



Role of Policies in the Progress of Renewable Energy: A Global Perspective

Dr. M. Asif

King Fahd University of Petroleum & Minerals, KSA

PRESENTATION OUTLINES

- ▶ The Renewable Energy Package
- ▶ Status and Trends
- ▶ Growth Drivers
- ▶ Policy Instruments
- ▶ Concluding Remarks

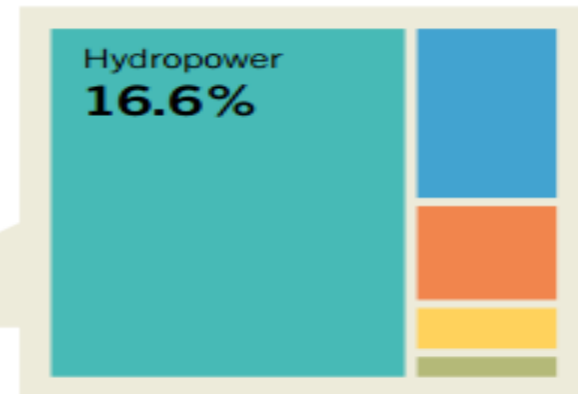
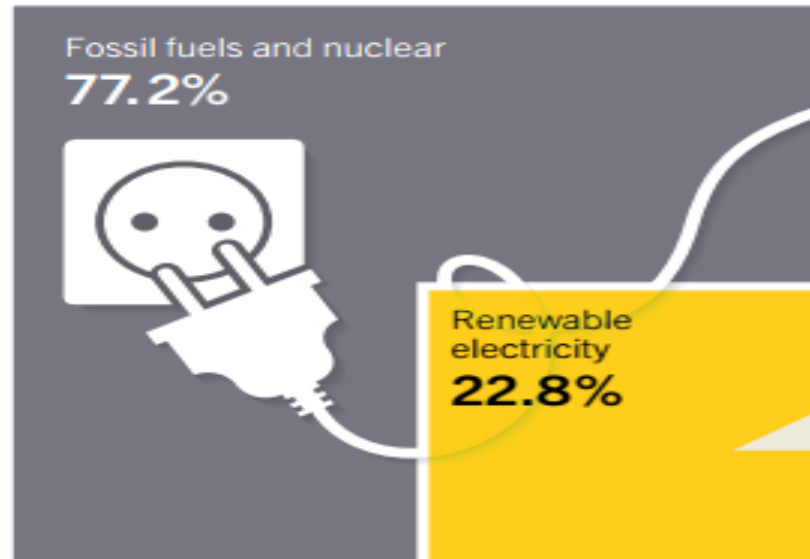
STRENGTHS OF RENEWABLE ENERGY

- ▶ Replenishing resource
- ▶ Diverse resources
- ▶ Global distribution of resources
- ▶ Diverse distribution of resources
- ▶ Environment friendliness
- ▶ Reducing cost trends
- ▶ Low maintenance cost
- ▶ Energy freedom

WEAKNESSES OF RENEWABLE ENERGY

- ▶ Intermittency
- ▶ Low capacity factor
- ▶ Weather dependency
- ▶ High capital cost
- ▶ Storage issues
- ▶ Grid connectivity issues

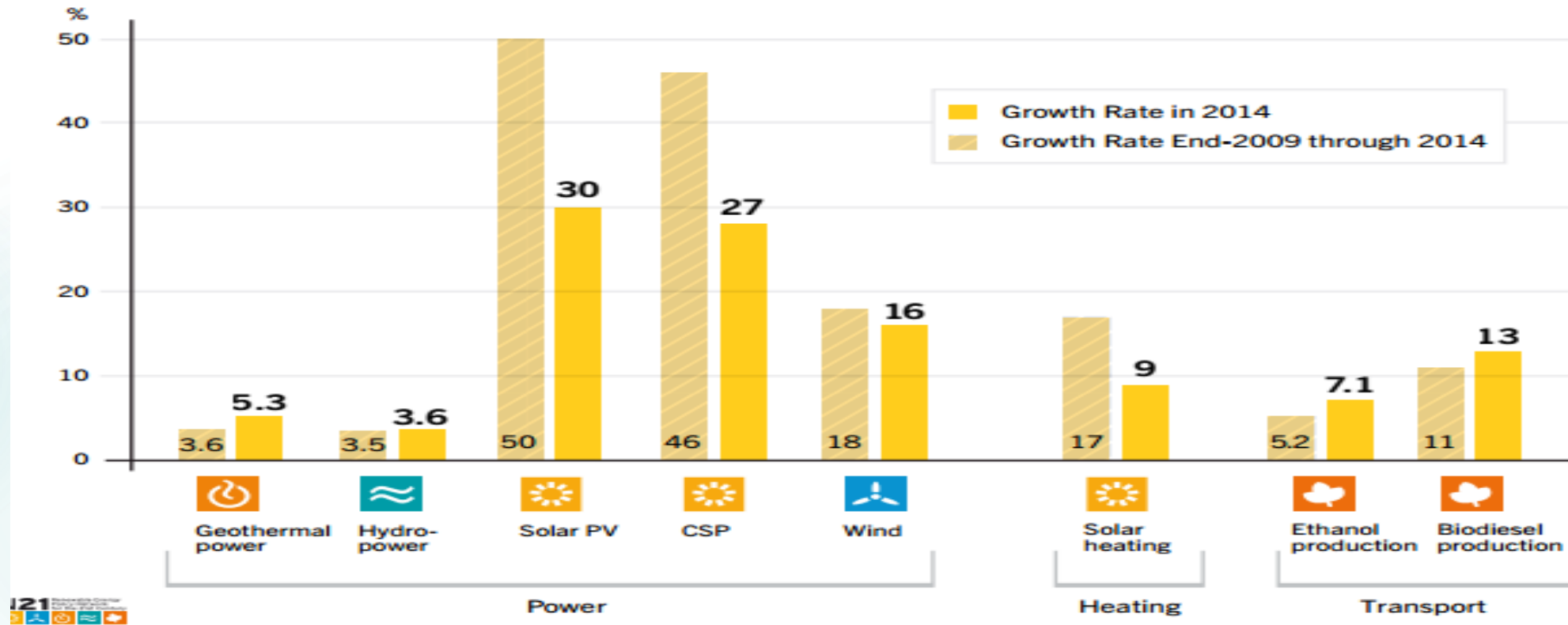
RE SHARE IN GLOBAL ELETRICITY SECTOR, 2015



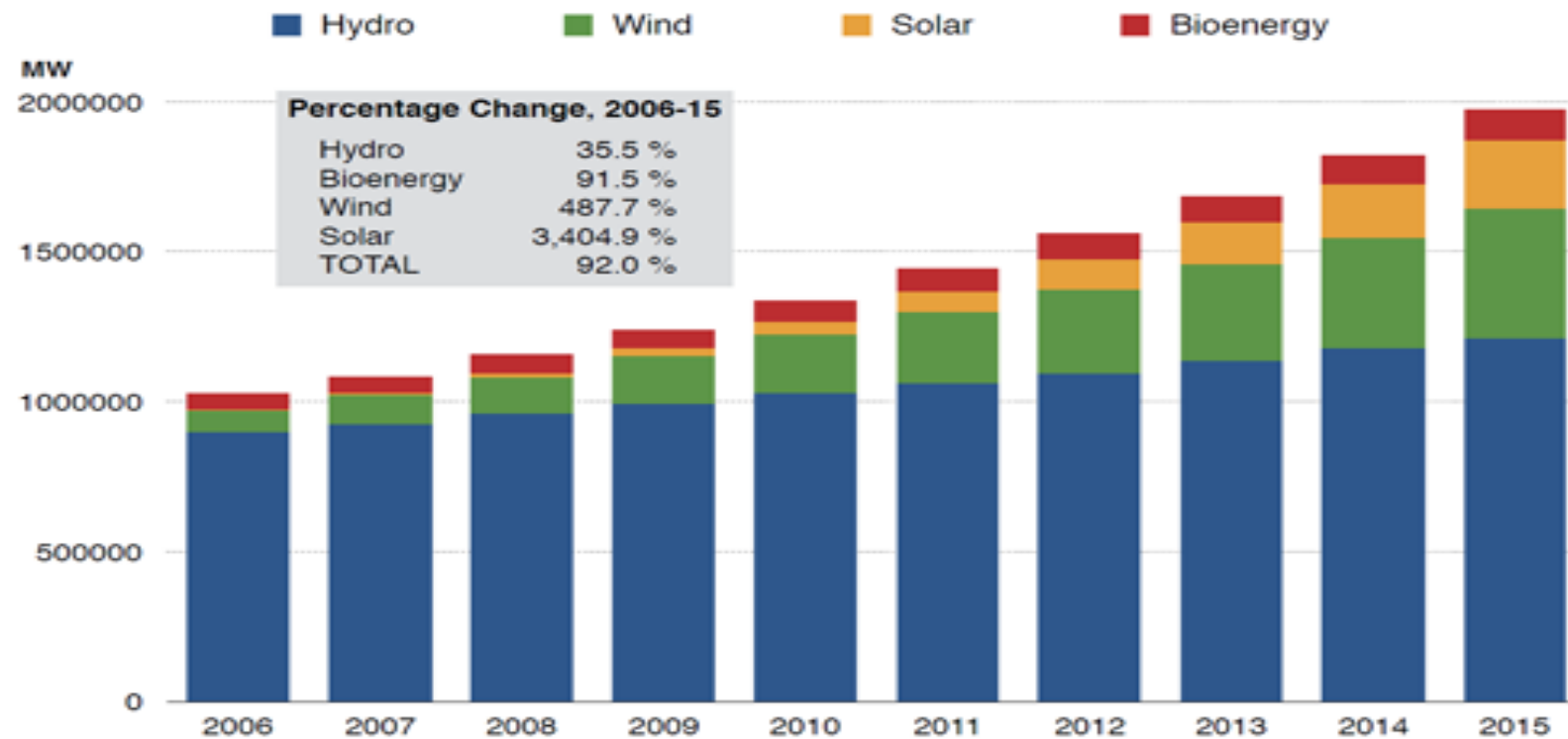
Wind	3.1%
Bio-power	1.8%
Solar PV	0.9%
Geothermal, CSP, and ocean	0.4%

Source:
See En
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RE GROWTH RATE, 2015

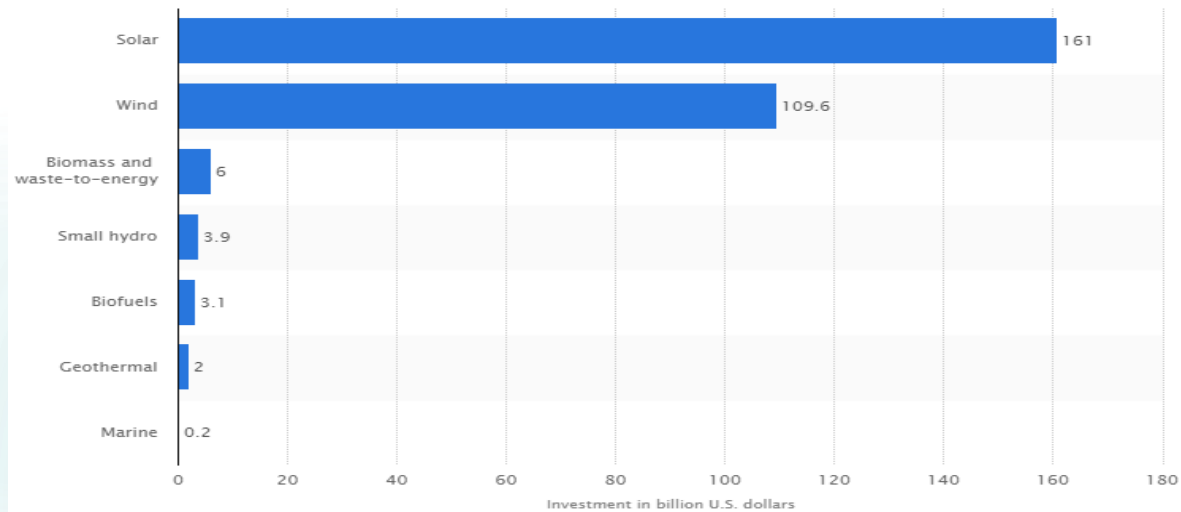


GLOBAL INSTALLED CAPACITY OF RE



Source: International Renewable Energy Agency, *Renewable Capacity Statistics*, 2016

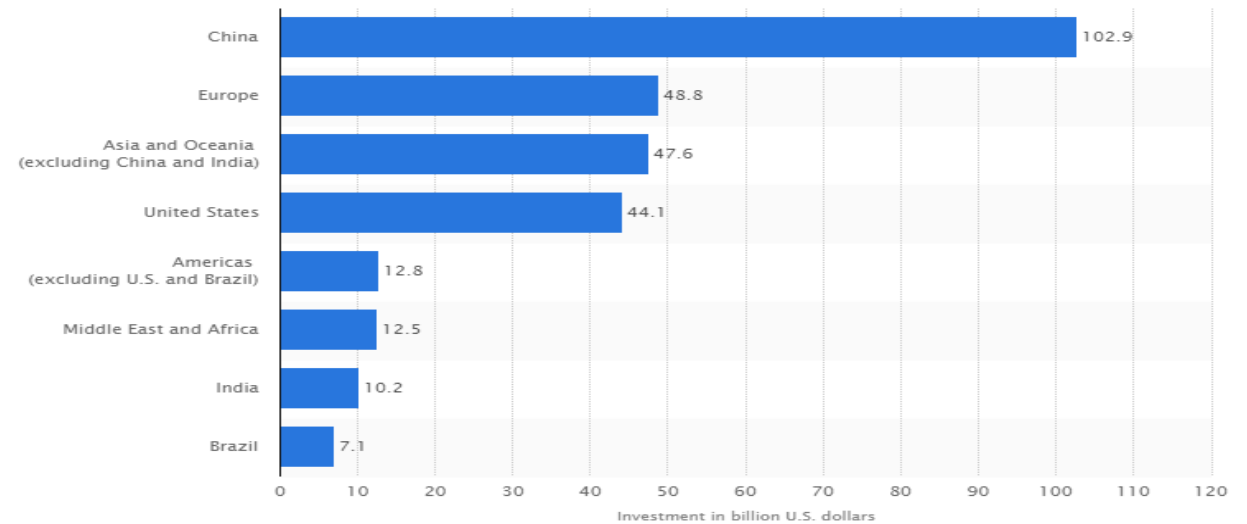
NEW INVESTMENTS IN RE, 2015



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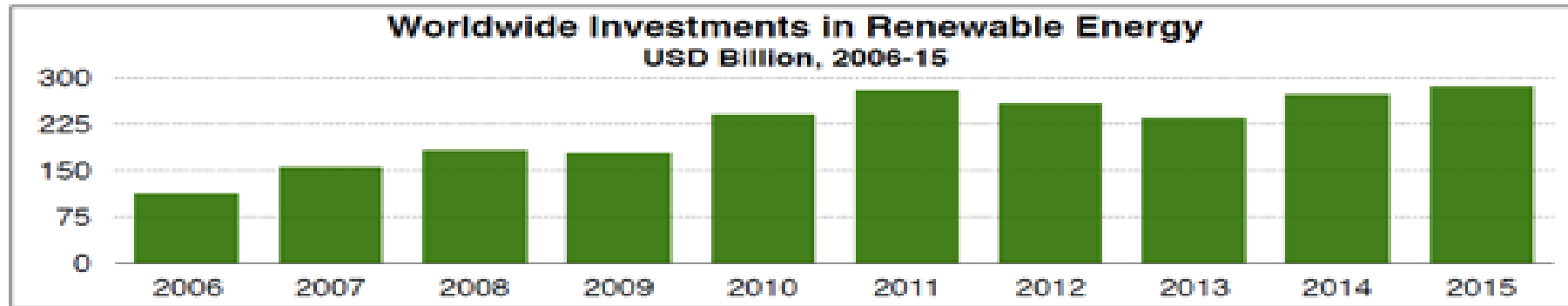
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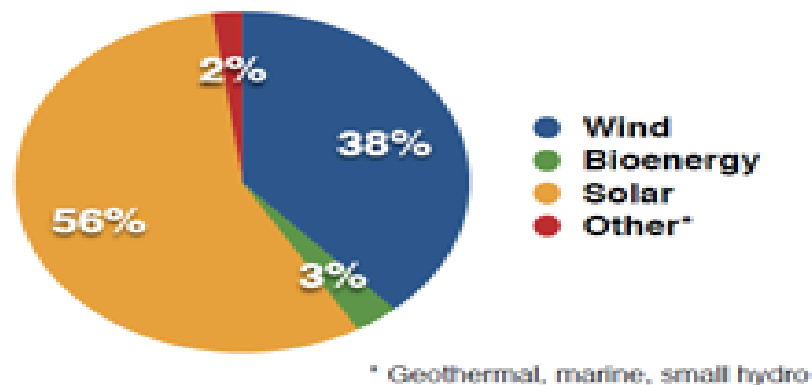
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LEADING COUNTRIES BY INVESTMENT



Renewable Energy Investments by Technology
Percent, 2015



Leading Investors in Renewable Energy
USD Billion, 2015

#1	China	\$102.9
#2	U.S.	\$ 44.1
#3	Japan	\$ 36.2
#4	U.K.	\$ 22.2
#5	India	\$ 10.2
#6	Germany	\$ 8.5
#7	Brazil	\$ 7.1
#8	South Africa	\$ 4.5
#9	Mexico	\$ 4.0
#10	Chile	\$ 3.4

Source: Bloomberg New Energy Finance, *Global Trends in Renewable Energy Investment*, 2016

RENEWABLES GROWTH DRIVERS

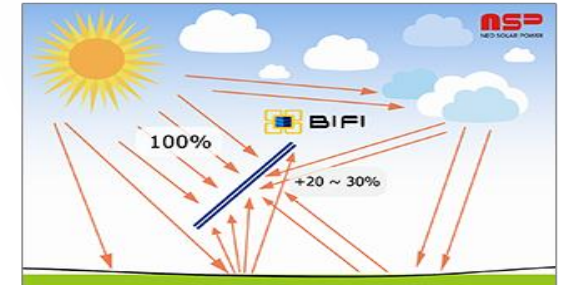
- ▶ Scientific developments
- ▶ Economy of scale
- ▶ Conducive policies

TECHNICAL ADVANCEMENTS

Concentrated PV – Efficiency > 45%



Bifacial PV – Efficiency > 23%



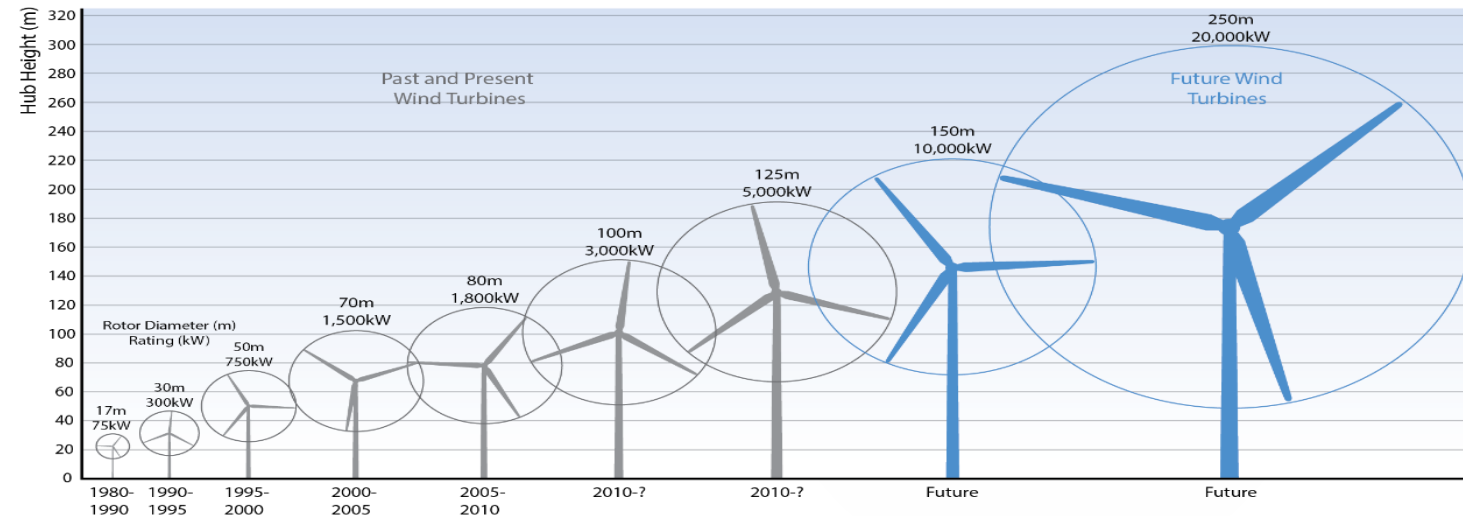
Concentrated Solar Thermal – Efficiency > 45%



WIND POWER

Upscaling

Offshore



STORAGE

Conventional batteries



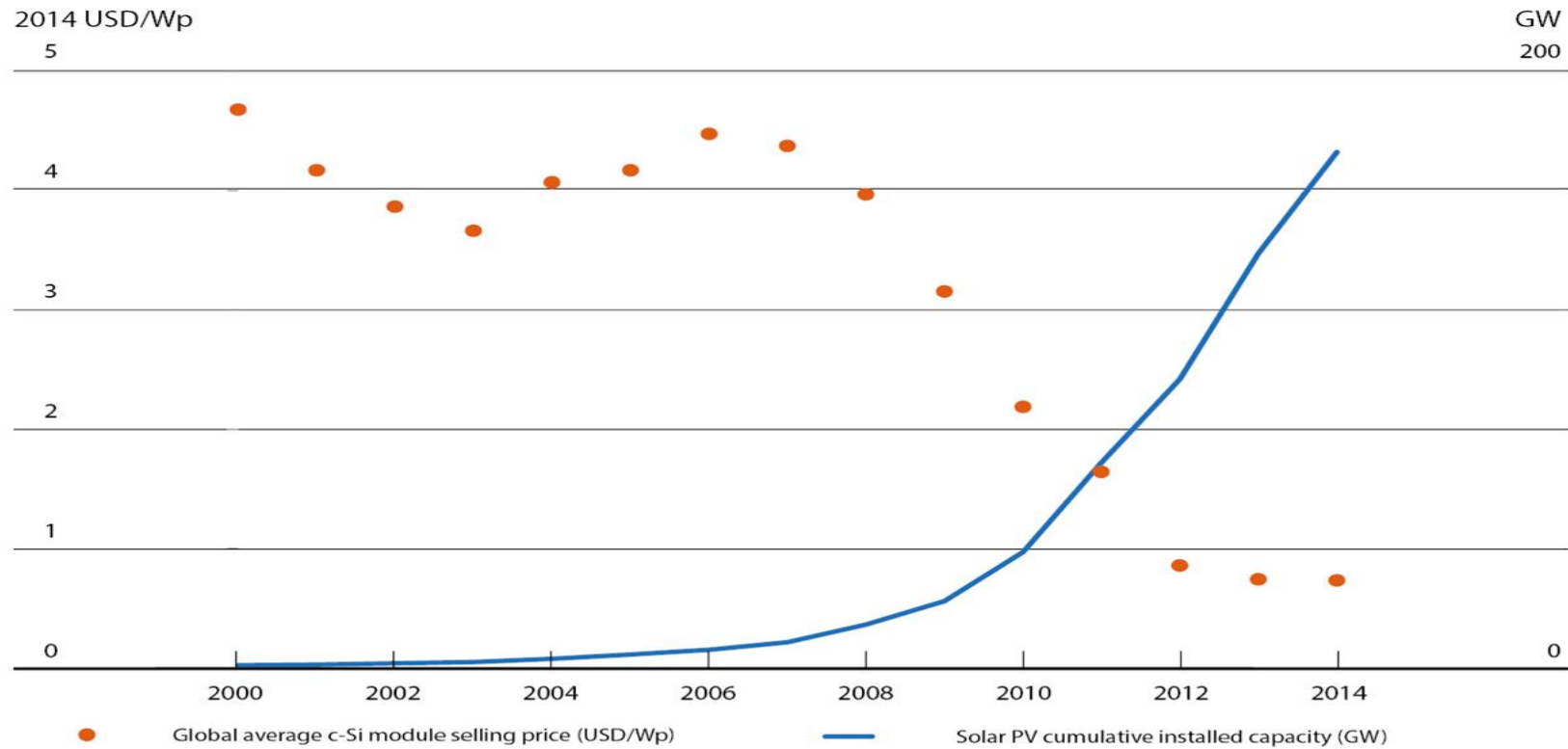
Deep-cycle batteries



Lithium batteries

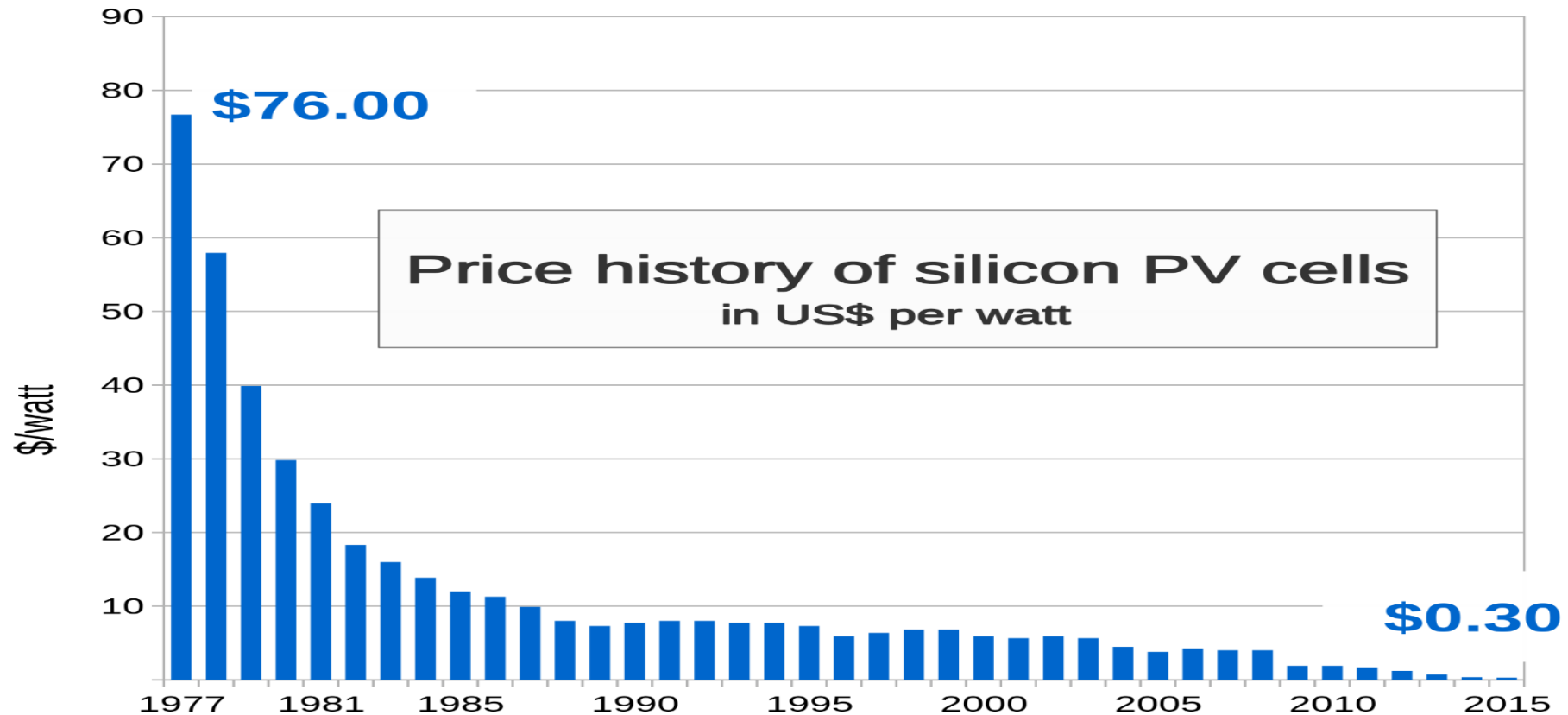


ECONOMY OF SCALE



Sources: IRENA and pvXchange, 2014.

PV PRICE TREND



Source: Bloomberg New Energy Finance & pv.energytrend.com

ECONOMIC COMPETITIVENESS



In May 2016 Abu Dhabi had power purchase agreement for 800MW solar PV project signed at less than 3 US cent/kWh

KEY INTERNATIONAL ENERGY POLICY STRANDS

- ▶ Energy security
- ▶ Energy conservation
- ▶ Renewables/environmentally friendly resource

RE POLICY INSTRUMENTS

- ▶ Energy independence
- ▶ Environmental friendliness
- ▶ Diversity in supplies
- ▶ Cost effectiveness
- ▶ International obligations

POLICY TYPES

Regulatory Policies

- ▶ 20-20-20 EU DIRECTIVE
- ▶ Feed-in Tariffs (FITs)/ Net metering
- ▶ Electric Utility Quota Obligation/Renewable Obligation Certificates (ROCs)
- ▶ Biofuel Obligation Mandate

Financial Policies

- ▶ Capital Subsidies & Grants
- ▶ Energy Production Payment/FIT
- ▶ Production Tax Credits

POLICIY DOMAINS

State/Province level

- ▶ Feed-in Tariffs (FITs)
- ▶ Renewable Heat Incentive (RHI)
- ▶ Zero Energy Homes

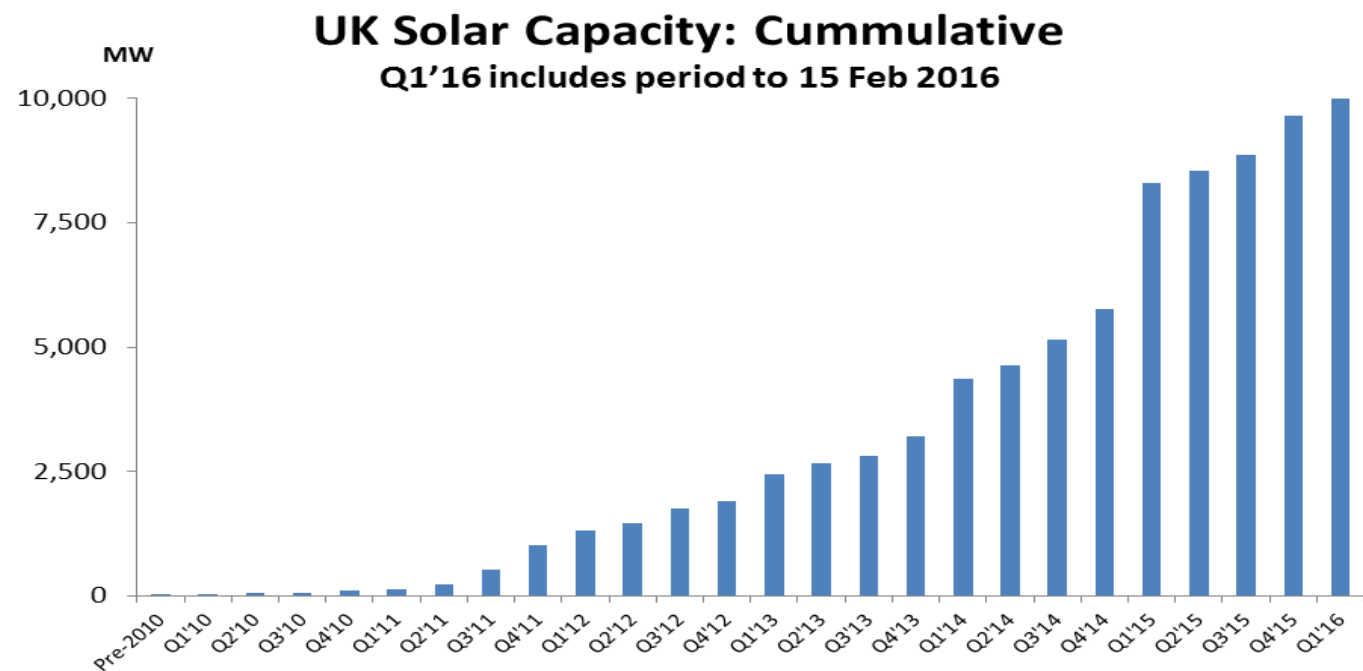
National level

- ▶ Feed-in Tariffs (FITs)
- ▶ Renewable Obligation Certificates (ROCs)

International/Regional level

- ▶ EU 20-20-20

INFLUENCE OF FIT ON PV GROWTH IN UK



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Sources: Solar Intelligence research, 15 Feb 2016

CONCLUDING REMARKS

- ▶ In recent years renewable energy has far outpaced other energy resources in terms of installed capacity
- ▶ Key drivers of RE growth include conducive policies, technical advancements and economy of scale
- ▶ Conducive policies are instrumental to technical advancements and economy of scale
- ▶ Energy policies have greatly evolved under regulatory and financial frameworks
- ▶ In terms of operational domain energy policies exist at state/province, national and international/regional levels

Thanks for your attention