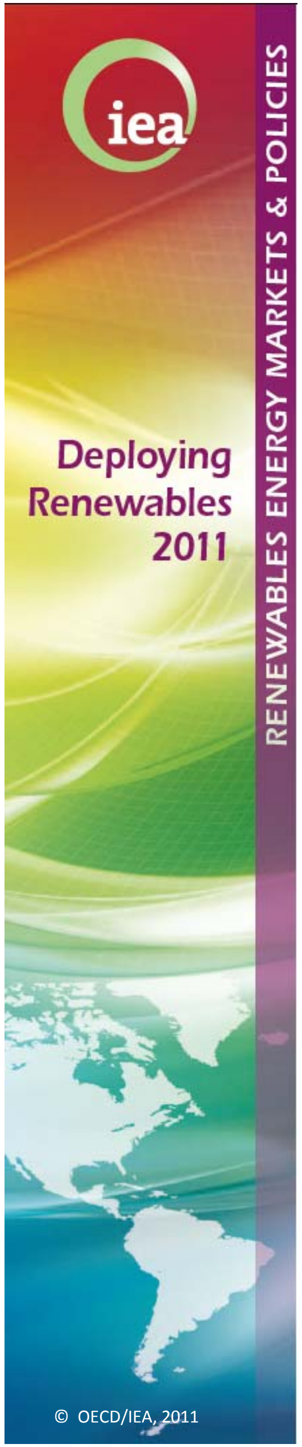




Impact vs Cost-Effectiveness

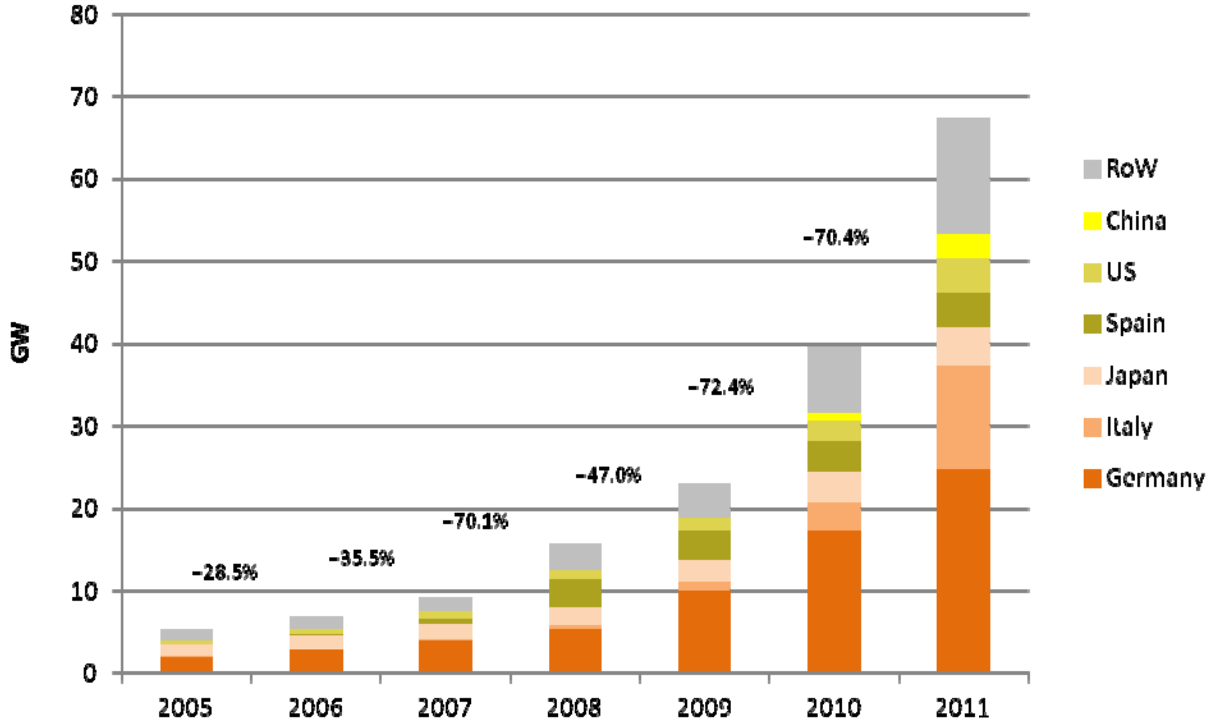
Example: Onshore Wind





Emerging Policy Challenges - PV

Cumulative global PV capacity



Sources: IEA, EA PVPS, EPIA

- Concentrated booming PV growth raises policy cost concerns in several EU countries
- Policies are not adapting quickly enough
- However, pressure will reduce as new markets emerge

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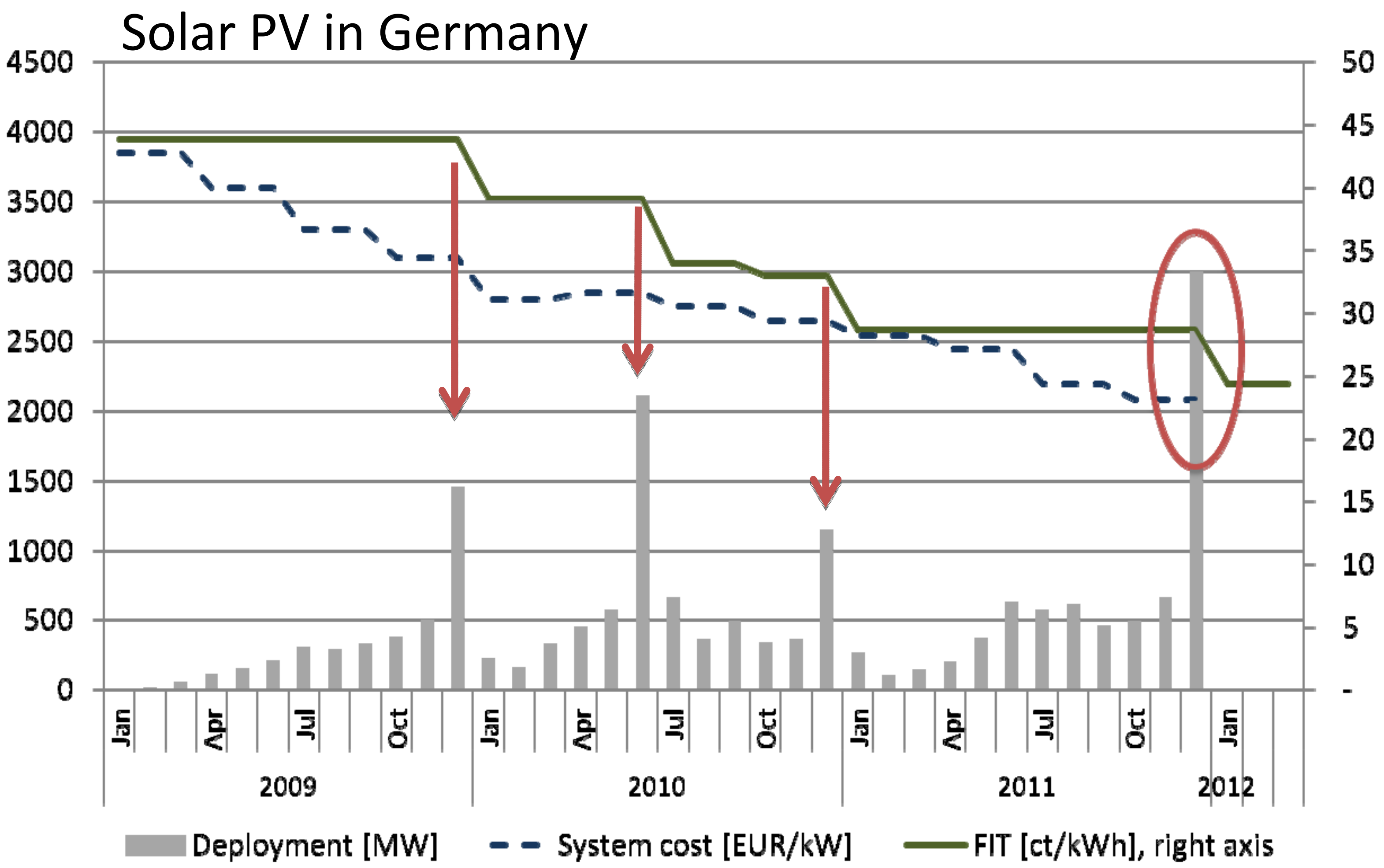
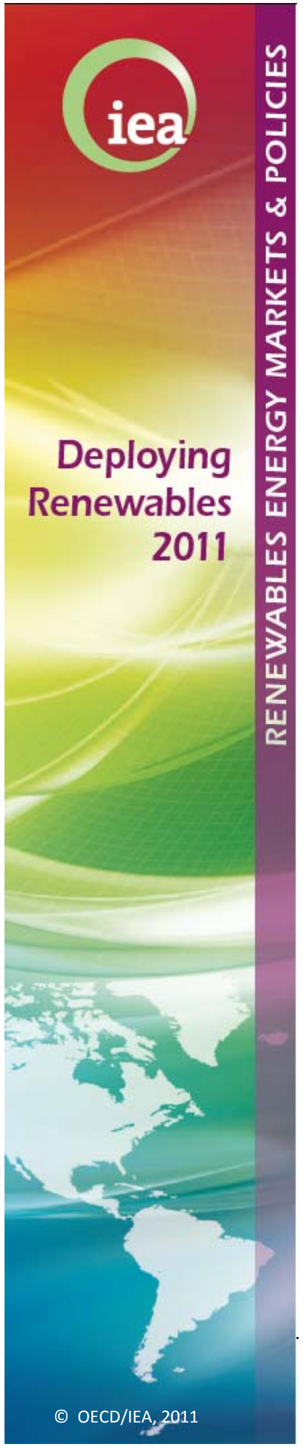
RENEWABLES ENERGY MARKETS & POLICIES

Adjust Tariffs – On time & Often

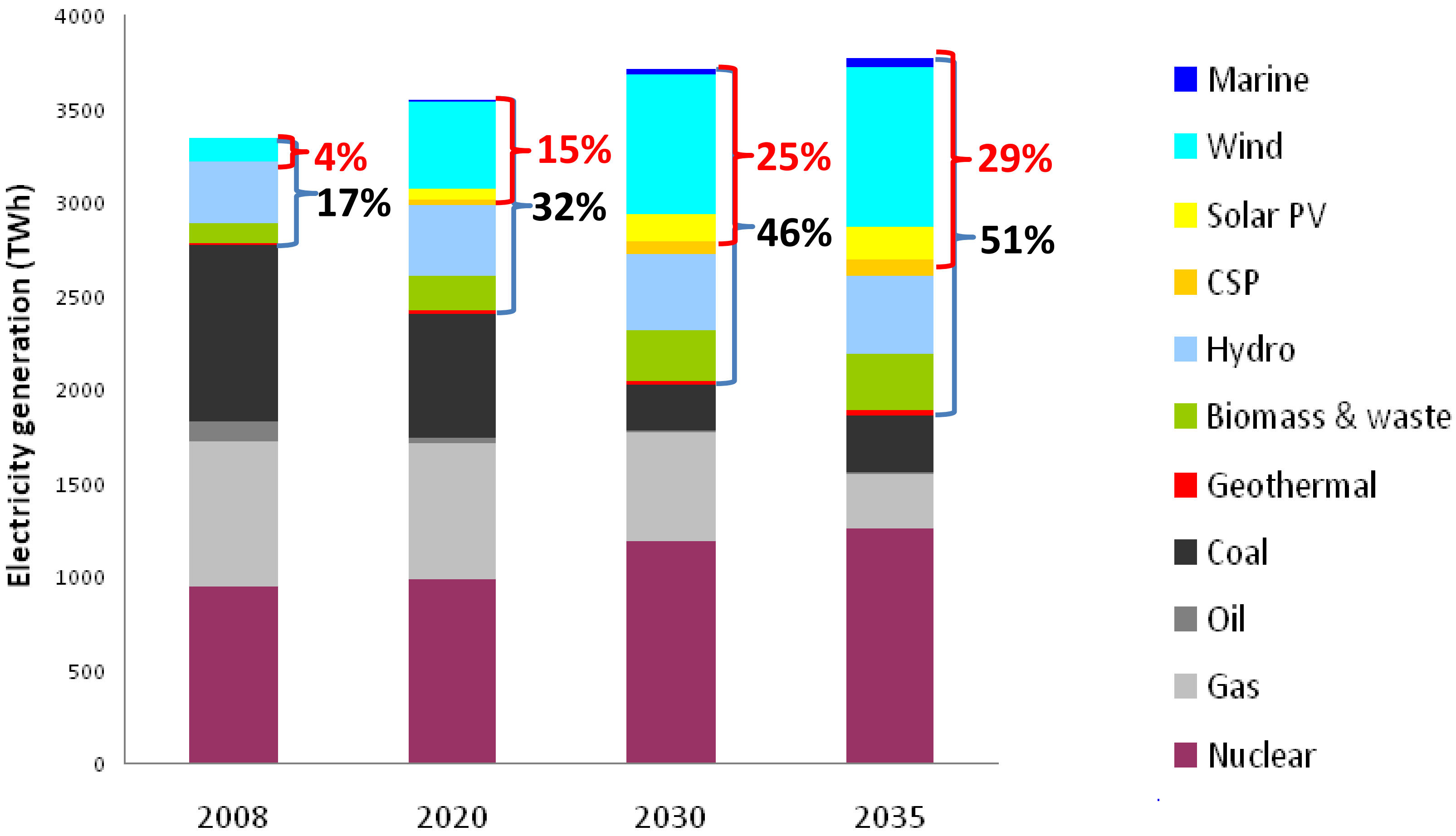


Key point: **Gap between incentives and costs and large, one-off tariff decreases can trigger "sales rush"**



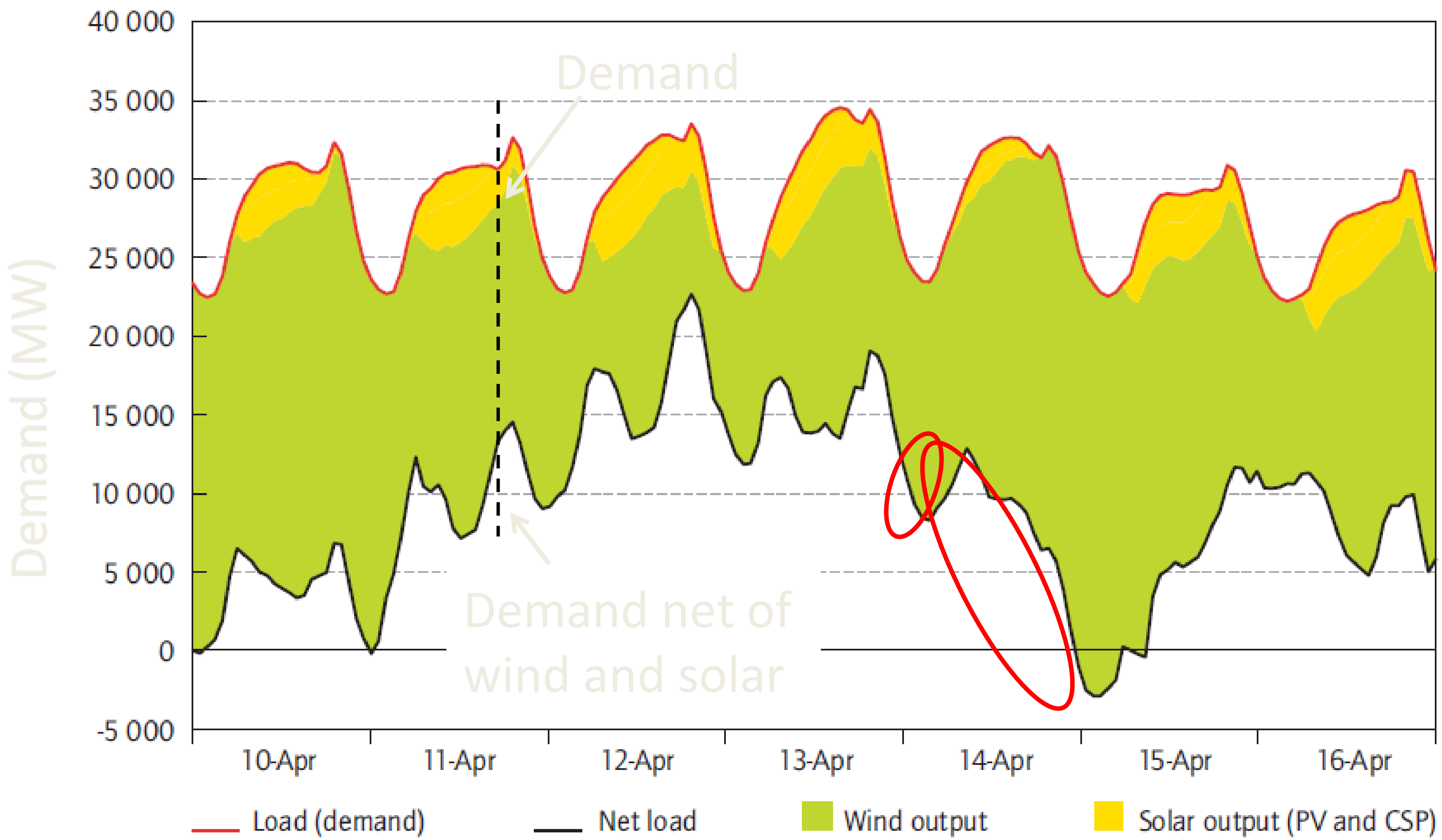
Importance of var-RE

WEO 450 Scenario electricity projections – EU

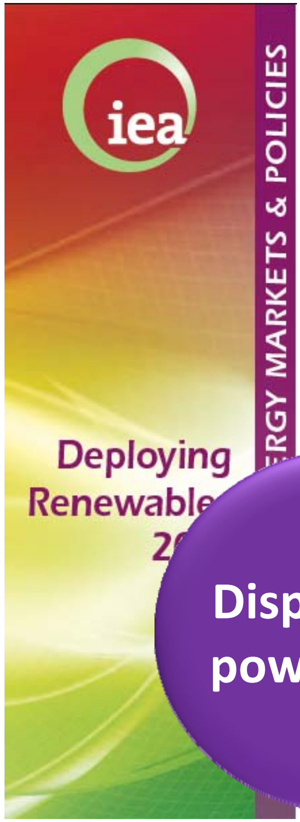


Emerging challenges: grid integration

Variability is not new, but it does get bigger



Source: *Western Wind and Solar Integration Study*, GE Energy for NREL (2010)

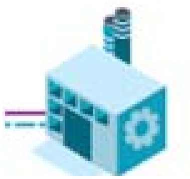


Flexibility is key

There are 4 flexible resources

- Dispatchable power plants
- Demand side Response (via smart grid)
- Energy storage facilities
- Interconnection with adjacent markets

A biomass-fired power plant



Industrial

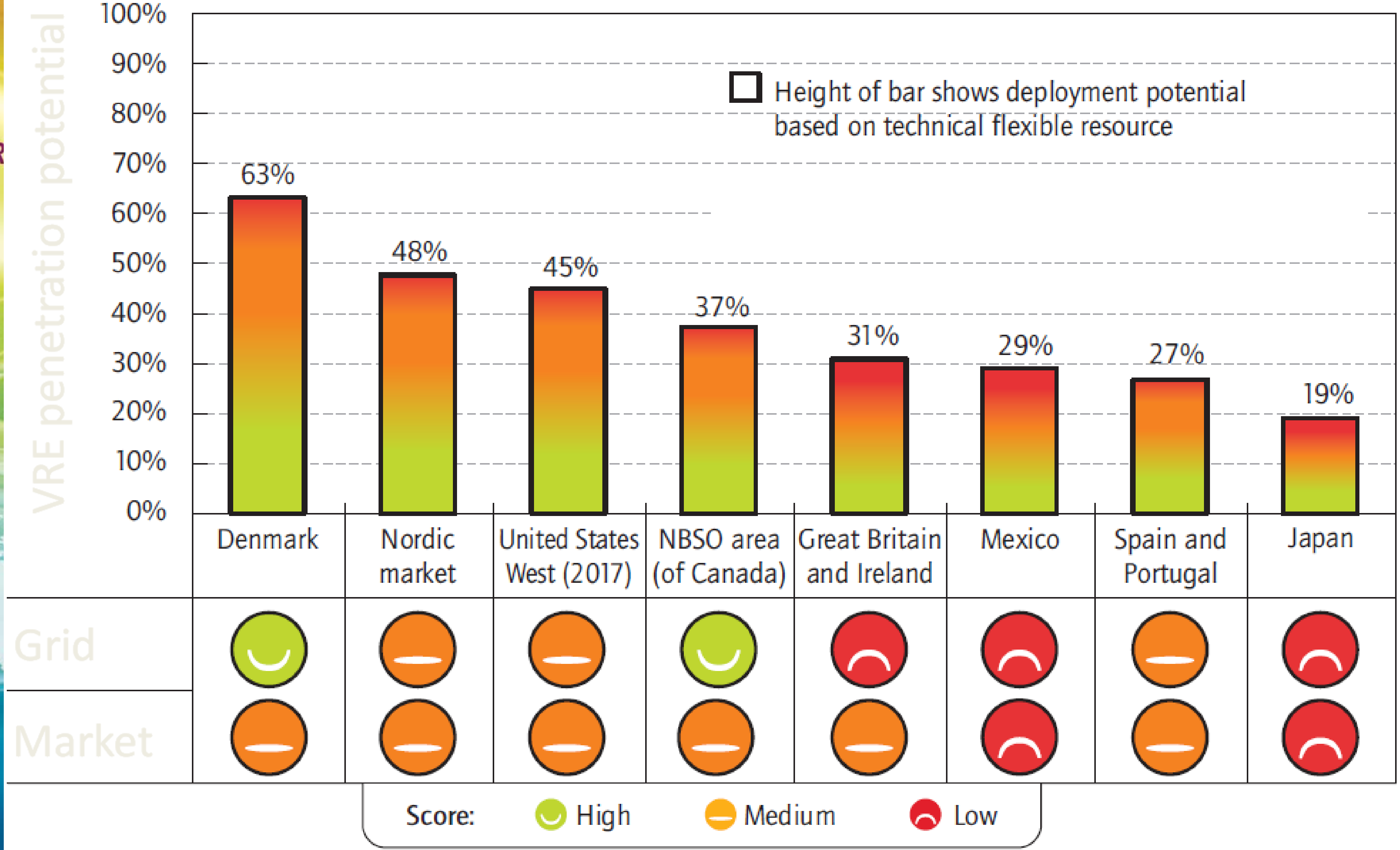
residential

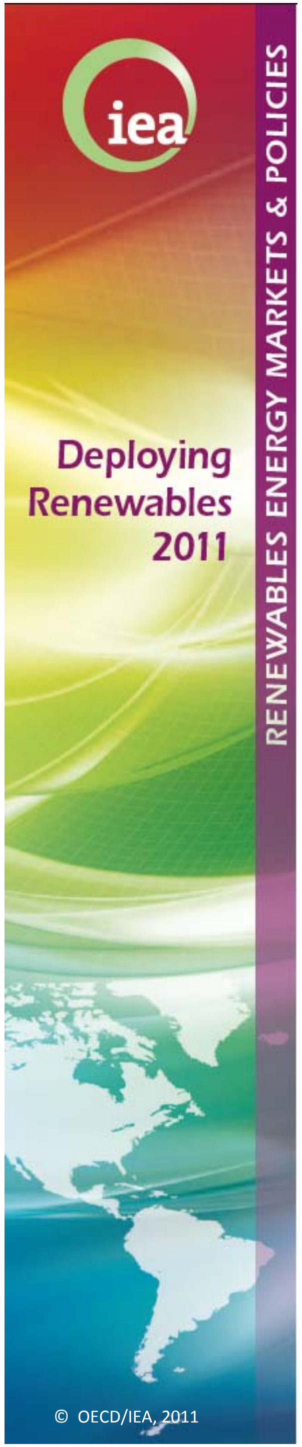
A pumped hydro facility

Scandinavian interconnections

Grid integration of var-RE

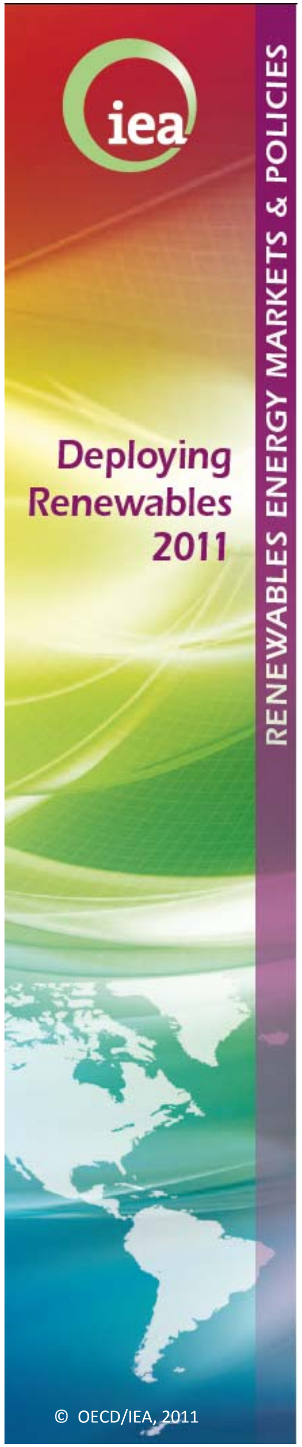
Snapshot of present penetration potentials



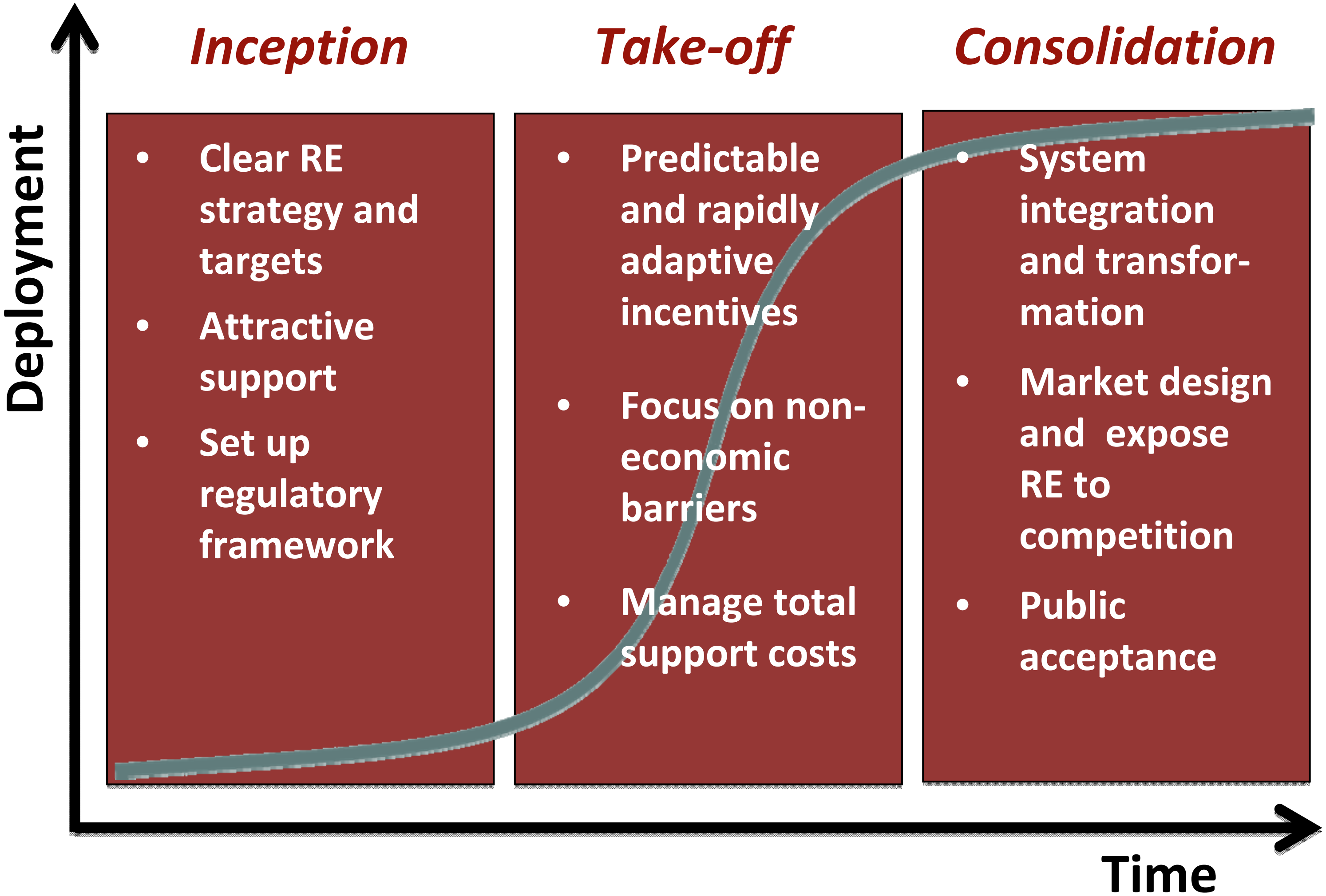


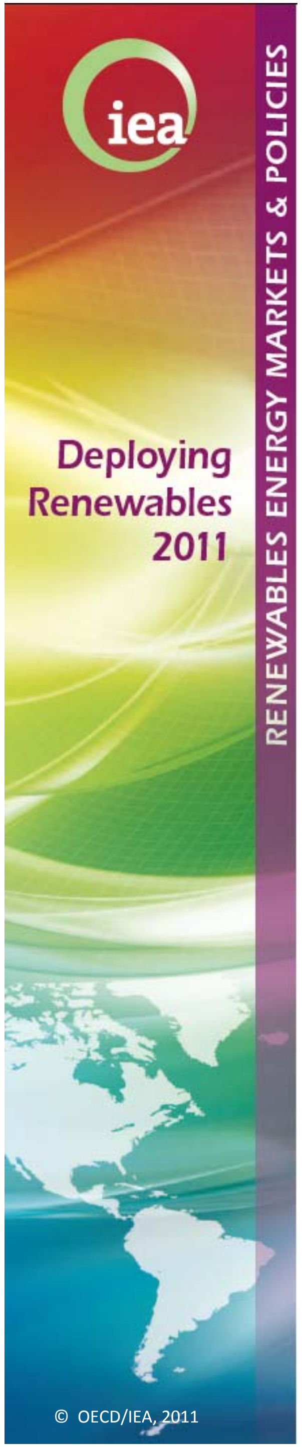
Best-Practice Policy Principles

- **Predictable** RE policy framework, integrated into overall energy strategy
- **Portfolio** of incentives based on technology and market maturity
- **Dynamic** policy approach based on monitoring of national and global market trends
- Tackle **non-economic** barriers
- Address **system integration** issues

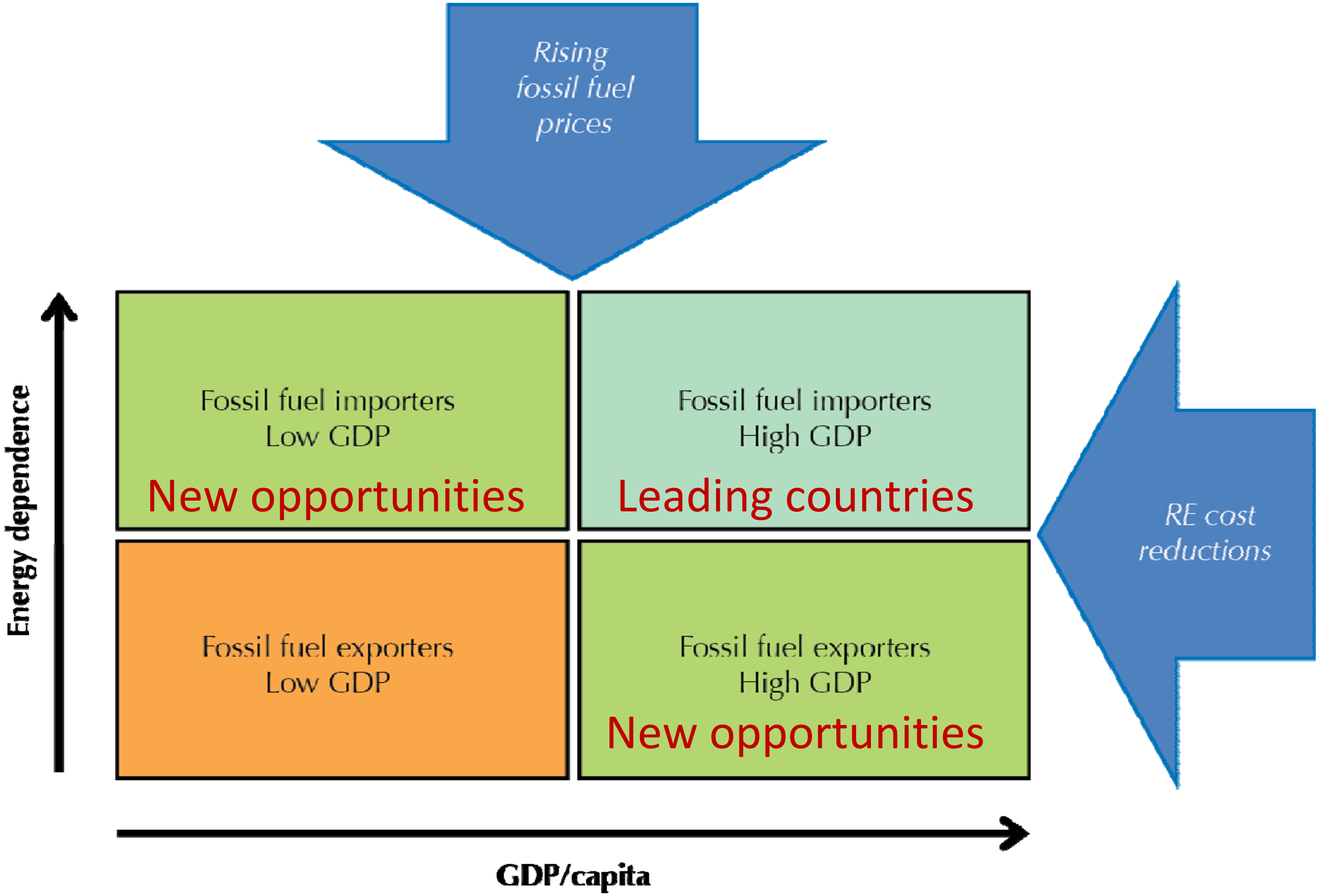


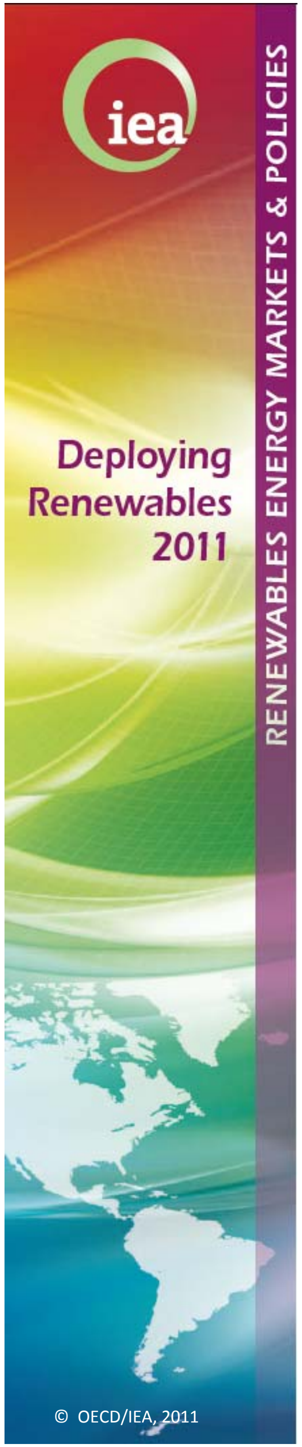
Policy Priorities: Changing Over Time





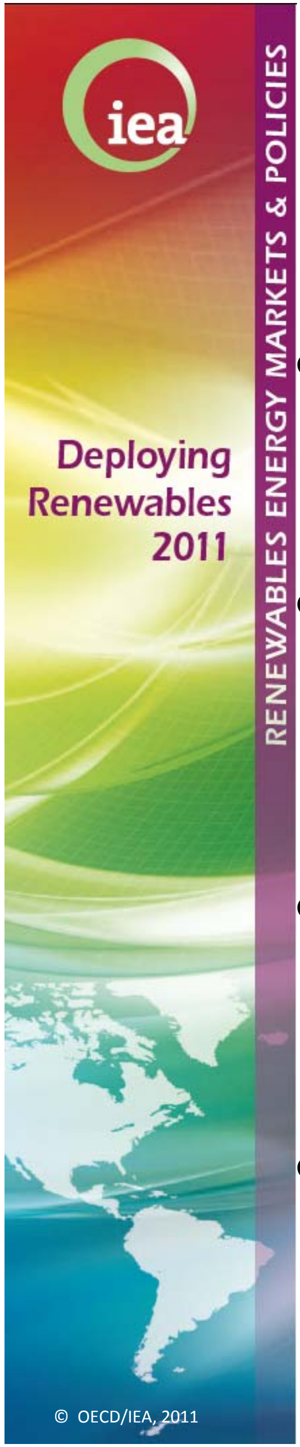
Market Expansion Opportunities





Conclusions

- Policies have started delivering in terms of RE deployment and cost reduction
- RE getting competitive in a broader set of circumstances
- However major economic and non-economic barriers persist and sustained policy effort is still needed
- *Deploying Renewables* identifies best-practice policy principles
    - Cost-effective, dynamic, integrated approach
    - Aims to help sharing best practice internationally so that countries can learn from each other



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