Training Module on Renewable Energy Technology, Policy & Integration

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For the International Energy Agency

Session 2: Policy

Session overview

- Future Role of RE – IEA Scenarios
- Why RE?
- Why Are Policies Needed?
- What Policy Options are available?
- Evaluation of Policy Options
- Policy Best Practice

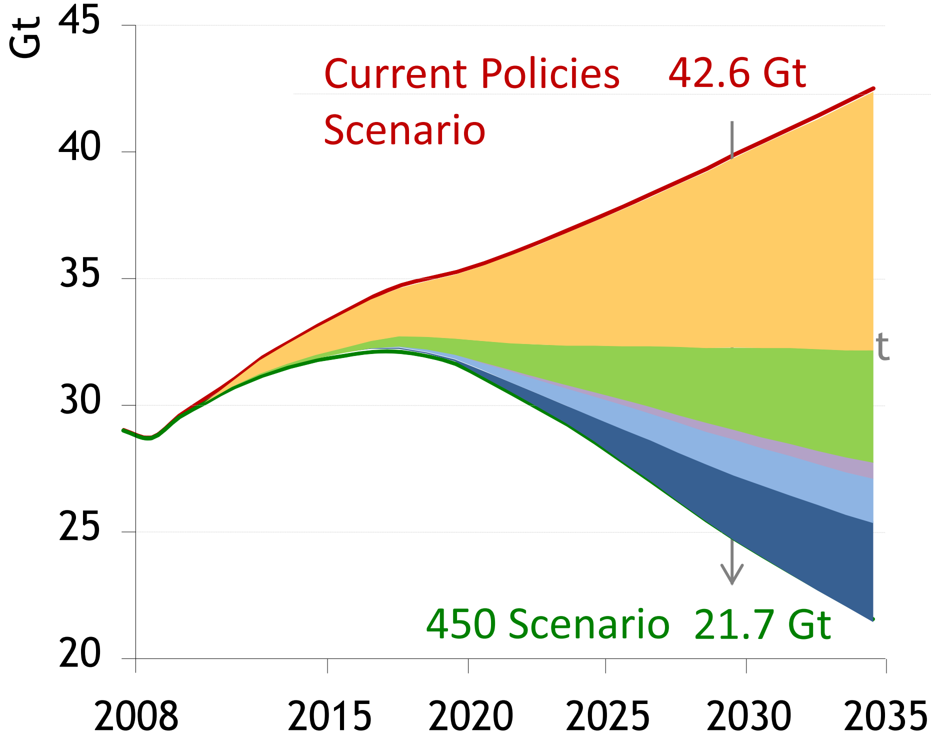
IEA Scenarios

WEO Scenarios

- Current Policy Scenario
  - Least optimistic
  - Formally adopted and implemented policies
- New Policy Scenario
  - Recent new policy commitments implemented
    - E.g. pledges to reduce subsidies to fossil fuels
- “450 PPM” Scenario
  - Adequate steps are taken to limit CO_2 concentrations in the atmosphere to 450ppm
  - Resulting in global mean temperature rise not greater than 2^0 C

How do we get to 450 ppm?

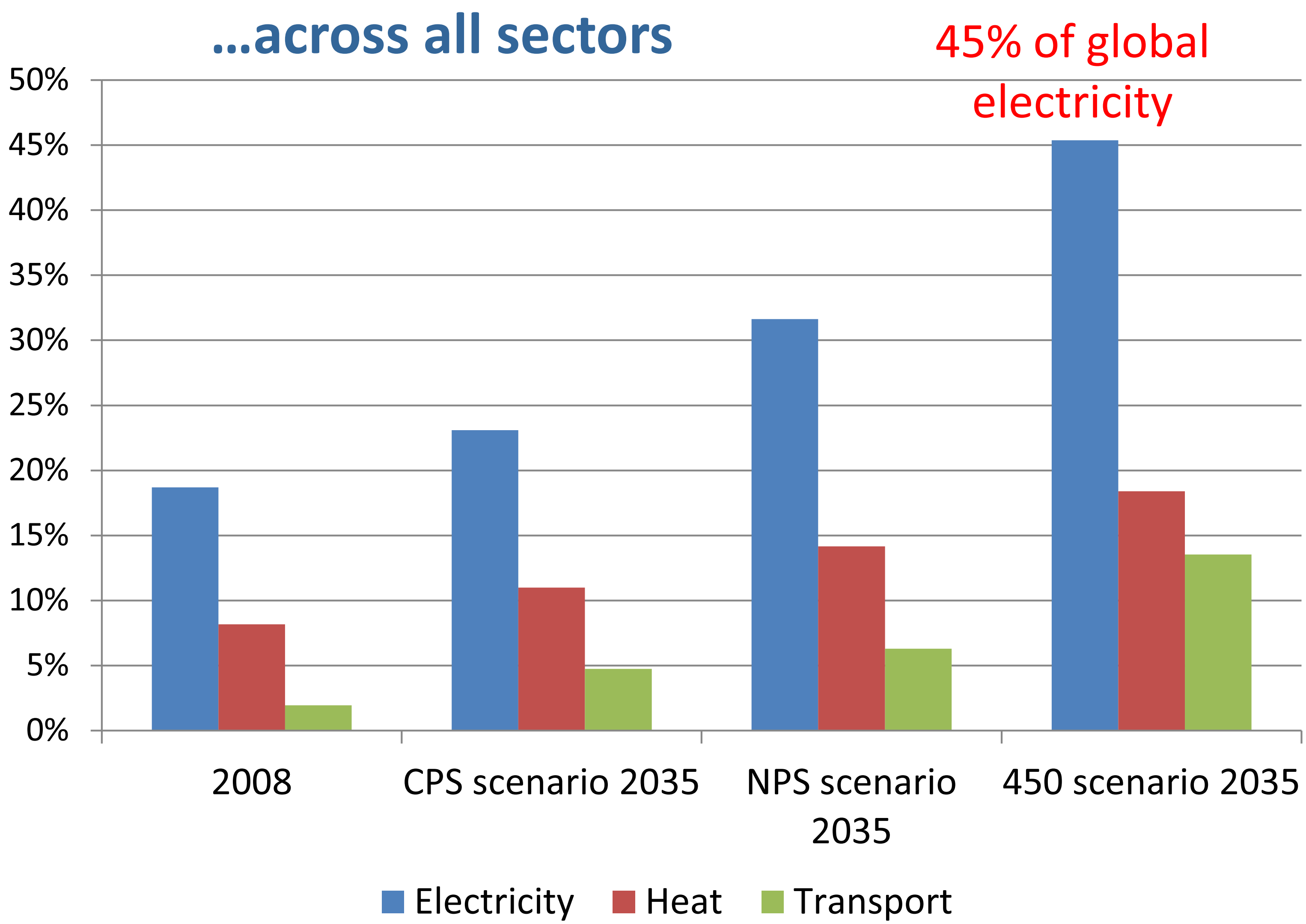
Energy-related CO2 emission savings by technology in the 450 Scenario relative to the Current Policies Scenario



Cumulative share of abatement 2010-2035	
Efficiency	53%
Renewables	21%
Biofuels	3%
Nuclear	9%
CCS	15%

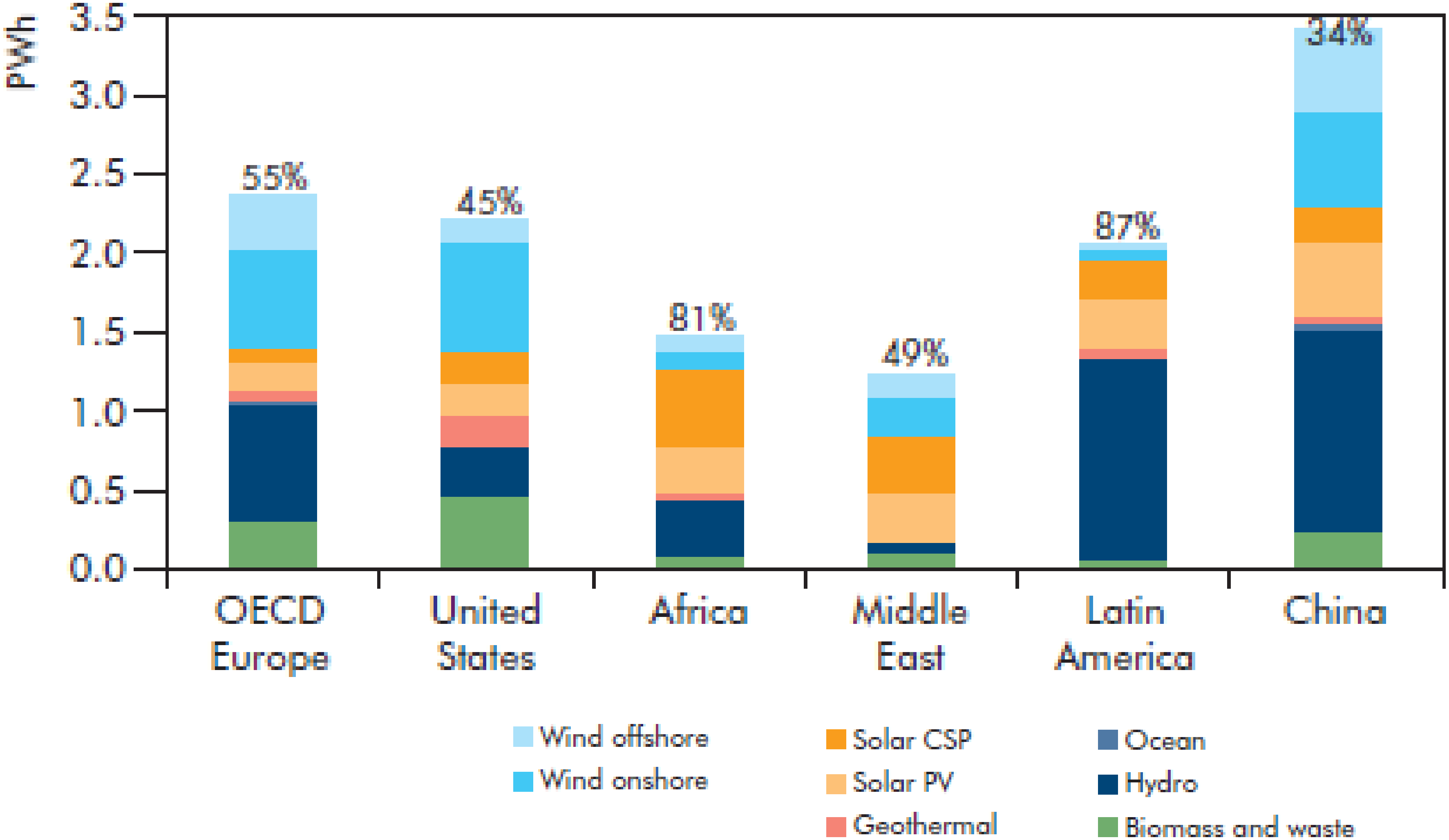
- **Small group of countries** have a large role
  - China and US responsible for **half of all emissions reduction** over the period

Renewables grow in all scenarios



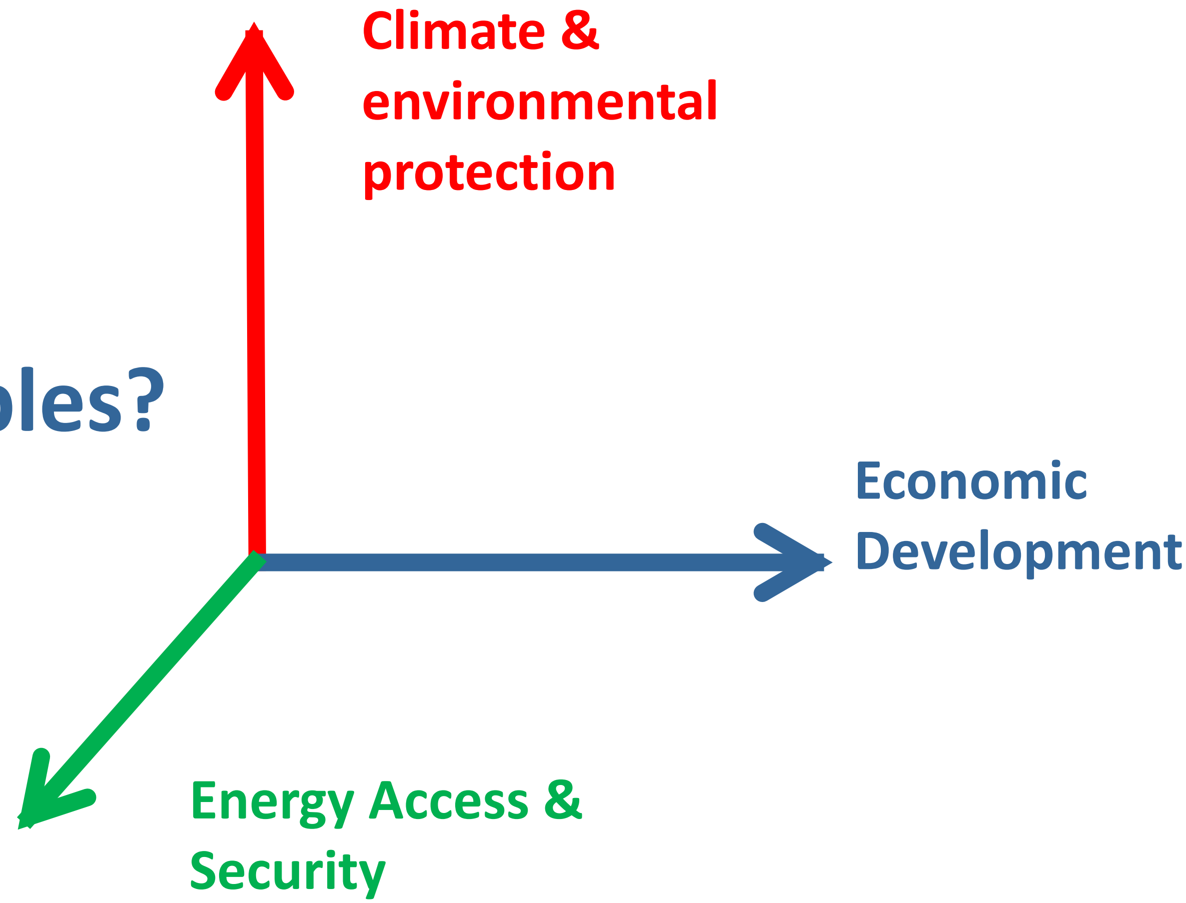
Massive growth particularly in electricity needed to reach the optimistic scenario

Ambition not limited to the OECD



Will developing economies take the renewables route (without going via fossil fuels first)?

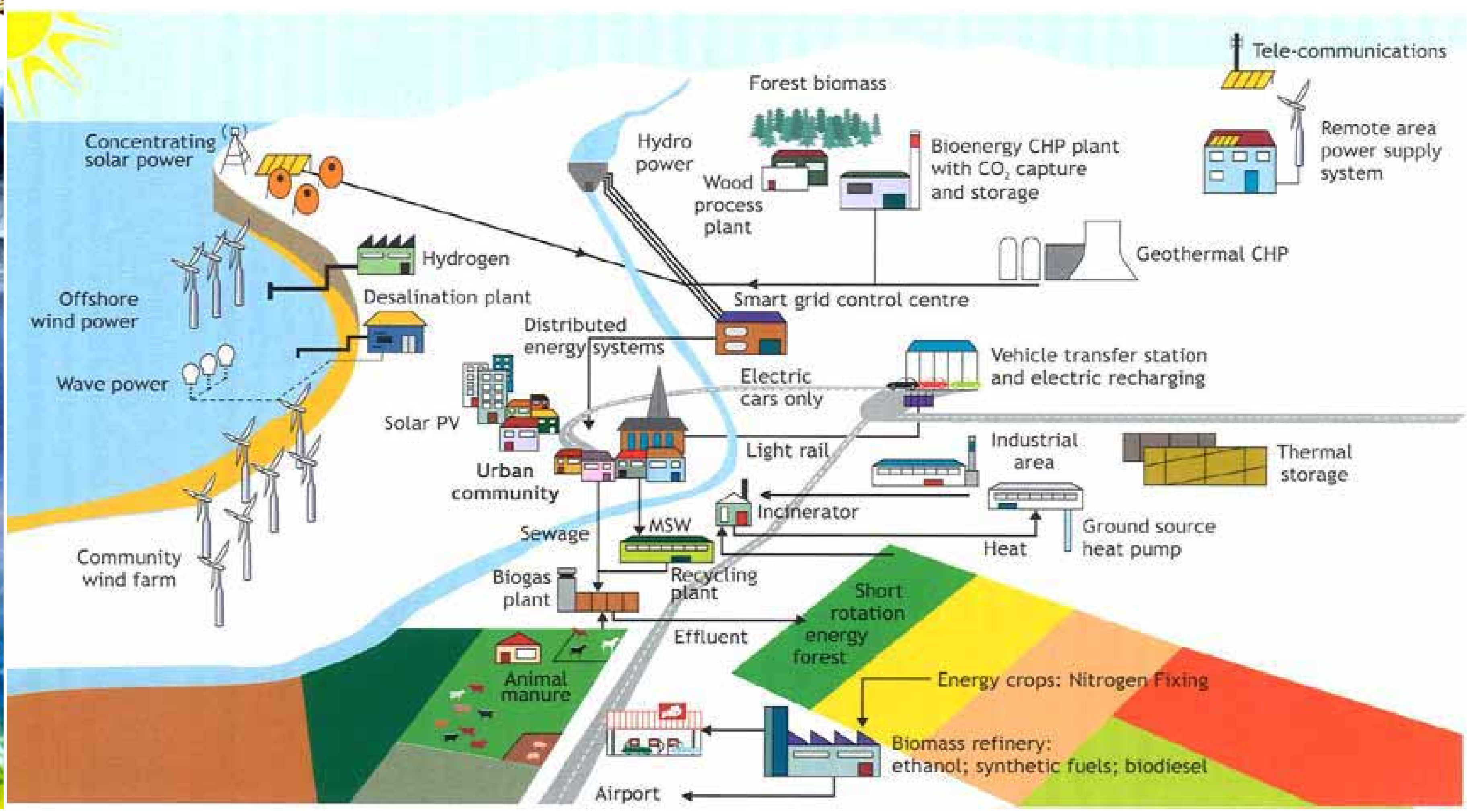
Why renewables?



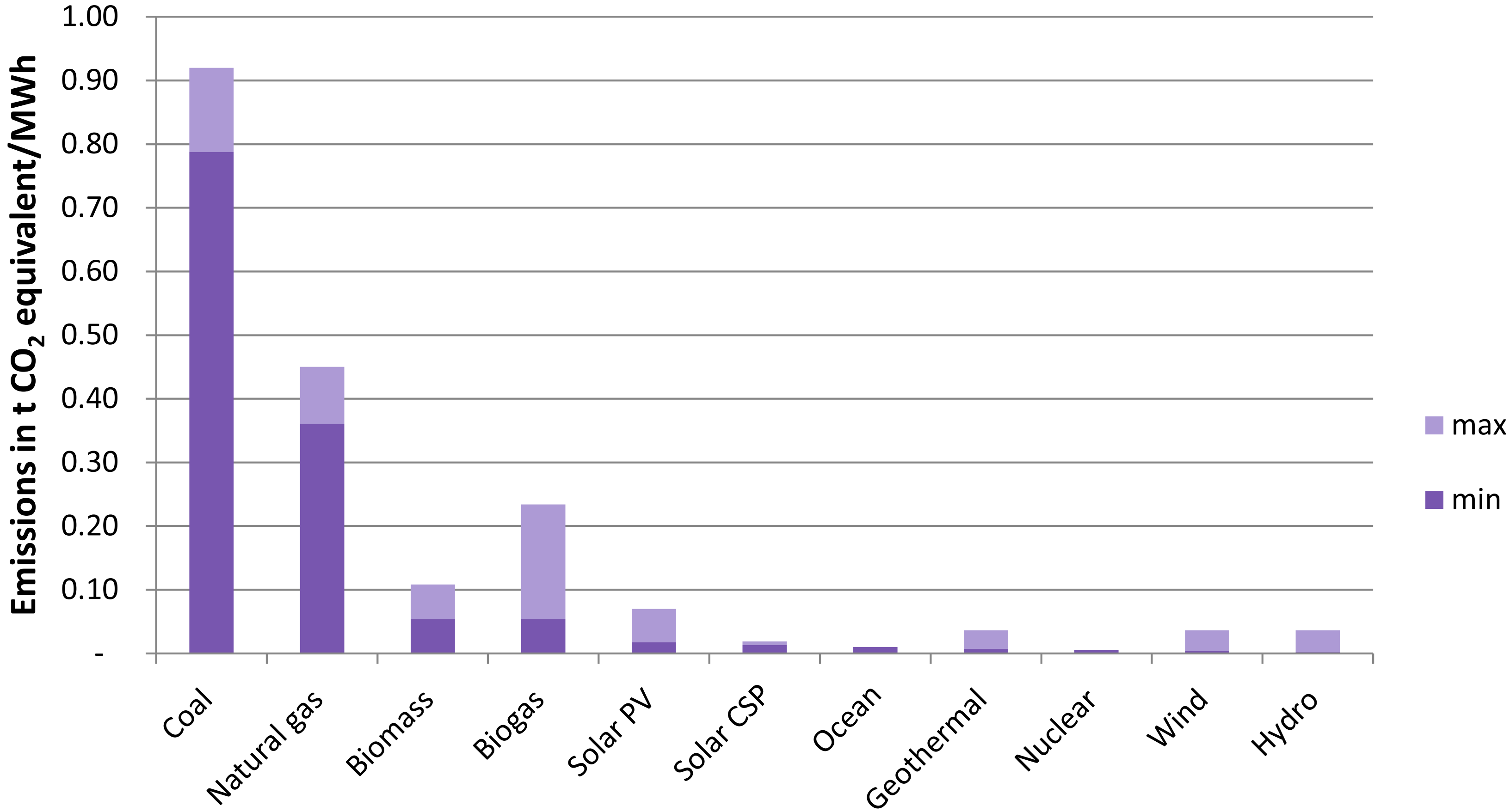
Renewable energy is a local resource

Over 50% of the global population lives in cities –

- And consume 2/3 of total world primary energy
- Urban population is increasing by 1 million per/week

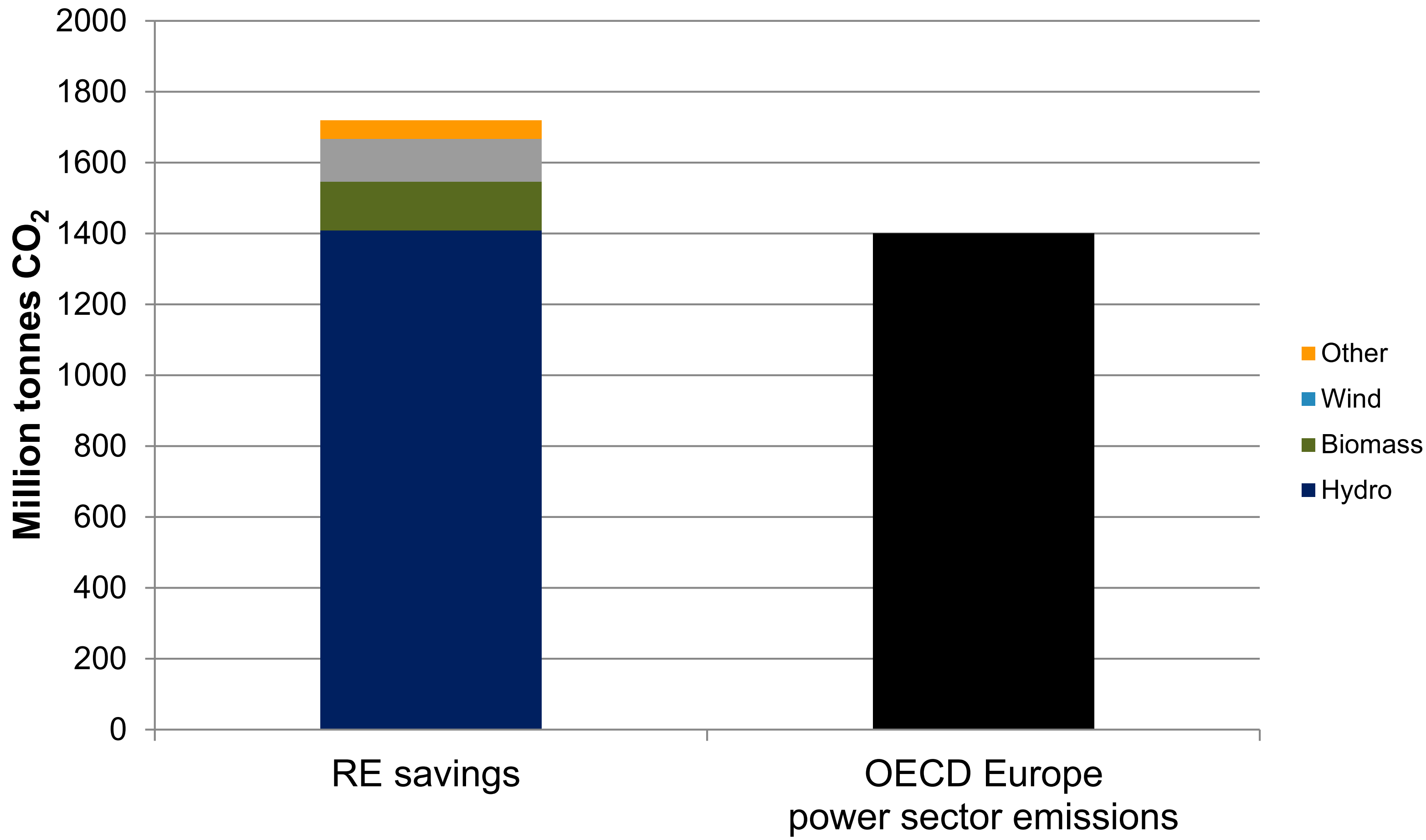


CO2 from renewables is tiny!



Lifecycle emissions

CO_2 Power Sector Emission Savings, 2008

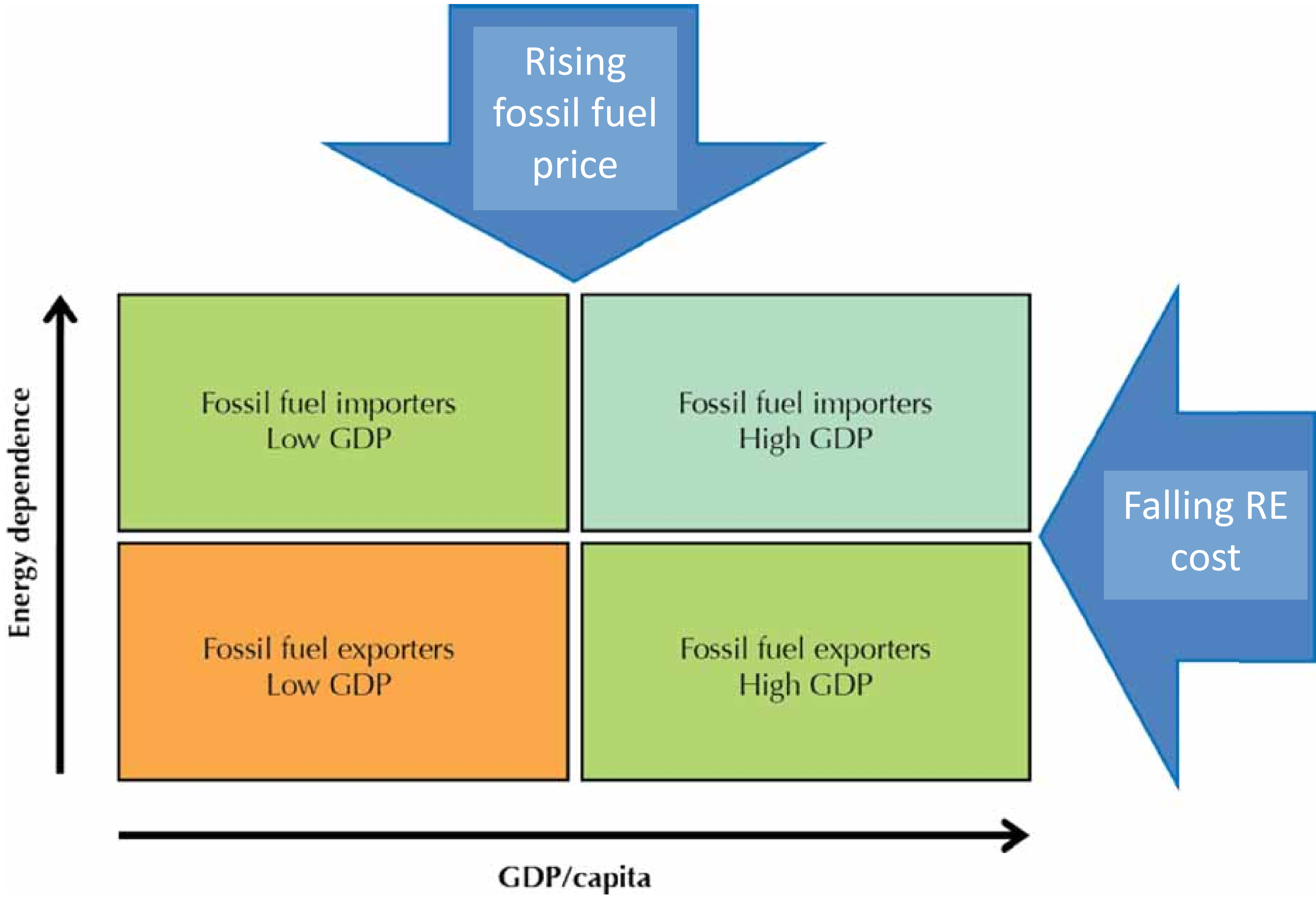


In 2008, renewables saved 1.7 Gt of power sector CO2 emissions

Global Employment in renewables, 2010

Technology	Global	Key regions
Biofuels	> 1 500 000	**Brazil** 730 000: sugarcane, ethanol production
Wind power	~ 630 000	**China** 150 000, **Germany** 100 000, **USA** 85 000, **Spain** 40 000, **Italy** 28 000, **Denmark** 24 000, **Brazil** 14 000, **India** 10 000
Solar hot water	~ 300 000	**China** 250 000, **Spain** 7 000
Solar PV	~ 350 000	**China** 120 000, **Germany** 120 000, **Japan** 26 000, **USA** 17 000, **Spain** 14 000
Biomass power	-	**Germany** 120 000, **USA** 66 000, **Spain** 5 000
Hydropower	-	**Europe** 20 000, **United States** 8 000, **Spain** 7 000
Geothermal	-	**Germany** 13 000, **USA** 9 000
Biogas	-	**Germany** 20 000
Solar thermal power	~ 15 000	**Spain** 1 000, **USA** 1 000
Total estimated	**> 3 500 000**	

Strategic Drivers - Outlook



Renewables are showing their value further afield, eg. Saudi Arabia to protect oil reserves

Policy Trends

- Gaining momentum
  - Many more countries are implementing policies in place, particularly outside OECD, than in 2005.
  - 45 of the IEA's 56 focus countries now have renewable electricity targets, including **20 non-OECD countries**.
  - 53 of the focus countries have electricity support policies in place, compared to 35 in 2005.

Why is policy so important?

Is it just because renewables are too expensive?

There are a lot of hurdles to cross

- **Economic:** how to compete with fossil alternatives?
- **Market:** barriers to entry, distorting price mechanisms, PPA availability
- **Financial:** Absence of investment?
- **Technical:** Is the technology mature?
- **Infrastructure:** Is the grid appropriate?
- **Administrative/ Social :** Are planning / permitting procedures streamlined?
- **Environmental:** Are regulations appropriate?

Cost of energy

- How to match / undercut fossil energy prices?

Though cost reductions continue, some RE technologies are still relatively expensive

And generation costs are influenced by all the below barriers also
E.g. expensive debt financing, undue grid expansion burden

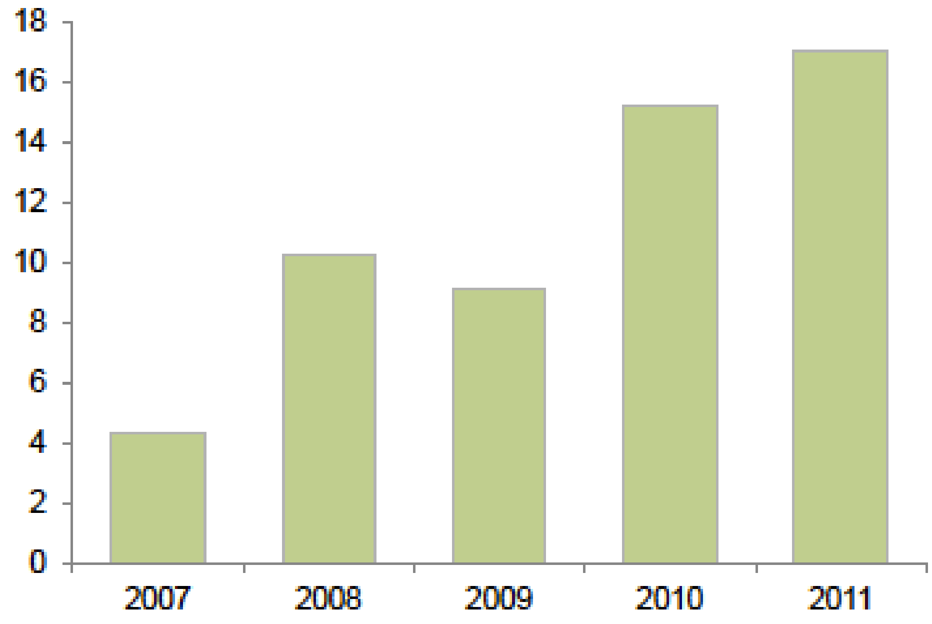
Market and finance

- **Market**
  - Historical market characteristics (unrelated to RE) that hinder market entry.
  - ➢ Subsidised electricity production from fossil sources (Algeria, Venezuela, UAE, KSA, central Asia)
  - ➢ Market power of encumbent (conventional) utilities
  - ➢ Absence of a carbon price (to reflect real costs of emissions)
- **Finance**
  - Inadequate finance, due to low returns, insecure investment context, suitable financial products
  - ➢ RE will go where the investment climate is most encouraging:
    - ➢ in 2009 China alone saw 25% of global investment in RE

Development banks: key catalyst

- …For asset finance in **emerging markets**
- …For **capital intensive** renewable energy technologies
- …To attract **private investment** (reduced perceived risk)

- Global investment *4 since 2007 (USD 17 bn in 2011)



KEY CHALLENGE: find quality, investment ready projects!

Development bank lending

- Multilateral collaboration among ADB, EBRD, other developing banks through Climate Investment Funds (CIF)
- **Clean technology fund** (within CIF)
  - Kazakhstan: Renewable Energy Funds III & IV (USD 75m)
- **EBRD** (committed):
  - Kazakhstan: CAEPCO district heating projects (USD 31m)
- **ADB**:
  - Uzbekistan: USD 436 million for transmission and supply (inc. 150 million for advanced electricity metering)

Technical and infrastructure

Technical

- Is the technology mature? Is it available? Is it manufactured locally?
  - Wind turbines are mature technology, but market tightness may inflate prices to the developer.
  - China has halved the cost of producing wind turbines since boosting local manufacture

Infrastructure

- Is local infrastructure adequate to build plant and distribute the output?
  - The UK is planning the construction of dedicated port facilities to install offshore wind power
  - 25% of Chinese installed wind capacity not connected to the grid

Administrative, socio-environmental

- **Administrative**
  - Is there enough political will? Are administrative procedures and legal frameworks efficient?
  - ➢ In 2011, Greece imposed a maximum length of 4 months to finalize a concession granting process

- **Social / Environmental**
  - What are the local impacts of RE?
  - ➢ Community ownership in Europe
  - ➢ Acceptance of the need for new grid infrastructure
  - ➢ Perceived impacts of wind power on bird populations

Policy Options

So what is the best way to deploy more renewables?

Good policy keeps an eye on the exit…

- Renewable energy deployment needs state support
  - Relying on the private sector alone will severely delay action
  - And may even be more costly in long term
- Support must evolve over time until it can be phased out altogether – when the technology is competitive.
  - The essential underlying goal of any good support policy
- No single policy package will suit all needs
  - Policy must be tailored to suit the circumstances
  - Barriers to RE deployment are complex and country-specific

Financial incentives

Name	Advantages	Disadvantages
Soft loans / one-off subsidy E.g. PROSOL in Tunisia	Strong incentive for investment in early stage project development; cost can easily be capped	No longer term incentive to produce energy cheaply and efficiently; risk of overstretch, with insufficient resources for follow-up / O&M; at risk from budget cuts
Government Purchase	Government purchase of electricity generated: long-term security for investments; stable generation targets	Not flexible enough to keep pace with decreasing costs (and adjust purchase tariff)

Tax incentives

Name	Advantages	Potential problems
Production-related tax credit E.g. Wind PTC in the USA	Liberates capital that can be re-injected in RE research, installation; good investor confidence; simple to implement	May be subject to budget cuts; no volume control; no cost control
Consumption-related tax E.g. CO_2 tax Sweden	Major economic driver in switching households and industries' consumption patterns on the long run. Allows for savings on electricity bill.	Only supports consumers that already have access to electricity from the grid

Contractual incentives

Name	Advantages	Potential problems
Power Purchase Agreements (PPA)	Appropriate tool to attract capital in the inception phase and safeguard against operation and maintenance costs	The utility has to secure funding to pay the tariff over a long term period (usually 20 years).
Third Party Access (TPA)with privilege in Dispatching	Third party and grid priority access for renewable electricity are primordial and much needed evolutions of electricity markets in supporting RE deployment	Need for long lasting agreement between the state and the utility compelled to secure priority access to third party producers.

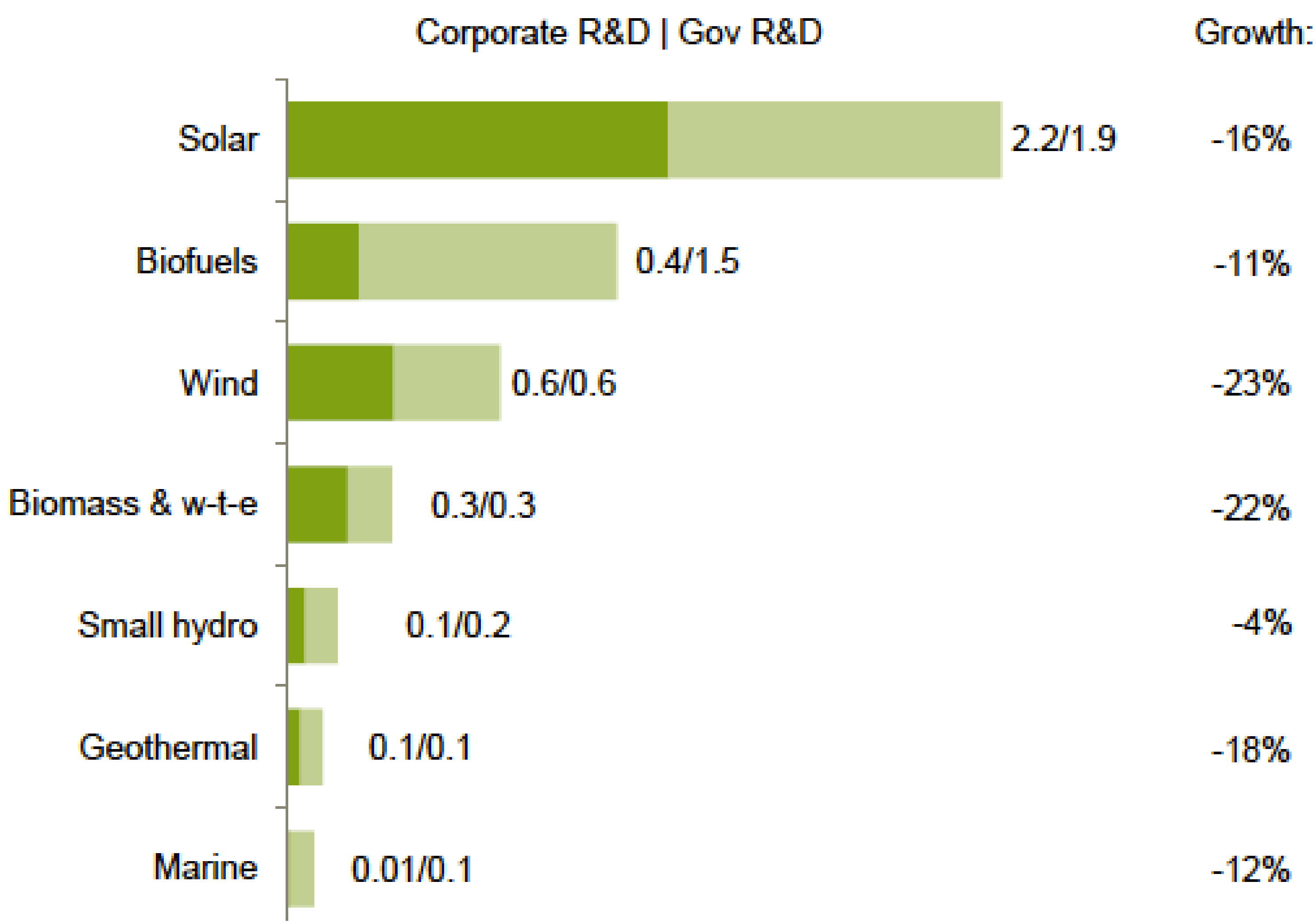
Quantity based incentives

Name	Advantages	Shortcomings
Quota E.g. renewable portfolio standards in USA states	Stable systems that can attract large, long-term investment; deployment control	Means and effectiveness in achieving quotas may vary greatly among neighbours
Green Certificates	Efficient policy tool to reach long-term generation targets in the EU and the US; cost capped by buy-out fee	Exposed to certificates market risk. Complex, especially for small producers
Competitive tenders	Rapid, flexible, good volume control, good cost control	Low investor security during bidding phase; risk of aggressive bidding, gaming; less mature tech will suffer without banding

Price based incentives

Description	Advantages	Shortcomings
Feed-in Tariff	Strong incentive for long term investment of private capital and entrepreneurship; very specific control	Sustainability of financing needs to be carefully thought through; capacity cap may be required; frequent controls
Feed-in Premium	Exposure to market with some protection. Premium declines with generation costs.	May give disproportionate support to least cost technologies at the expense of valuable but less mature technologies

Research, development, demonstration



2011 values from UNEP/ BNEF Global Trends in Renewable Energy Investment 2012

Policy Priority changes over time

Deployment

Inception

- Strong will, strategy, targets
- Attractive support
- Set up regulatory framework
- R&D focus

Take-off

- Predictable, rapidly adaptation of incentives
- non-economic barriers
- Manage total cost of support

Consolidation

- System integration & evolution
- Exposure to competition
- Public acceptance

Time

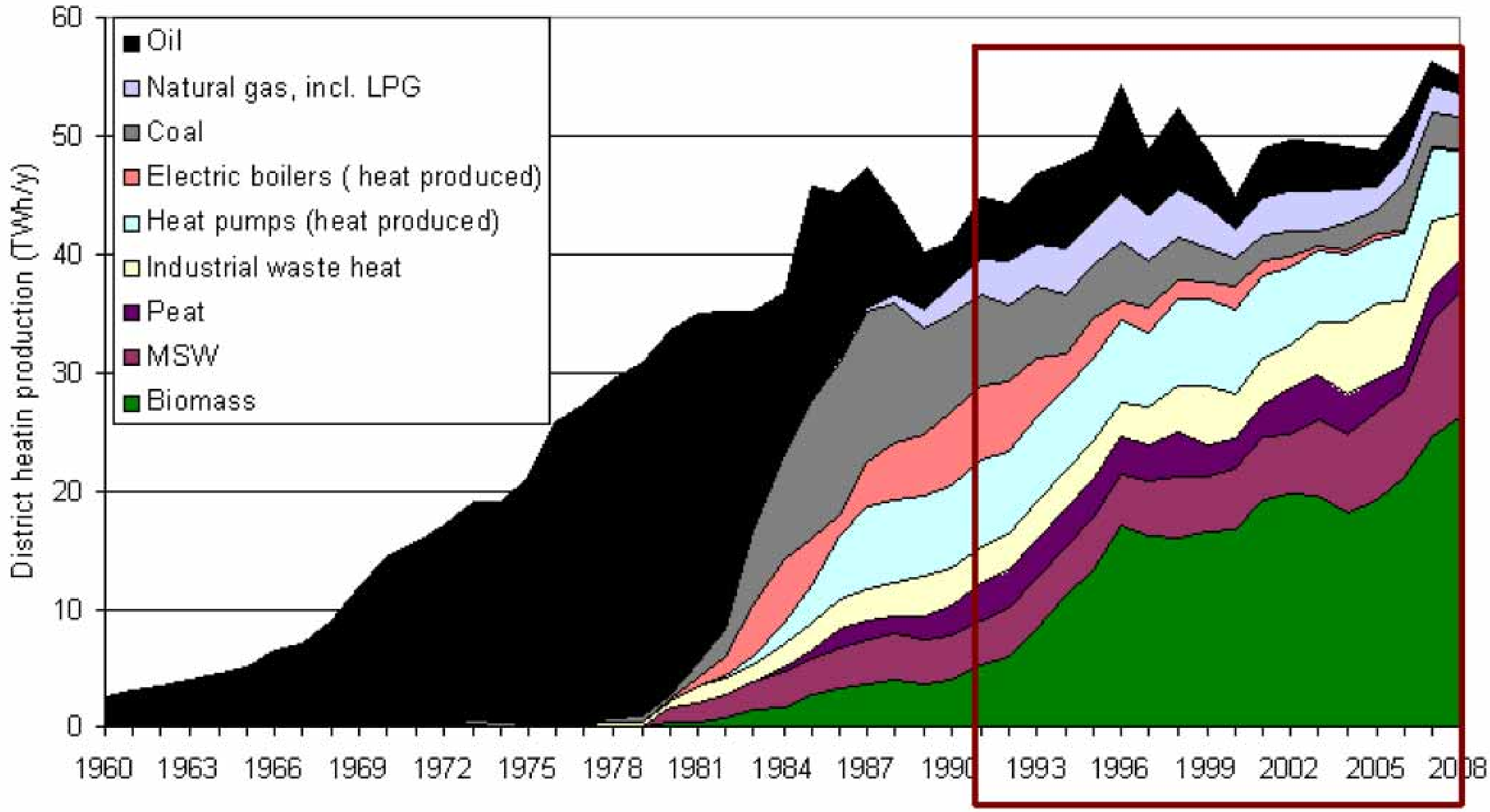
Offshore Wind, Advanced Biofuels, Enhanced Geothermal , Ocean Energy

Solar PV, wind

Recent renewable heat policies

Recent renewable heat policies

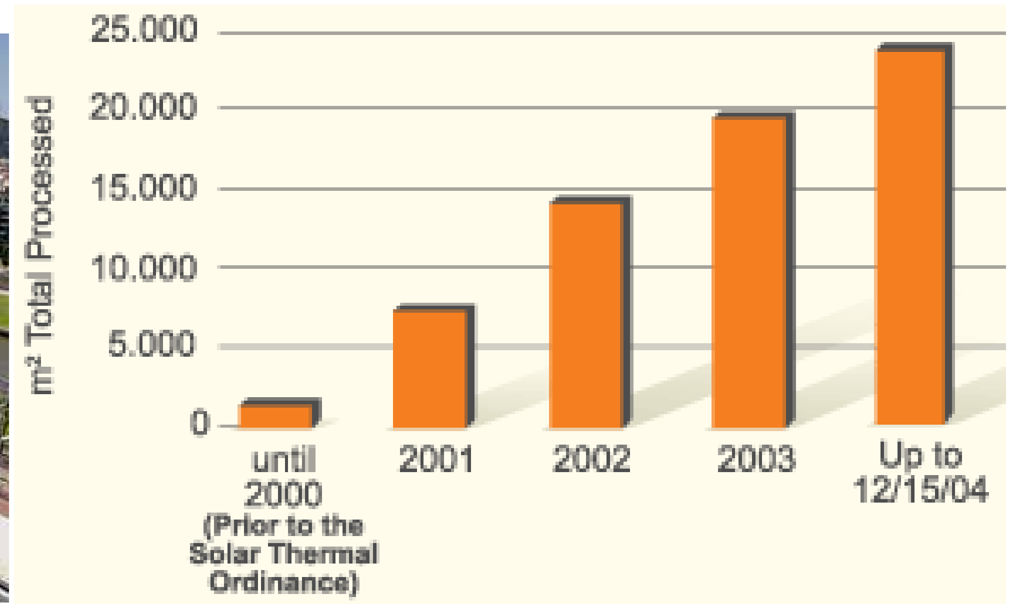
- Carbon tax on fossil fuels used in heat production: Sweden (from 1991)



Source: Lund University

Recent renewable heat policies

- Barcelona solar ordinance



- German building regulations: 30% RES-H in all new buildings

Recent renewable heat policies

- UK: Renewable Heat Incentive (mid 2011)

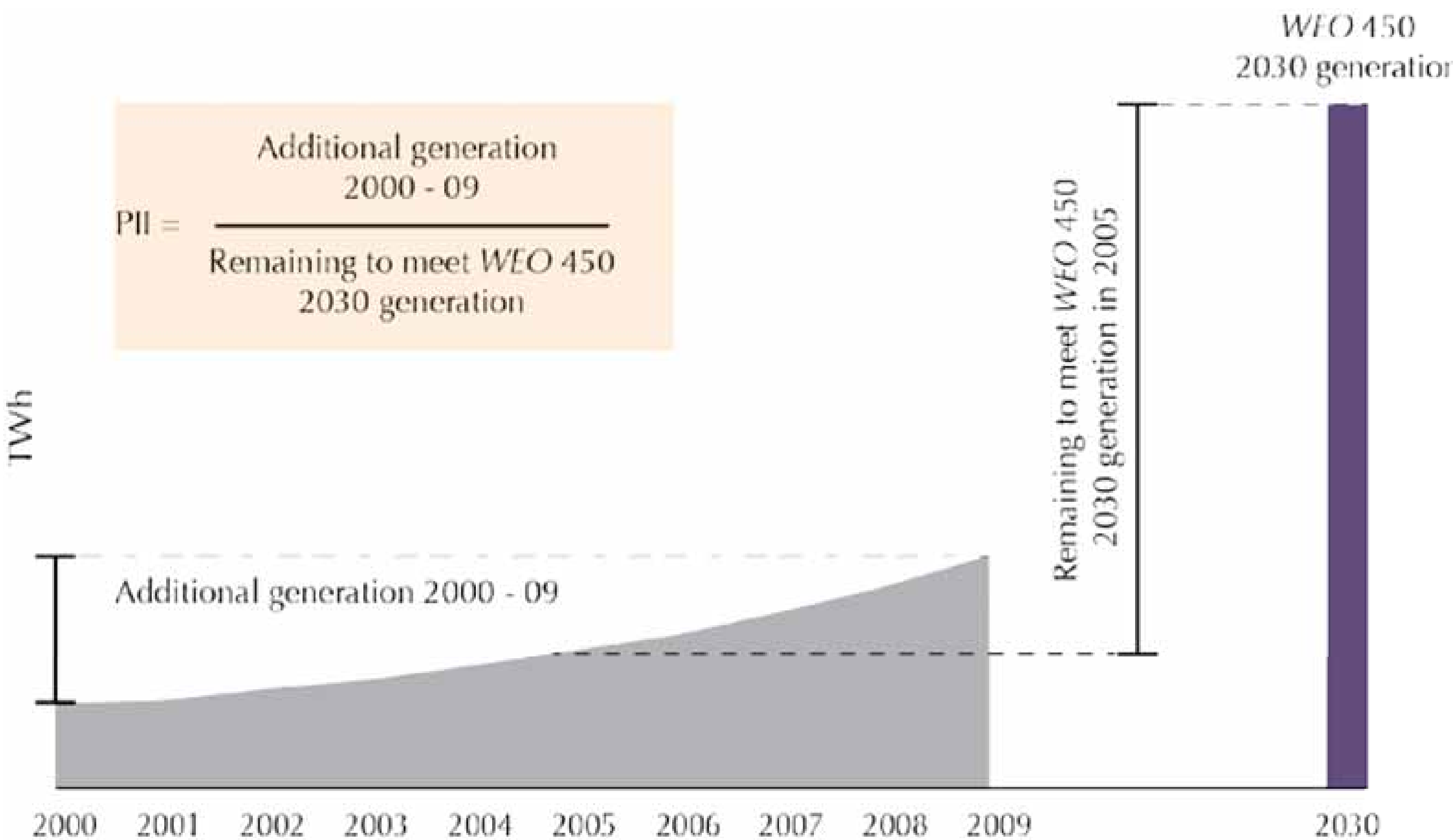
Technology	Tariff (€ct/kWh)	Tariff duration	Support calculation
Small to large biomass	8.8 (< 200 kW_{th}) 3.0 (> 1000 kW_{th})	20 years	Metering (small & medium: restrictions to prevent excess heat)
Heat pump (ground & water) Deep geothermal	5.0 (< 100 kW_{th}) 3.5 (> 100 kW_{th})	20 years	Metering
Solar thermal	9.9 (< 200 kW_{th})	20 years	Metering
Biomethane injection & biogas combustion	7.5 (biogas comb. < 200 kW_{th})	20 years	Metering

Evaluating support policies

Two key questions evaluate policy

- Cost control:
  - Does the country / region / taxpayer / ratepayer pay a reasonable amount per unit of renewable energy?
- Volume control:
  - Does the country get satisfactory energy (TWh) for the remuneration it pays to generators?

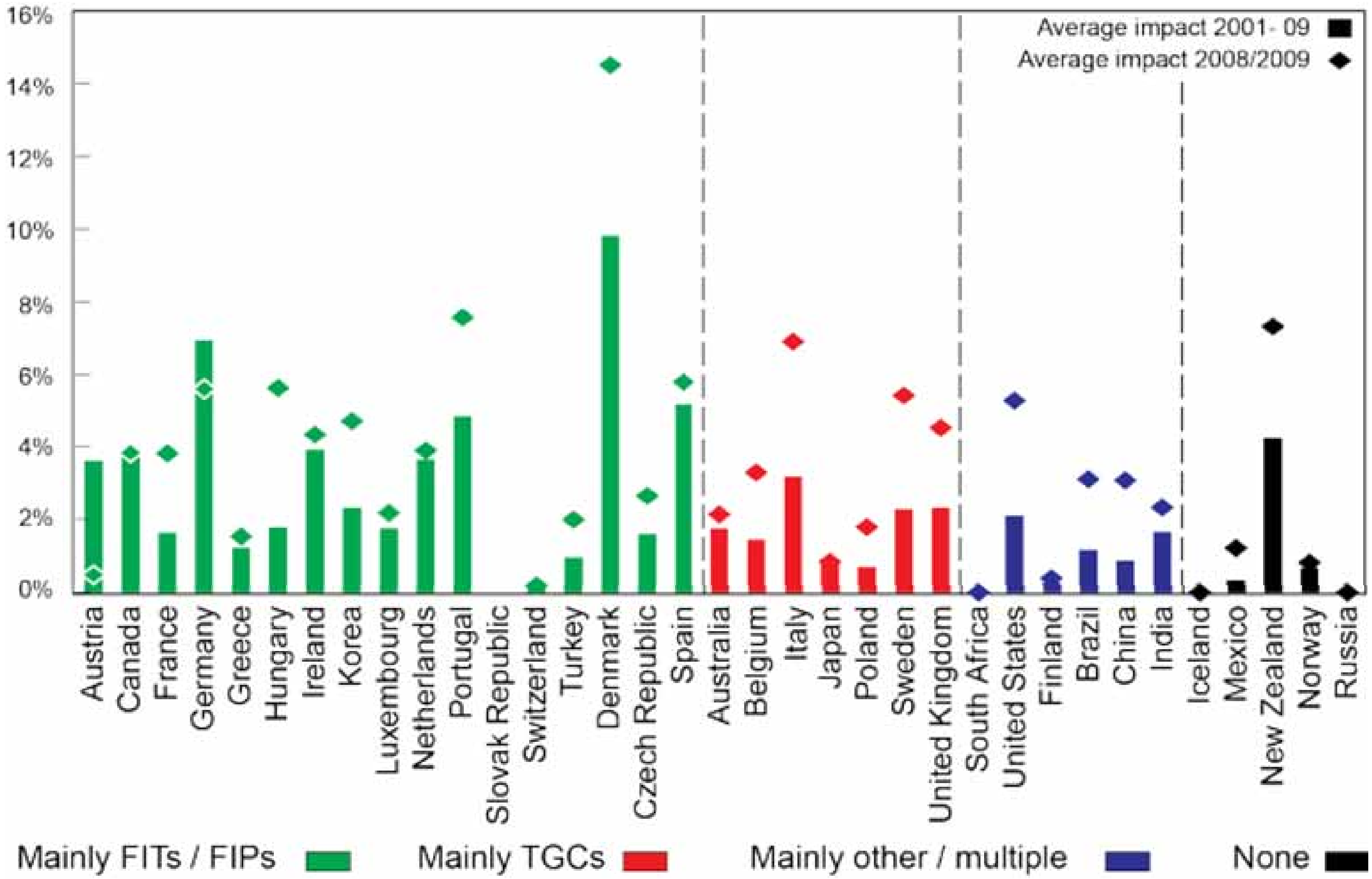
How much progress?



IEA projections can be used to benchmark policy impact

Impact: how much more RE electricity?

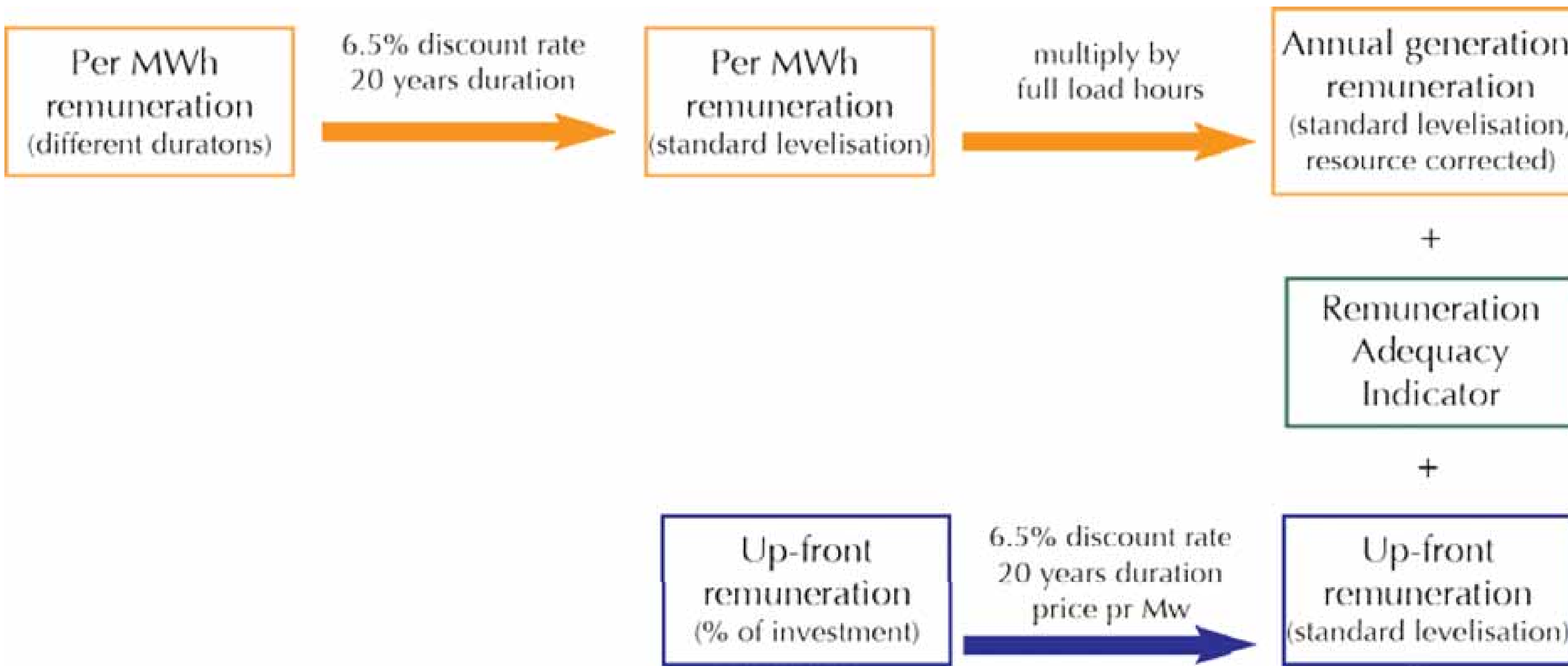
Example*: **Onshore Wind***



In the past, FITs had higher impact than TGCs, but TGCs are improving

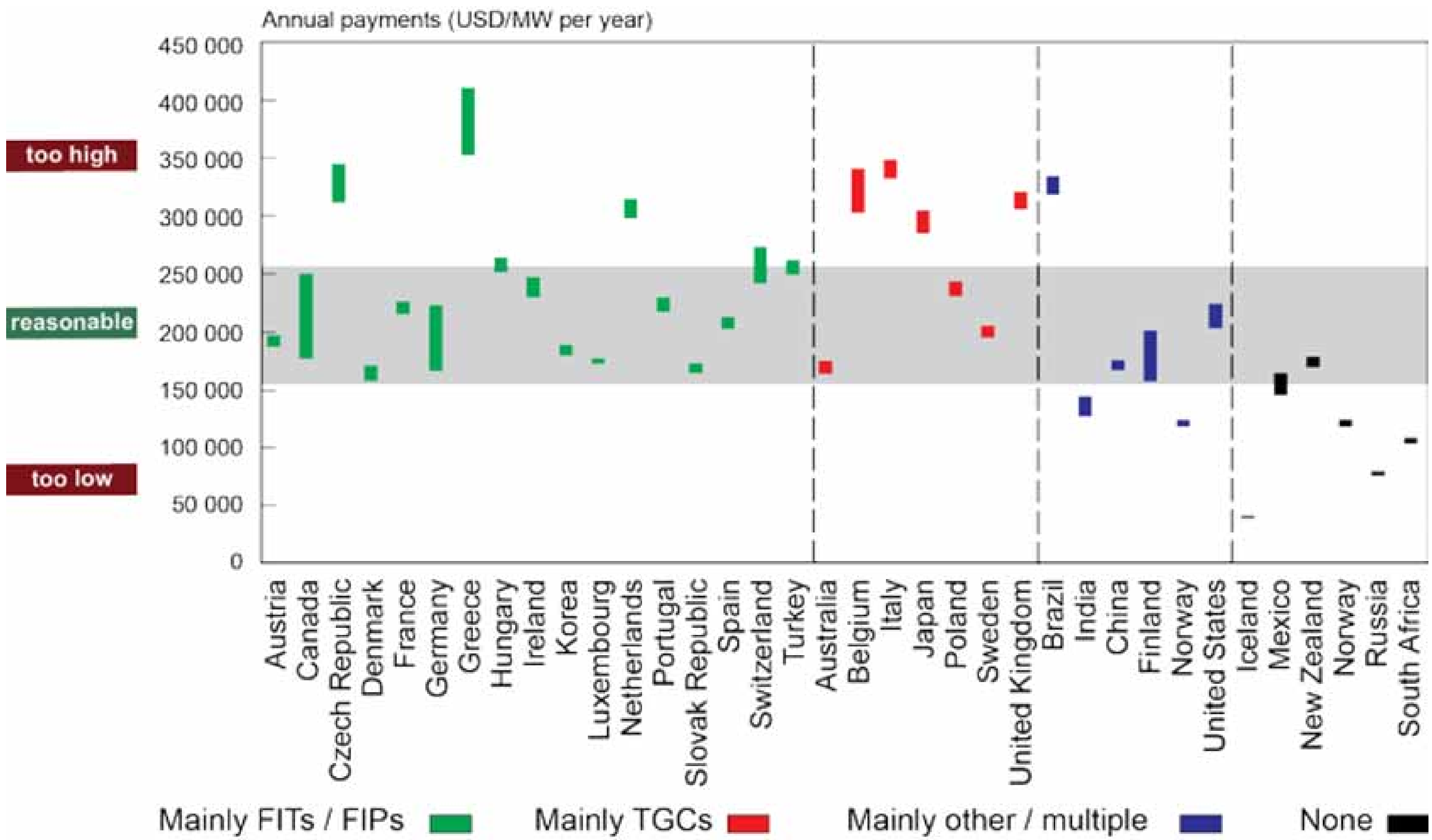
Measuring Remuneration Adequacy - Methods

- *How much is the developer rewarded?*
- *Is this adequate or is support too generous?*



Cost effectiveness: how much is it costing?

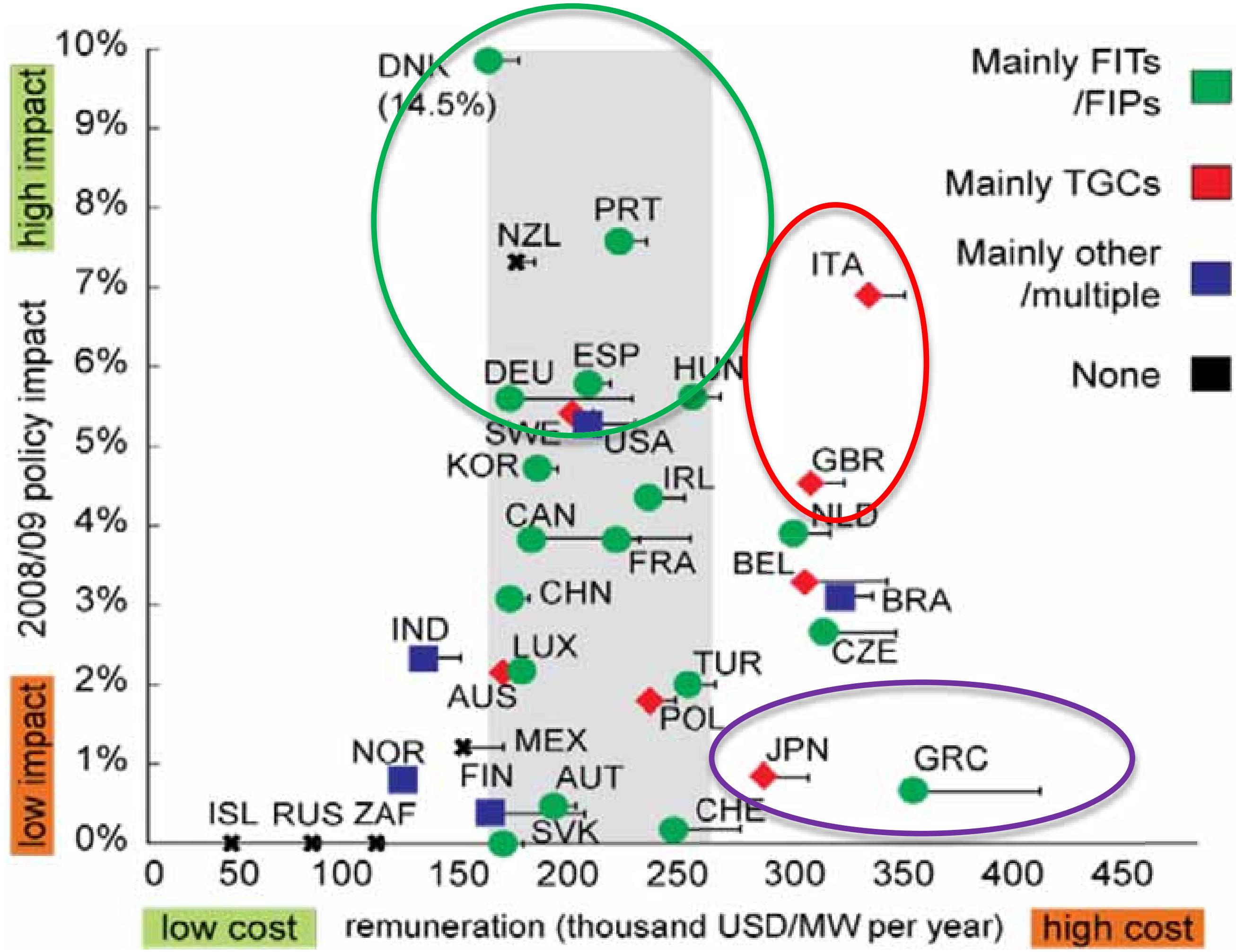
Example***: Onshore Wind***



Majority of countries paying within rage, outliers more frequent for TGCs.

Impact vs. Cost-Effectiveness

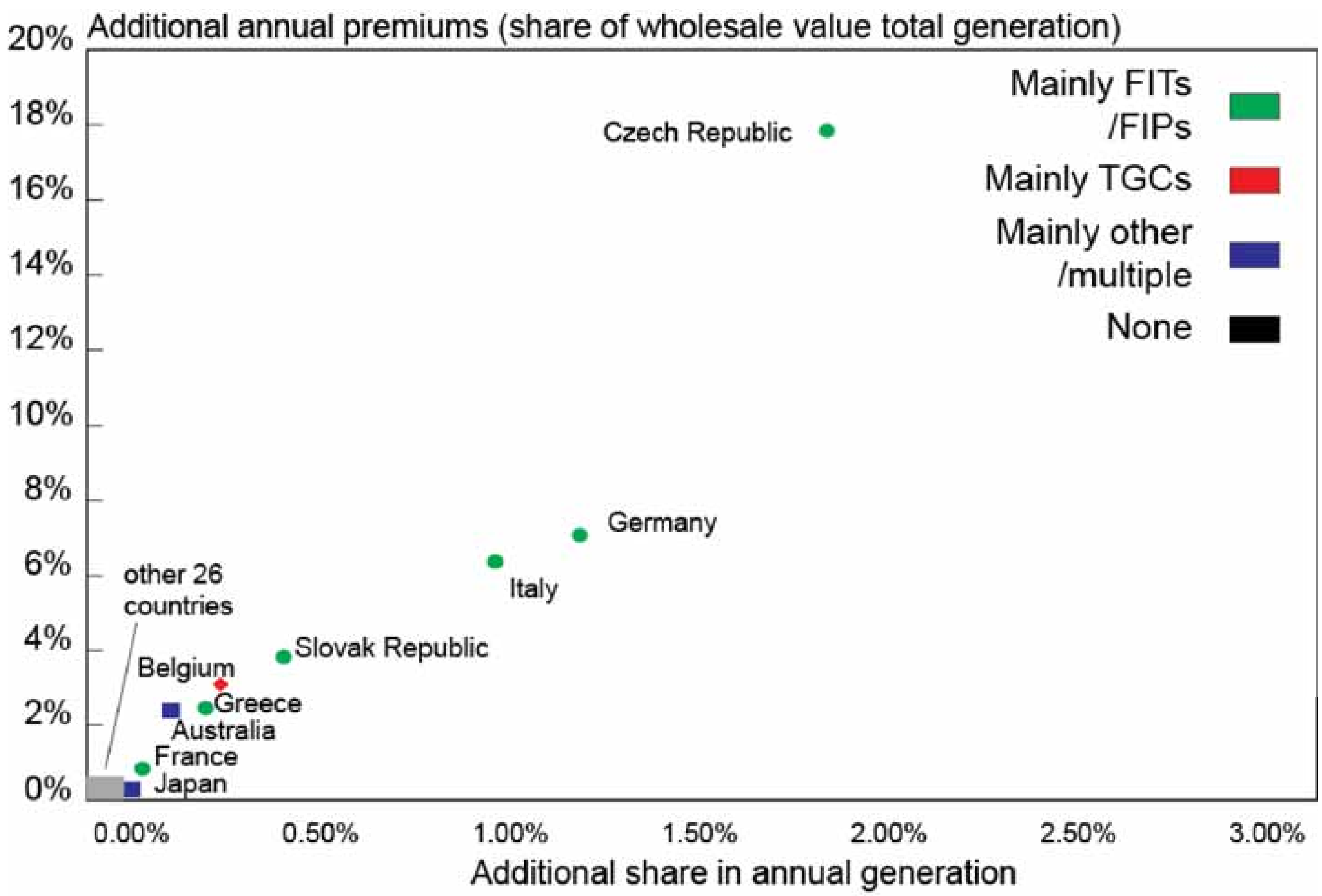
Example*: **Onshore Wind***



FIT/FIP systems tend to have a better cost/impact trade-off than TGCs.

Is the policy affordable?

Example***: Solar PV***



The few countries engaged in PV deployment pay a significant total cost.

Summary best-practice

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

Session 2: Policy

Questions and Answers

Characteristics of Support Systems

	FIT/FIP	TGC	Tender	Tax Incentive	Capital Grant
Deployment volume management	Difficult unless designed with capacity cap	Built-in but not technology specific	Good	None	Possible via cap on grant volumes
Price control	Very specific control possible; frequent reviews required	Price capped by buy-out fee and set by market; price floors can be introduced	Good	None	Possible by setting maximum grant levels
Investor security	High, some exposure to electricity market fluctuations for FIPs	Exposed to electricity and certificate market risks; can be mitigated by floors	High once concession is obtained, very low during bidding phase	High but susceptible to budget cuts	High but susceptible to budget cuts; especially attractive at high discount rates
Transaction costs/ complexity	Relatively simple if procedures streamlined and applicable to small developers	Complex, best for larger developers; can be mitigated by introducing public buyer for small projects	Relatively straightforwar d but best for larger projects; risk of too aggressive bidding and “gaming”	Relatively simple as part of overall tax management	Relatively simple