



Enhancing energy security with renewable energy – risks and opportunities

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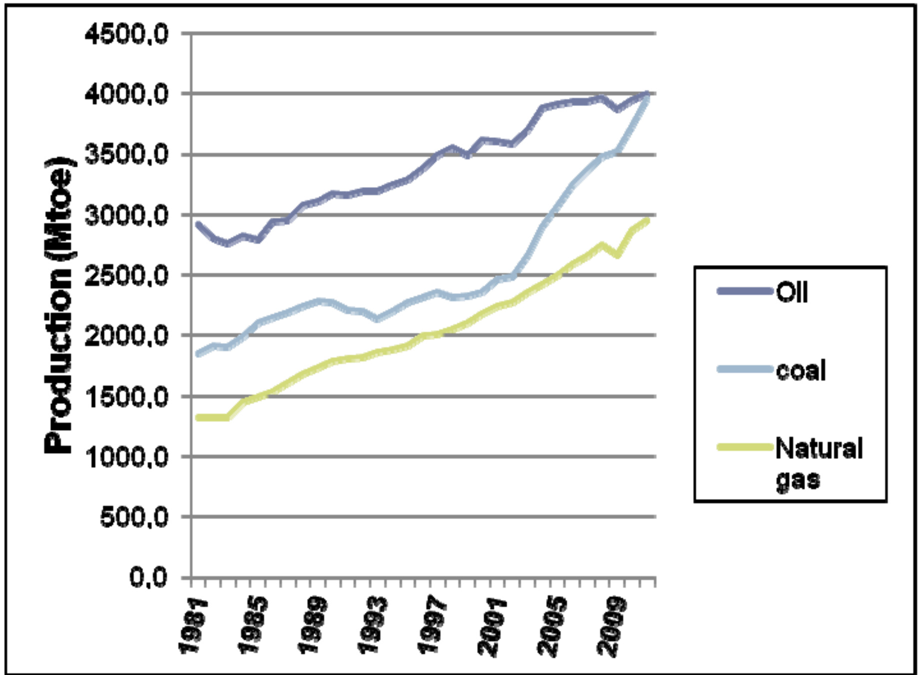
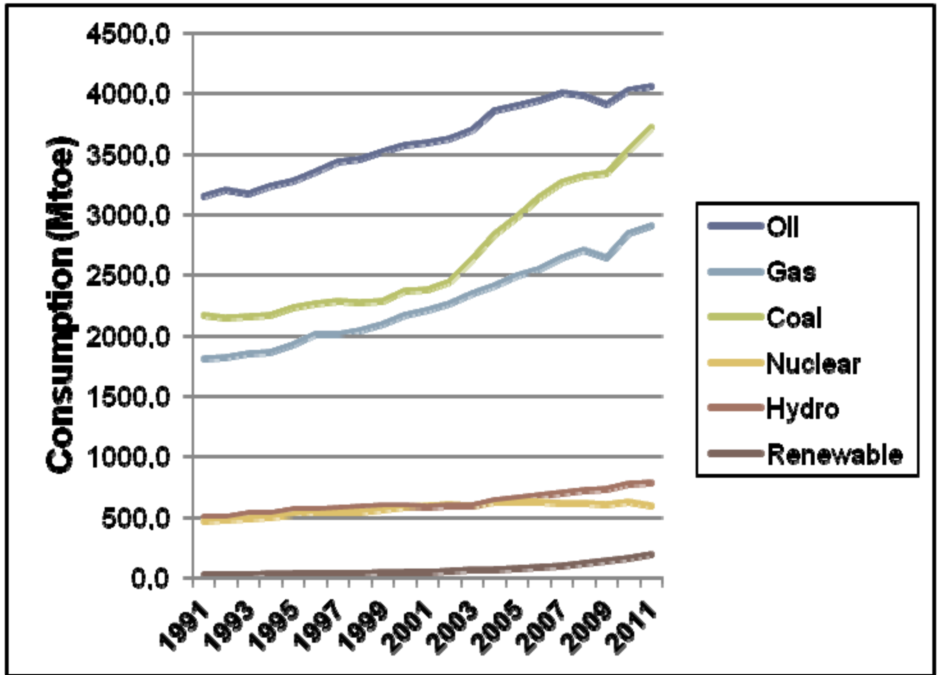
Global energy trend check



Fuel production over years



Fuel consumption over years

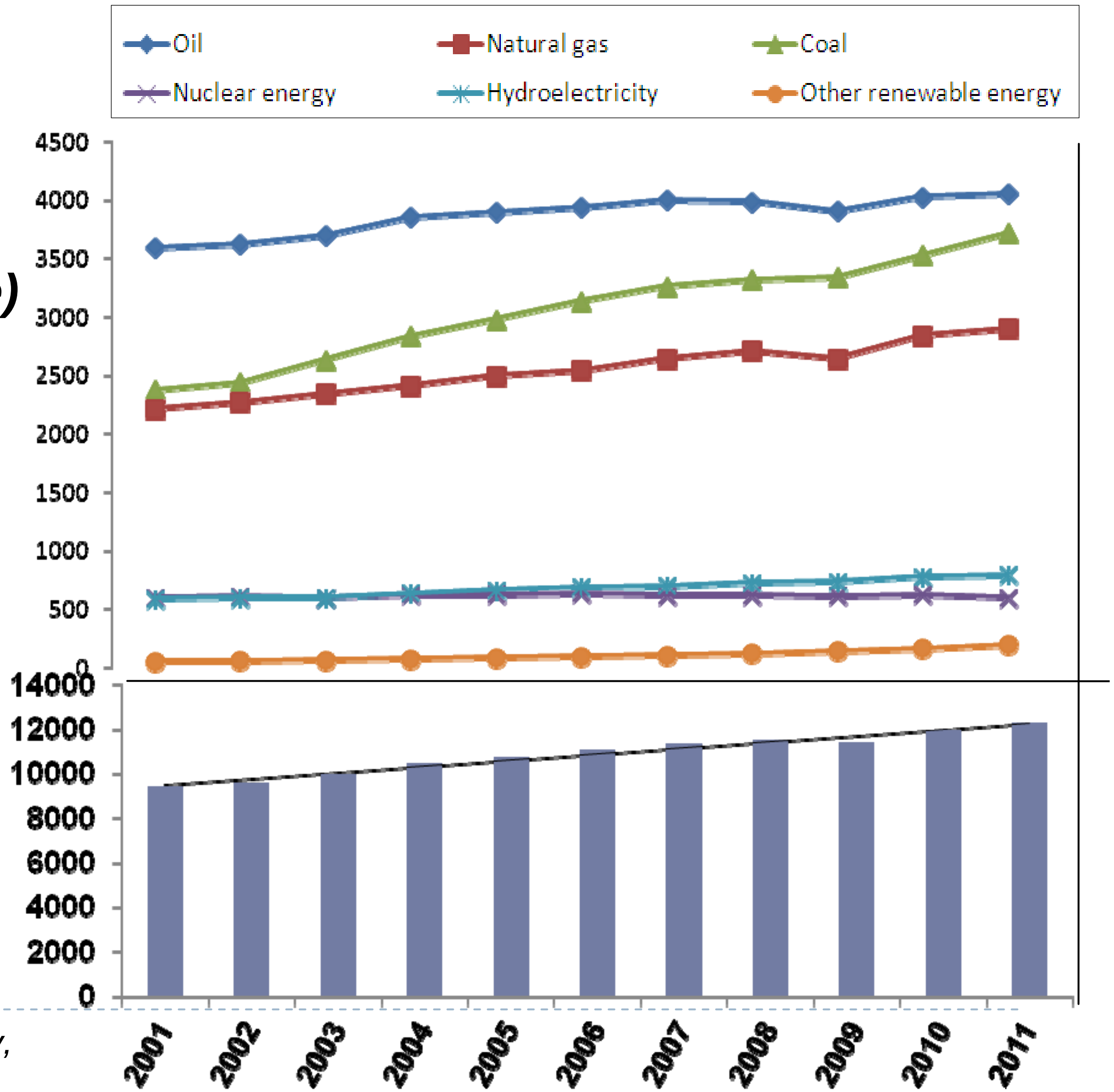
- + 0.8% oil productio n
- +6.1% coal production
- - 4.3% in nuclear output
- +3.1% natural gas production
- +1.6% hydroelec tric output
- +17.7 % RE global productio n

Source: BP Statistical Review of World Energy, June 2012

Global energy trend check (contd.)

Resource Consumption (Mtoe)

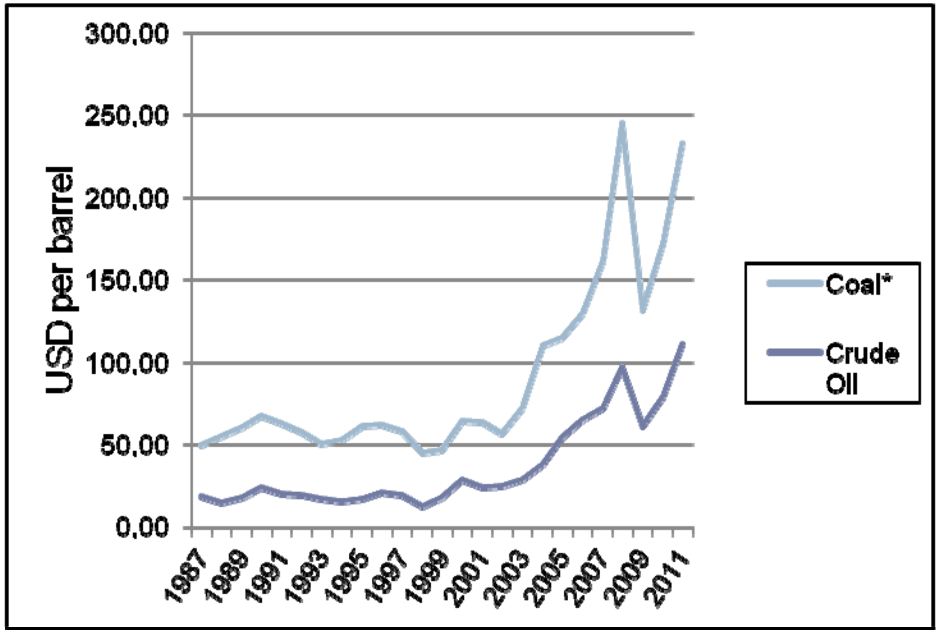
Primary Energy Consumption (Mtoe)



Source: BP Statistical Review of World Energy, June 2012

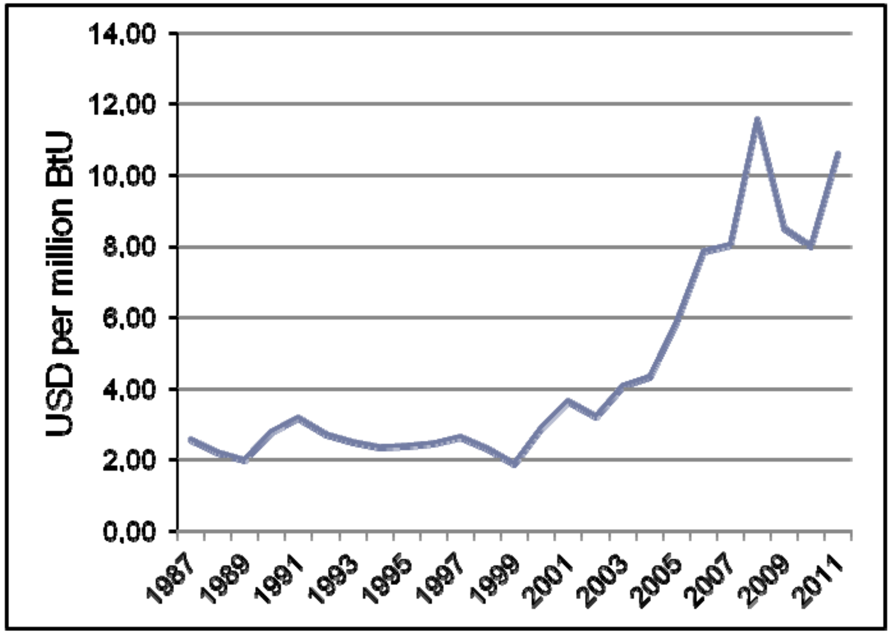
Global energy trend check (contd.)

Coal and Crude oil



* Northwest Europe marker price

Natural Gas



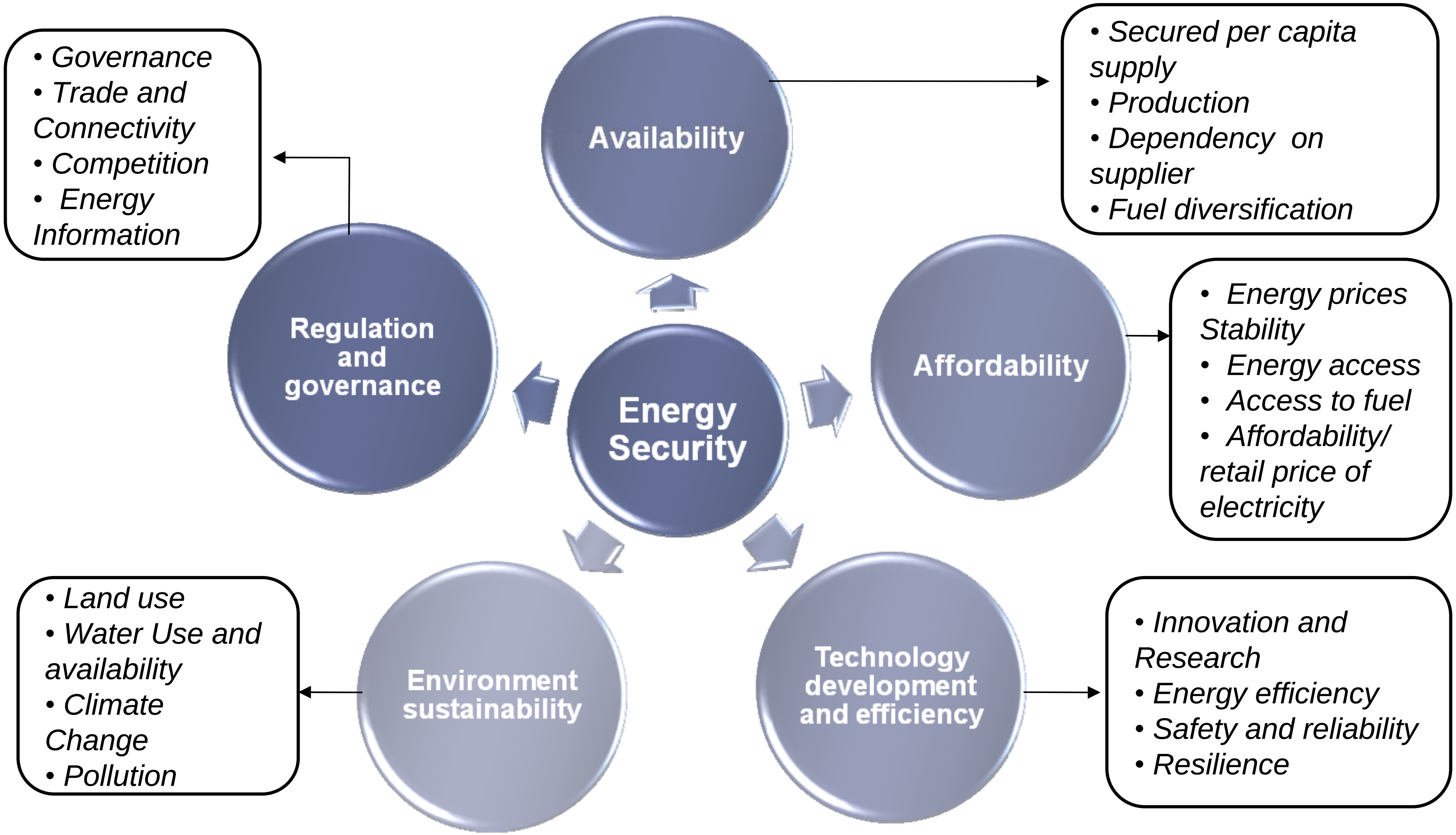
Fuel prices over the years

Source: BP Statistical Review of World Energy, June 2012

Energy Security: Need of hour

- Ever increasing energy demand
- Rising and fluctuating fuel prices impacts the international trade
- Unstable political conditions in the donor countries – a geopolitical threat
- Energy supply remains continued yet disrupted
- The climate change effect – rising CO_2 emissions – environment risk
- Fuel diversification is a much required step
  - for reducing the dependence
  - for economic development of the country
- The eventful 2011 !
  - Arab Spring
  - Fukushima disaster

Energy security: a wholesome perspective



Source: Sovacool, B.K., 2013. An international assessment of energy security performance. Ecological Economics , 88(2013), p. 148-158

Energy security with renewable energy

- Long term security with free fuel supply, indigenously produced
- Diversification of fuel will help in fuel independence
- Buffers from national and international shocks through flexibility and resistance
- Low carbon emitting technologies
- Help in meeting peak load demand from grid connected power generation
- Energy generation from RE can reach to remotest parts of the nation through decentralised and distributed generation – supporting energy access

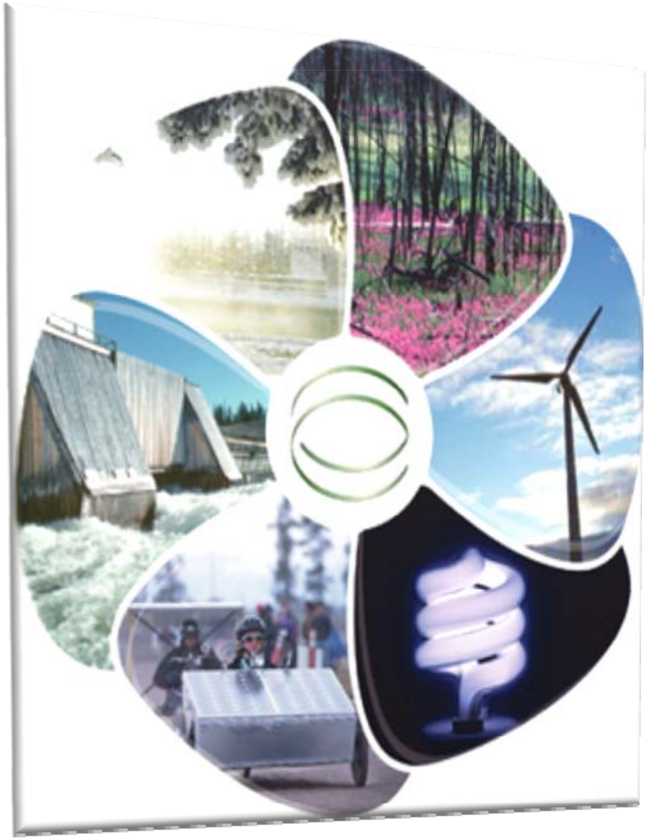
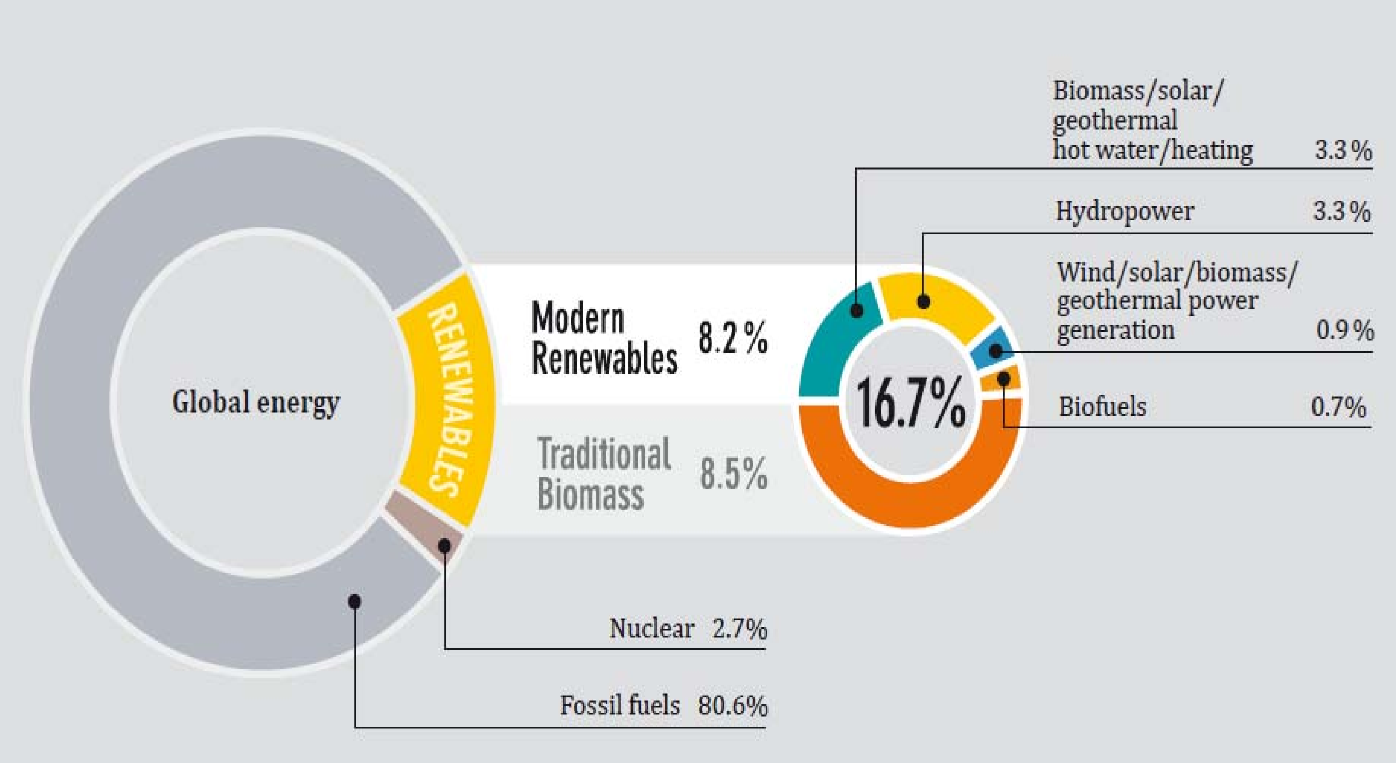


Image source: http://insight.rit.edu/node/145

RE global status



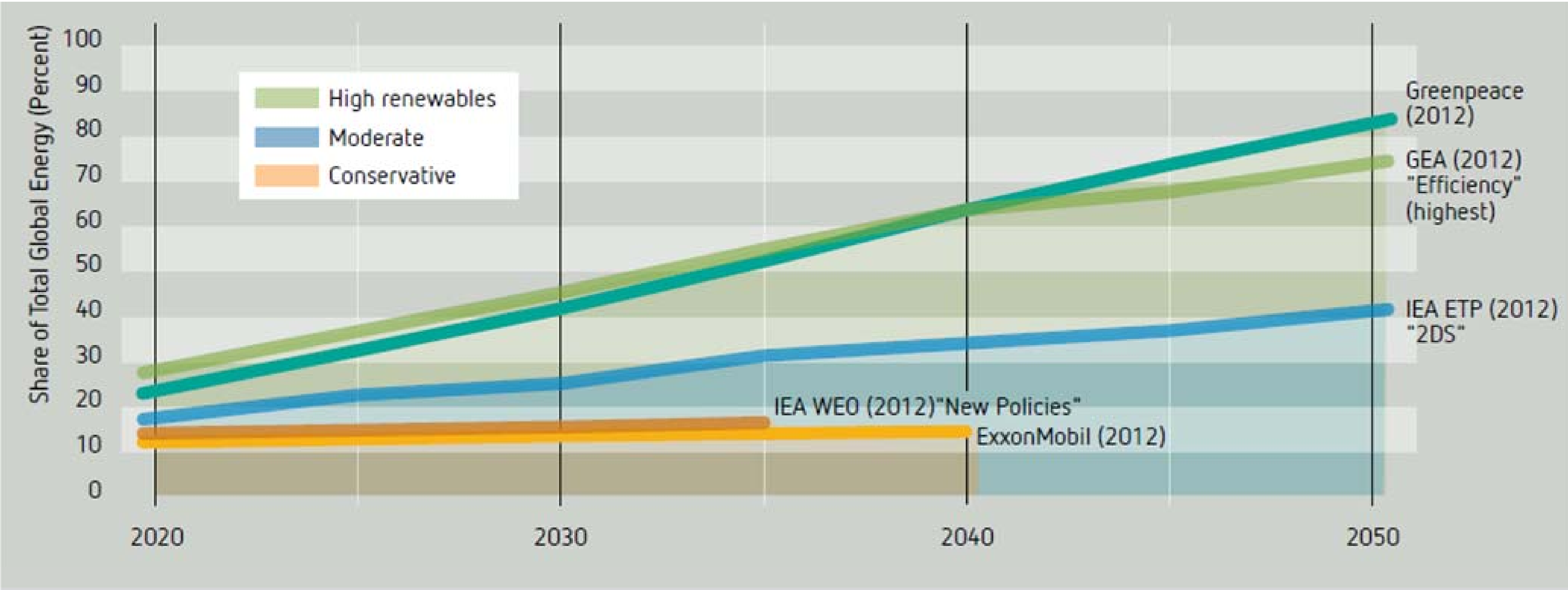
- Ocean energy is slowly picking up through small pilot projects, total global capacity of 527 MW
- At global level about 1760 MW of CSP has been added

Source: Renewables 2012 Global Status Report

Opportunities

- Creating green jobs
  - 5 million jobs in 2010 (REN 21, 2012)
- Huge potential yet to be tapped
- Cooperative R&D research
- Technology innovation for more applications
- Decentralised generation promoting energy access
- Distributed generation through RE promotes energy savings, efficiency and management

RE total global energy share - scenarios



About 64 countries with future RE targets to contribute to the country's energy mix

Source: Renewables 2013 Global Status Report

Risk Comparison across fuels – an indicative matrix

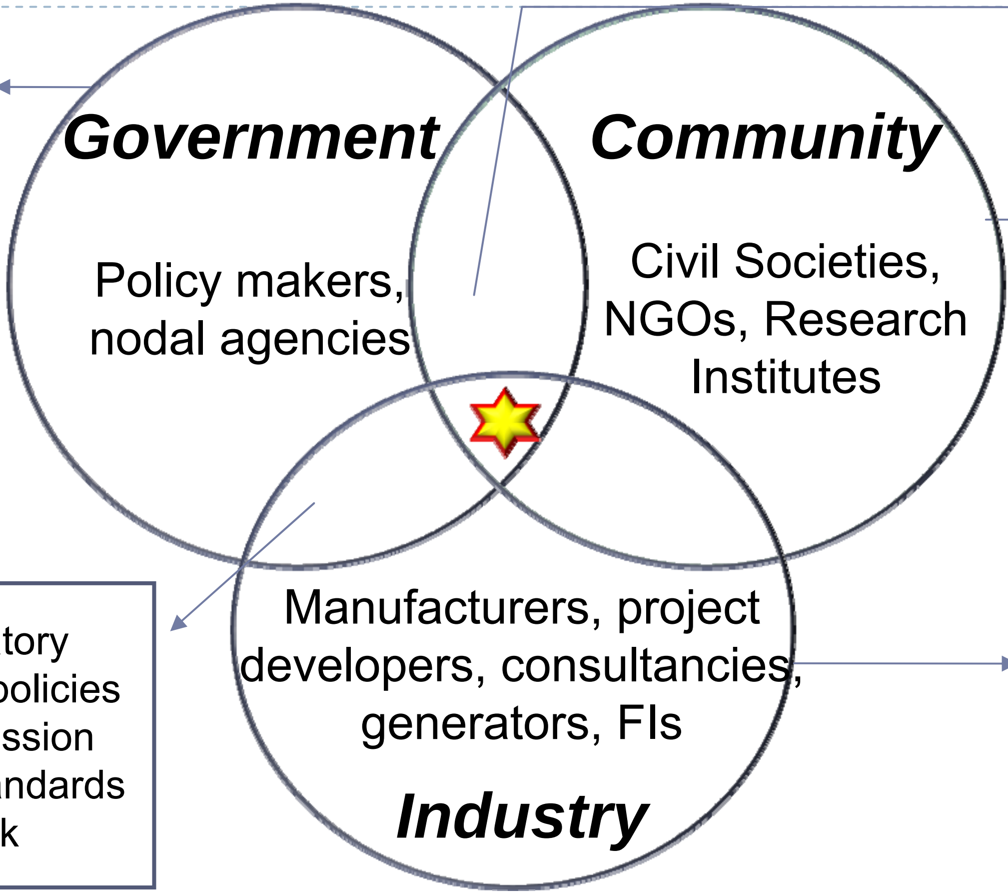
Risks / challenges	Coal	Oil	Gas	Nuclear	Hydro	RETs
Climate change risk	H	H	M	L	L	L
Other environmental concerns	H	H	M	H	H	L
Prices volatility	M	H	H	M	L	L
Fuel Supply uncertainty	H	M	M	L-H	L	M
Technology supply uncertainity	L	L	L	L	L	H
Lack of Finance support	M	L	L	H	H	H
Seismic risk	M	M	M	M- H	H	L
Infrastructure requirement	L	L	H	H	M	H
Technology uncertainty	M	L	L-H	H	M	H
Geopolitical risk	M	H	M	H	L	L
Regulatory and governance risk	H	M	M	M	L	H

H – high risk, M – medium risk, L – low risk

Source: Draft TERI project progress report, 2009, Survey with experts

Perceptions and concerns in RE

- Energy security



- Workers health
- Accidents

- Aesthetics
- Local biodiversity

- Suitable regulatory framework and policies
- Abiding to emission and pollution standards
- Geopolitical risk

- Technology/raw material availability
- Market conditions
- Inaccurate resource information/ resource availability
- Financial viability
- Infrastructure availability
- Delayed clearances
- Institutional support
- Waste generation and management
- Local resistance
- Operational risks
- Security threat
- Political instability

- Land acquisition and compensation
- Water availability and management
- benefit distribution
- Environment protection

Project based risks: Solar

Stage	Process within stage	Type of risk
System components manufacturing	• Extraction of pure silicon • Manufacturing of CdTe based thin film	Environment, Economic, Market and Human Health
Site selection	• Resources assessment • Acquisition of land	Technical, social, political
Site clearance	Acquisition of land	Political, regulatory, social
Financial closure	• Finalisation & documentaion of above steps • PPA and other contracts negotiation • Bank requirements finalised	Regulatory and financial
System commissioning	• Availing incentives under govt. schemes • Operation and maintenance	Environmental, technical and economical
System de-commissioning	• Proper dismantling of CdTe based thin film • Scrap generation of mounting structure	Environmental / health

Project based risk: Wind

Stage	Process within stage	Type of risk
Site selection	• Resource assessment • Site ownership/leasing of land	Technical, economic and socio-political
Site clearance	Signing of power purchase agreement	Political, regulatory and economical
Financial closure	• Finalisation and documentaion of above steps • PPA and other contracts negotiation • Bank requirements finalised	Political, regulatory and economical
System operation	• Turbine power generation • Blades moving	Technical, economical and environmental
System de-commissioning	Wind blades	Environmental

Project based risks: Biomass

Stage	Process within stage	Type of risk
Raw material extraction	Harvesting and collection	Environmental risks
Site clearance	Signing of power purchase agreement	Political, regulatory and economical
Financial closure	● Finalisation and documentaion of above steps ● PPA and other contracts negotiation ● Bank requirements finalised	Political, regulatory and economical
System operation	• Ensuring fuel supply for production • Biomass based power generation • Processing of fuel & Conversion process • Biomass based power generation	Environmental, health and accidental

Project based risks: Geothermal

Stage	Process within stage	Type of risk
Site selection	• Resource assessment • site ownership/leasing of land	Technical, economic and socio-political
Construction phase	● Plant drilling ● Disposal drilling effluents	Environmental and accidental
Site clearance	Signing of power purchase agreement	Political, regulatory and economical
Financial closure	● Finalisation and documentaion of above steps ● PPA and other contracts negotiation ● Bank requirements finalised	Political, regulatory and economical
Generation activity	Depends on type of geothermal reservoirs (water dominated or stream dominated)	Environmental, bio-diversity, technical and accidental

Technology specific risks

Risks associatie d	Public policy	Supply and demand	Resource information	Technology performance data	Grid integration	Operationa l risks	Intangibl e risks*	Extent of current risk analysis
Solar thermal	**H**	**M**	**L**	**L-H**	**H**	**M**	**M**	**L**
Solar PV	**H**	**M-H**	**H**	**M**	**M**	**M**	**L-M**	**M**
Biomass	**H**	**L**	**M**	**L-H**	**M**	**M**	**H**	**M**
Wind	**M**	**M-H**	**M**	**M**	**H**	**M**	**H**	**M**
Geotherm al	**M**	**L**	**H**	**H**	**M**	**M-H**	**L**	**M**
Wave	**H**	**L**	**L**	**H**	**H**	**H**	**M**	**L**
Tidal barrage & lagoons	**H**	**L**	**M**	**M-H**	**H**	**H**	**H**	**M**

* Stakeholder opposition, public perception

Source: Risk quantification and management in renewable energy projects, Report, 2010 by IEA-RETD

Major project set up risks

- Regulatory policies
- Land use, acquisition and compensation
- Financial support and viability
- Accurate resource information
- Country risk

RE Supporting policies for grid connected power

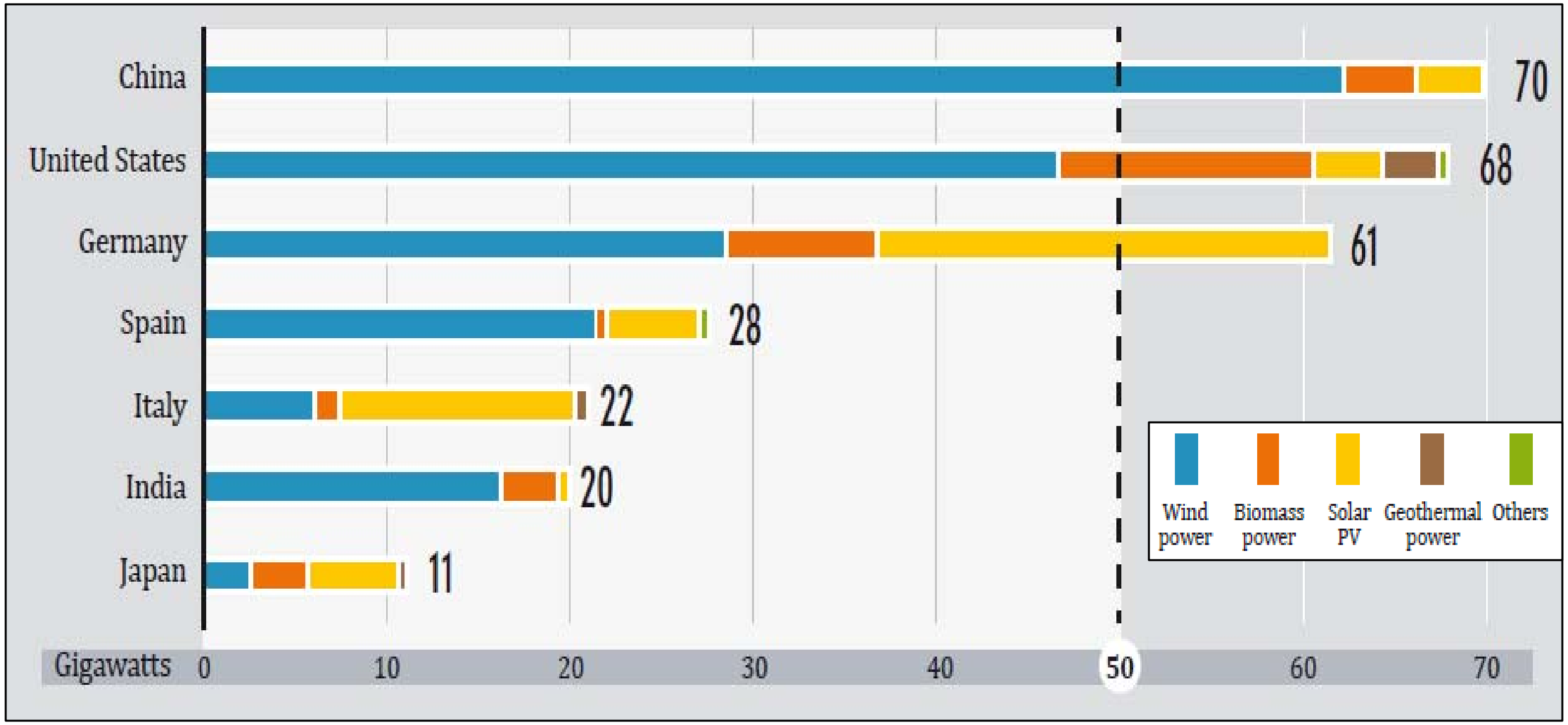
Countries	REGULATORY POLICIES: Feed-in tariff (incl. premium payment)	Electric utility quota obligation/ RPS	Net metering	Biofuels obligation/ mandate	Heat obligation/ mandate	Tradable REC	FISCAL INCENTIVES: Capital subsidy, grant, or rebate	Investment or production tax credits	Reductions in sales, energy, CO_2, VAT, or other taxes	Energy production payment	PUBLIC FINANCING: Public investment, loans, or grants	Public competitive bidding
High Income	1	4	5	2	6	3	1	3	2	4	1	2
Upper middle Income	1	5	3	2	4	6	1	3	2	4	1	2
Lower middle income	1	4	3	2	5	5	3	2	1	4	=	
Low Income	1	2	-	1	-	-	2	3	1	-	1	2

Scale 1 → 6

Most widely adopted — Least widely adopted

Source: Renewables 2012 Global Status Report

RE global status in leading countries



Source: Renewables 2012 Global Status Report

RE global ranking

	RE power (incl. hydro)	RE power (w/o hydro)	Solar PV	Wind power capacity	Biomass Power capacity	Geothermal direct heat use
1	China	China	Germany	China	United States	United States
2	United States	United States	Italy	United States	Brazil	Philippines
3	Brazil	Germany	Japan	Germany	Germany	Indonesia
4	Canada	Spain	Spain	Spain	China	Mexico
5	Germany	Italy	United States	India	Sweden	Italy

- Spain leads in the CSP installation
- Europe has the biggest market so far for biofuel

Recommendations

- Risks to be scientifically tackled and sorted
- Public Awareness required
- Government should have stronger and stricter policies and regulations to support national development and international competition
- Incentivisation is essential for RE growth
- Knowledge and sharing is required to accelerate global revolution of RE

Conclusions

- Renewable hold strong position and share in energy transition
- Technology advancing and innovating
- Prices are falling
- Risks are opportunities
- There is need out there!

Thank you

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