

Clean Energy Transformations 2018 & Beyond

CEBC 6th MENA Clean Energy Summit
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Dr. Nasser Saidi
Chair of CEBC

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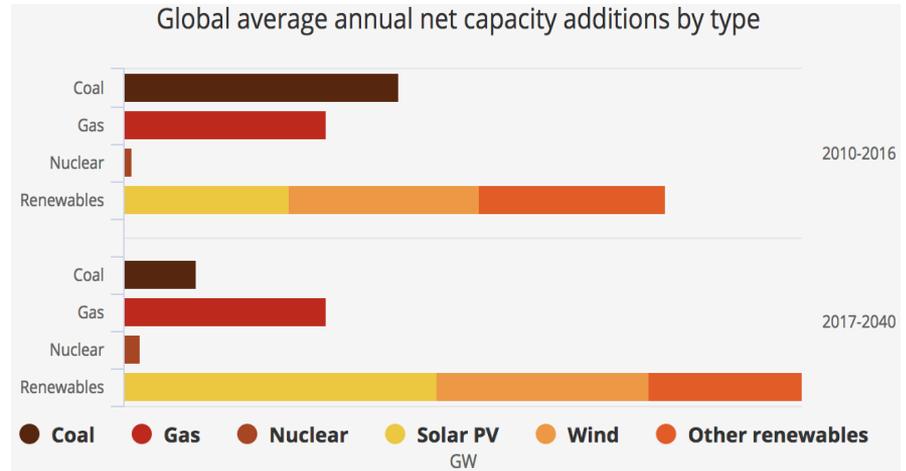
الشرق الأوسط وشمال أفريقيا

Clean Energy Transformations 2018

- Global & Regional Energy Landscape under Transformation
- Landscape will be further disrupted & transformed
- Takeaways for MENA/GCC transformations
- CEBC: Main activities during 2016-17 & plans for 2018

Global Energy Landscape under Transformation

- Renewable energy capacity has grown at record-high levels
- Solar & Wind surged vis-à-vis other energy sources; but, fossil fuels still dwarf renewables
- RE costs are rapidly declining
- Private sources providing the bulk of renewable energy investment
- Conventional debt & equity still most prominent financing instruments
- Investment levels are highly responsive to policy changes
- Gov't efforts to curb climate change + tech advances + falling costs => **renewables are more competitive** => unsubsidised CE world records in 2017
- China assuming leadership on RE and Climate Change



Global New Investment in Clean Energy, by Sector

bn

Solar moves from third biggest sector in 2006, behind wind and biofuels, to the biggest sector in most quarters by 2011

2004-17 \$bn



Version WF18.01
All values nominal

■ Solar ■ Wind ■ Energy smart technologies ■ Bioenergy ■ Other

Source: Bloomberg New Energy Finance

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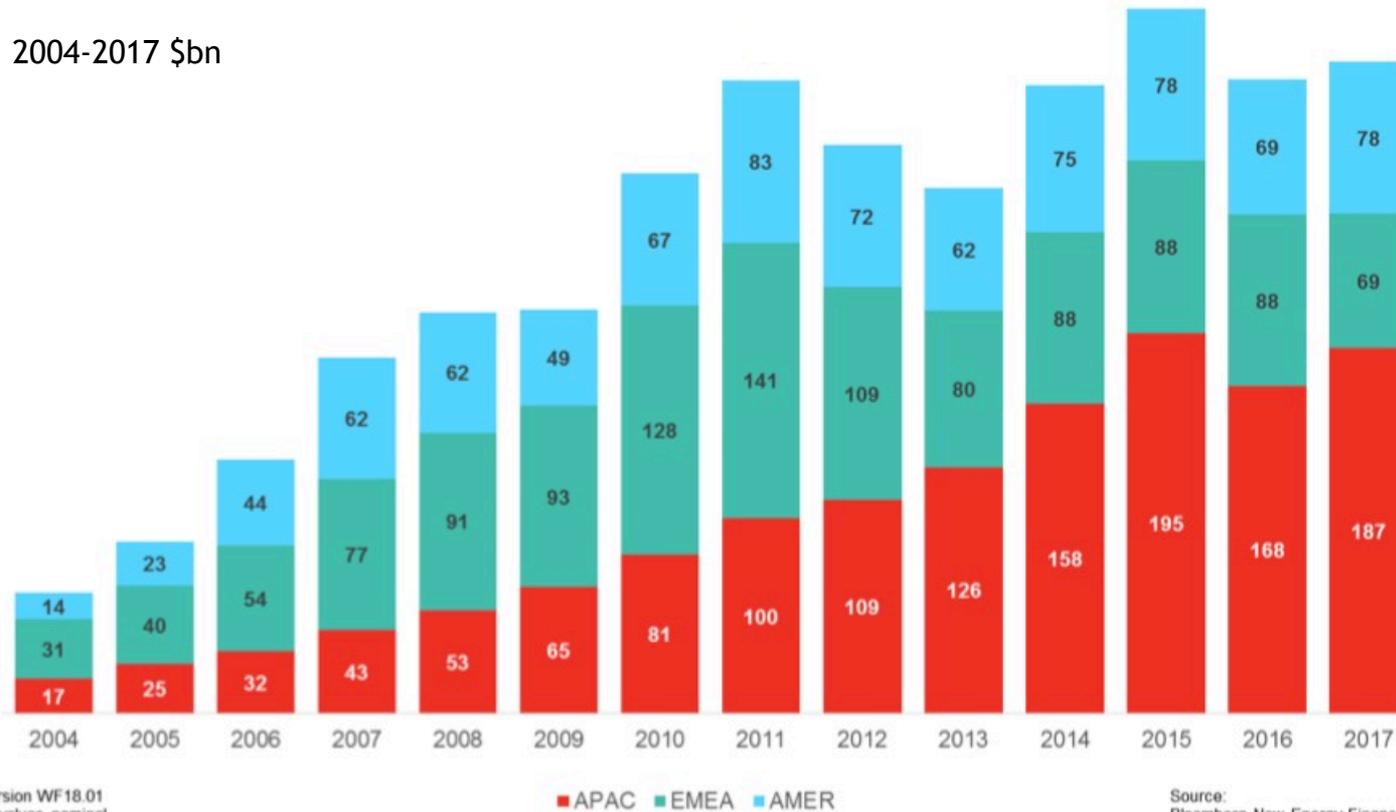


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Clean Energy Investments rise in 2017

Balance has shifted from Europe as largest-investing region to Asia as #1 region

2004-2017 \$bn



Version WF18.01
All values nominal

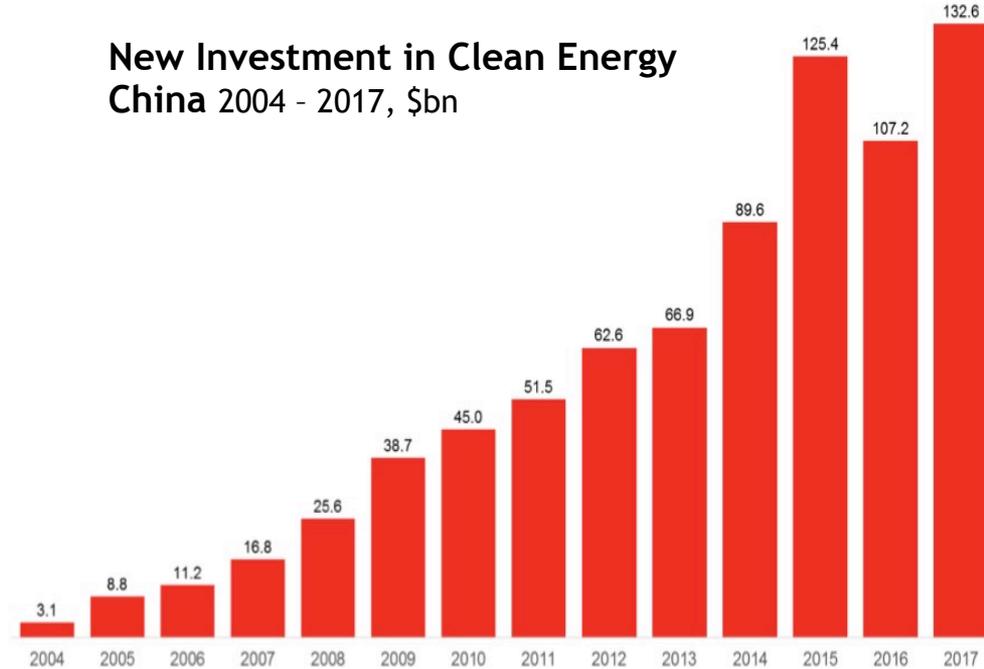
Source:
Bloomberg New Energy Finance

China set new record for CE Investment in 2017; UAE among those nations investing \$1bn+ in CE

Investments of \$1bn+ in CE (2017)

- India \$11bn, -20% yoy
- Brazil \$6.2bn, +10%
- France \$5bn, +15%
- Sweden \$4bn, +109%
- Netherlands \$3.5bn, +30%
- Canada \$3.3bn, +45%
- South Korea \$2.9bn, +14%
- **Egypt \$2.6bn, +495%**
- Italy \$2.5bn, +15%
- Turkey \$2.3bn, -8%
- **UAE \$2.2bn, +23X**
- Norway \$2bn, -12%
- Argentina \$1.8bn, +7%
- Switzerland \$1.7bn, -
- Chile \$1.5bn, +55%
- Austria \$1.2bn, +4%
- Spain \$1.1bn, +36%
- Taiwan \$1bn, -6%
- Indonesia \$1bn, +71%

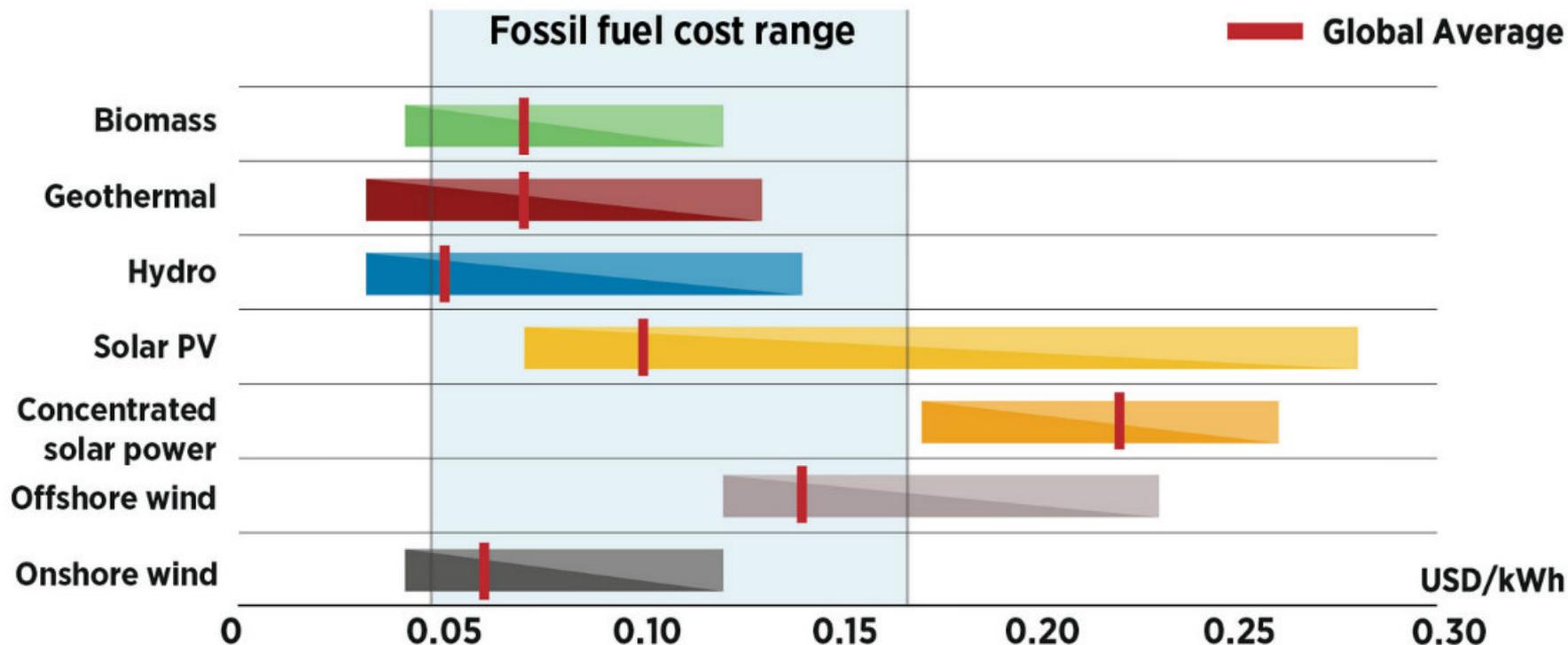
New Investment in Clean Energy China 2004 - 2017, \$bn



Version WF18.01
All values nominal

Source:
Bloomberg New Energy Finance

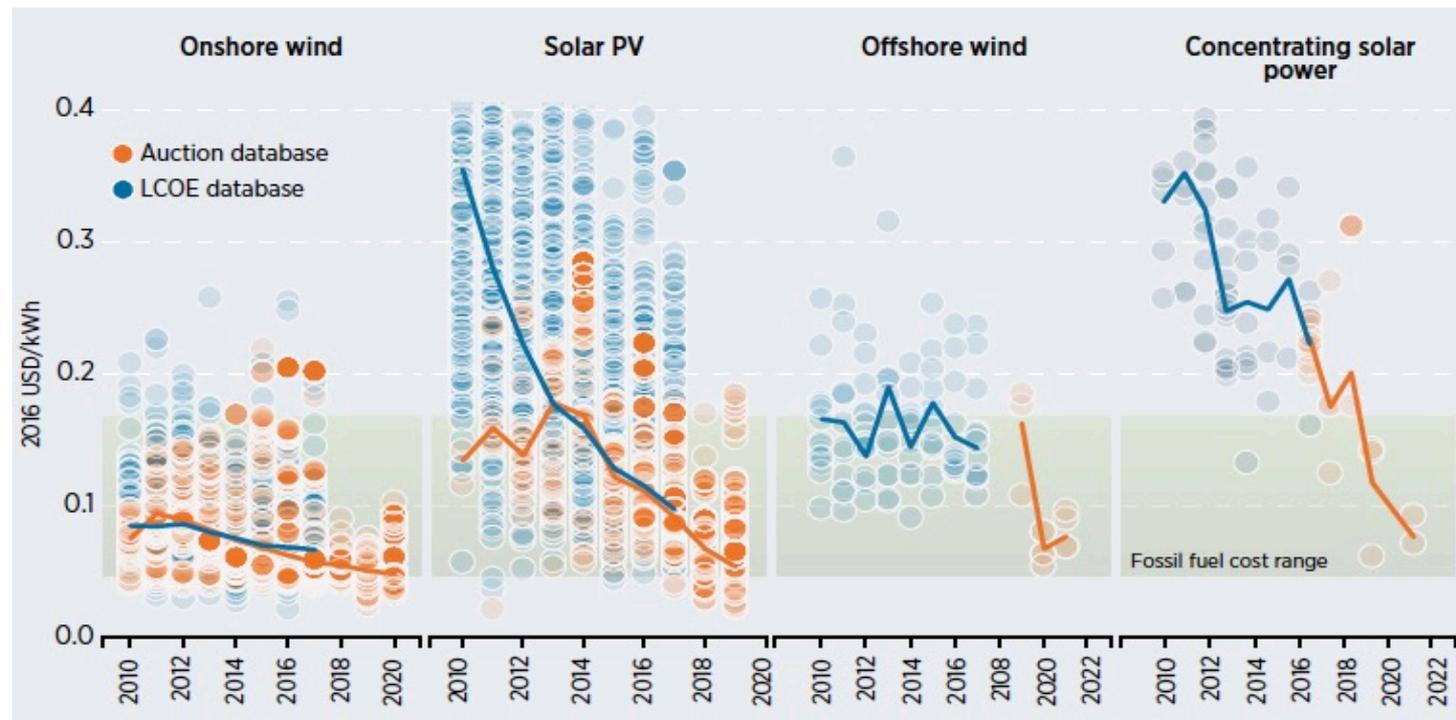
Average Renewable Power Generation Costs in the Fossil Fuel range in 2017



Source: 'Renewable Power Generation Costs in 2017', IRENA, Jan 2018

Renewable energy will cost less than fossil fuel generated electricity by 2020

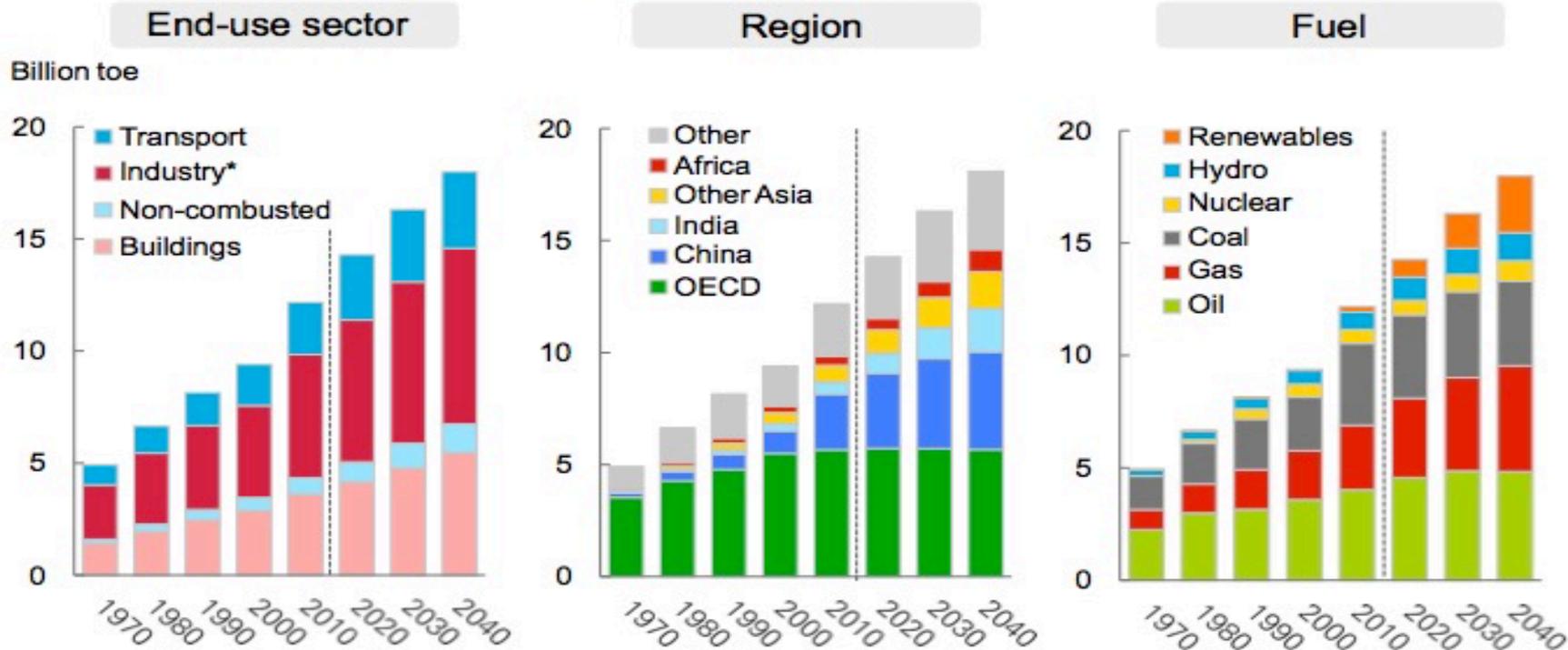
Global levelised cost of electricity and auction price trends for solar PV, CSP, onshore and offshore wind from project and auction data, 2010-2022



Source: Renewable Power Generation Costs in 2017, IRENA, Jan 2018

Emerging Energy Transition Going Forward...

Primary energy demand



*Industry excludes non-combusted use of fuels

Source: 2018 BP Energy Outlook

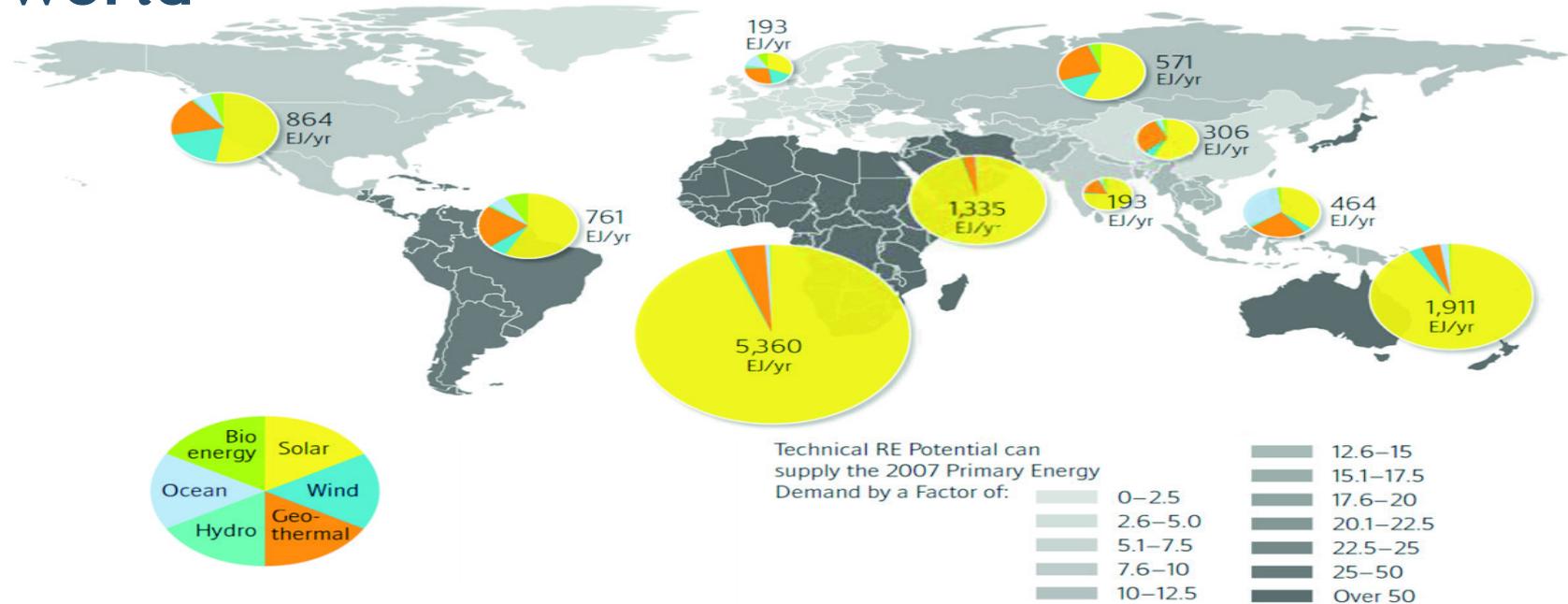
GCC have RE targets but need to ramp up

Country	Renewable energy (strategy/action plan/program)	Renewable energy targets						
		Primary energy from renewable resources	Final energy from renewable resources	Electricity generation from Renewable Resources	Technology-specific share of electricity generation	Renewable power installed capacity and/or generation	Heating and cooling from renewable resources	Transportation energy from renewable resources
Bahrain				5% by 2030				
Kuwait				15% by 2030		Solar PV: 4.6 GW by 2030; CSP: 5.7 GW by 2030; Wind power: 700 GW by 2030		
Oman								
Qatar				2% by 2020; 20% by 2030		Solar PV: 1.8 GW by 2014		10% by 2020
Saudi Arabia	Saudi Arabia Vision 2030		4% by 2020			Unspecified Renewable Energy: 9.5 GW by 2023		
UAE	UAE Energy Strategy 2050 Dubai: Dubai Integrated Energy Strategy 2030		24% by 2021	No national target; Abu Dhabi—7% by 2020; Dubai—7% by 2020, 25% by 2030 and 75% by 2050		44% of power generation capacity from clean energy by 2050		

RE in the limelight in MENA/GCC as well

- **Egypt:**
 - Benban solar park: aims to reach b/n 1.6-2.0GW of solar power by mid-2019
 - Launched a first-of-its-kind renewable energy curriculum at technical schools (Feb)
- **Dubai:**
 - Region's first hydroelectric pumped storage plant to be built in Hatta total capacity 250MW
 - Dubai announced launch of AED 2.5bn waste to energy plant
 - First solar-driven hydrogen electrolysis facility to be established in Dubai
- **Saudi Arabia:**
 - Set up the Renewable Energy Project Development Office in 2017
 - ACWA Power to develop first utility scale solar power plant + new solar record
- **Oman:** target of 10% contribution from RE projects in total power mix within 10 yrs
 - Large-scale Wind Assessment Tender
 - Launch of RFQ for potential 500MW solar project: completion targeted for 2021
- **Turkey** looking to launch 1GW solar tender this year
- **Jordan** to launch 30MW energy storage project
- **Bahrain** to develop 100MW solar power plant

Technical RE potential in various parts of the world

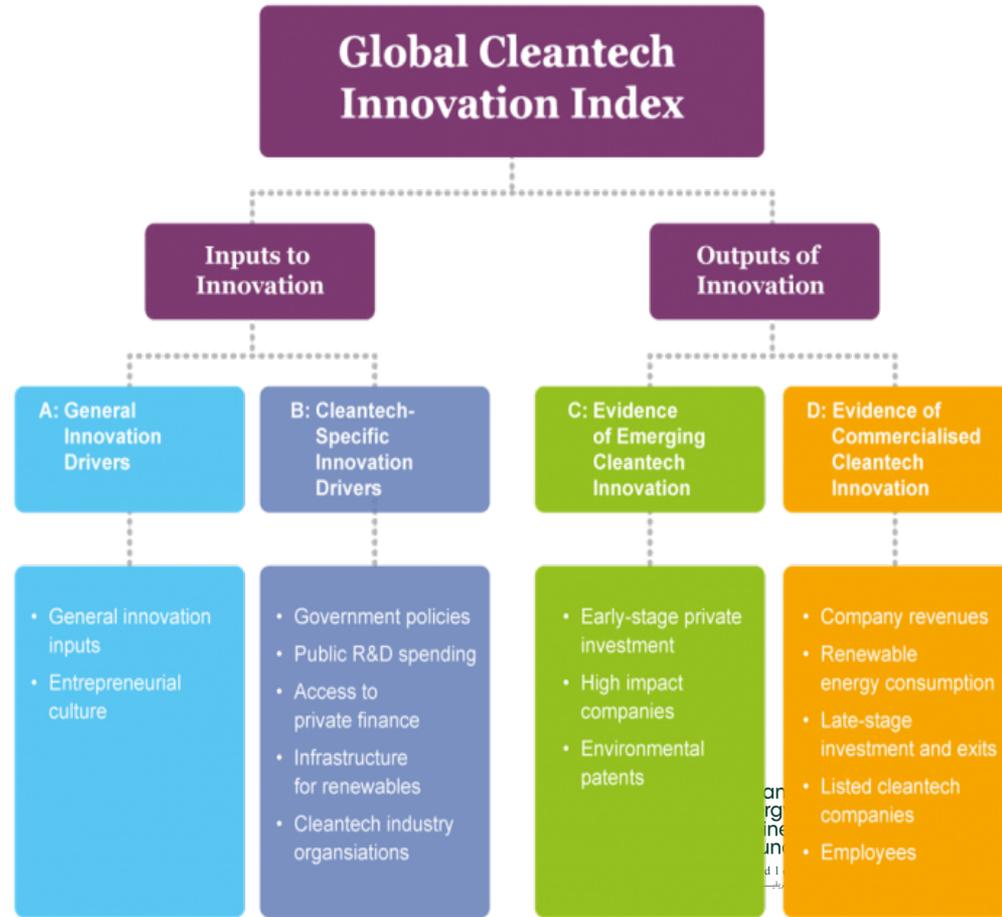


Extreme abundance of solar and wind resources in some regions is likely to spur international trade in renewables-based, hydrogen-rich chemicals and fuels

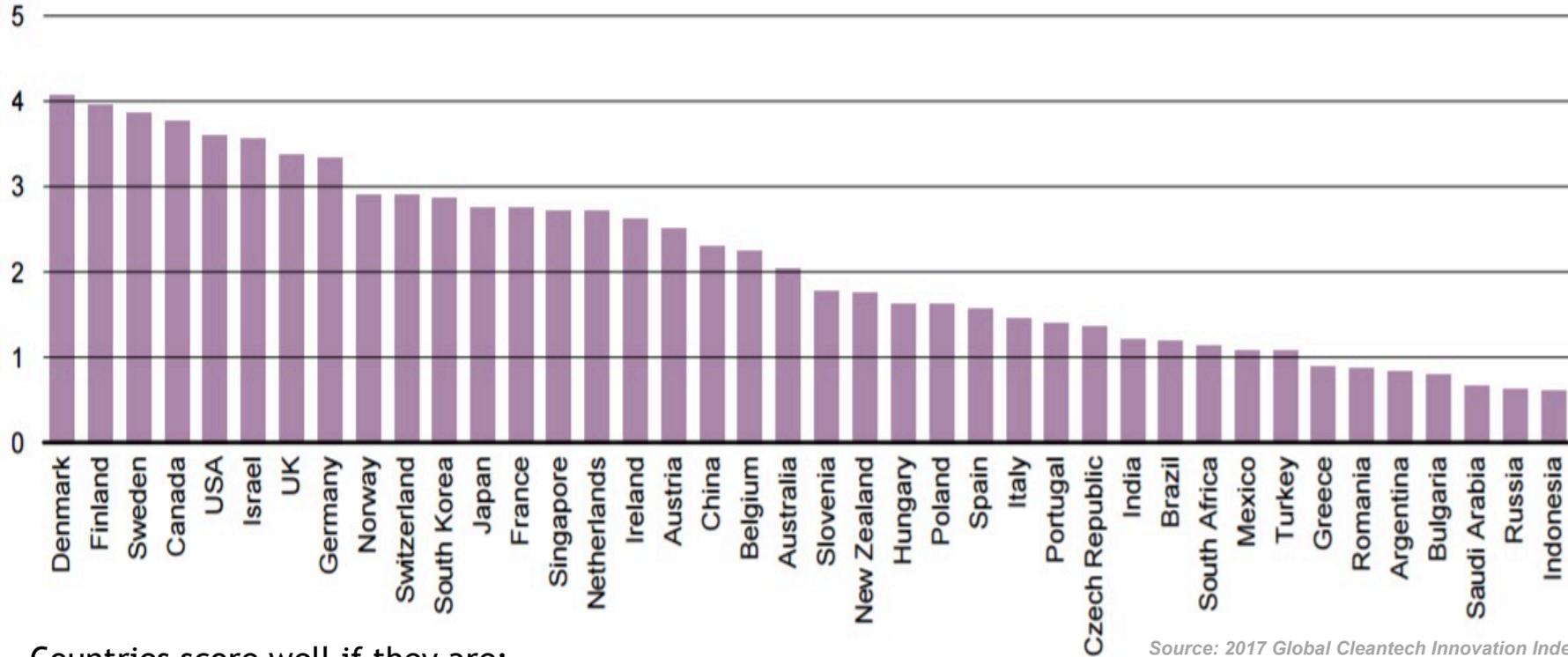
Source: OECD/IEA https://www.iea.org/publications/insights/insightpublications/Renewable_Energy_for_Industry.pdf

Global Cleantech Innovation Index

- Index explores where entrepreneurial CT co's are most likely to emerge over the next 10 years - and why
- The *inputs to innovation* correspond to the creation of innovation and *outputs* relate to the country's ability to commercialise innovation



2017 Global Cleantech Innovation Index country scores

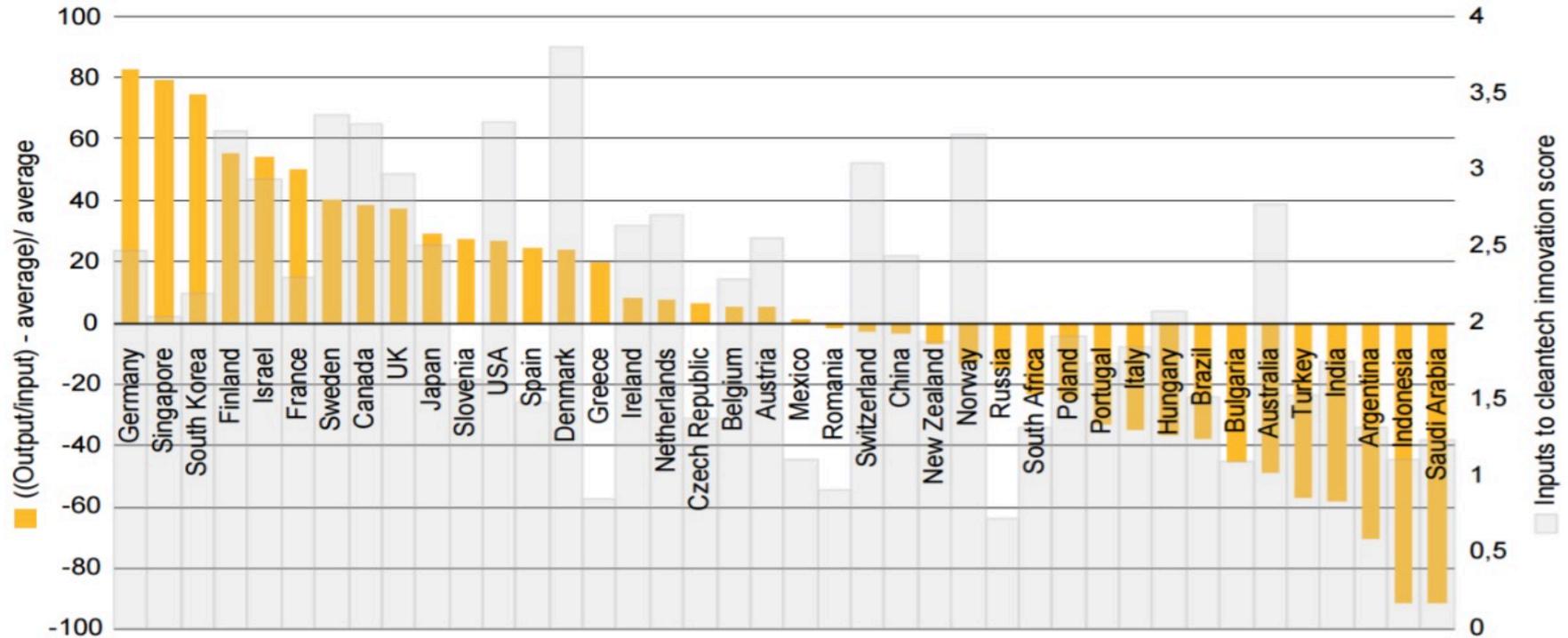


Source: 2017 Global Cleantech Innovation Index

Countries score well if they are:

- Addressing growing demand for RE and other CT;
- Connecting start-ups with multiple channels to increase their success rates; and
- Increasing international engagement across the CT ecosystem.

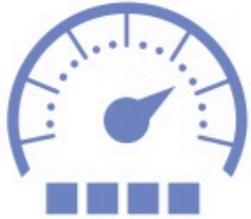
Cleantech innovation conversion rates: commercialisation efficiency varies



Source: 2017 Global Cleantech Innovation Index

Germany, Singapore, and South Korea, show relative strength in evidence of commercialised cleantech innovation without having leading inputs to innovation scores, highlighting a **strong efficiency in converting inputs**

Witnessing initial birth pangs of two revolutions: AI-Blockchain and Renewable Energy



INDUSTRY FLOWS

- Settlements
- Change of supplier
- Real-time capacity matching



ASSET MANAGEMENT

- Autonomous network configuration
- Self-serve maintenance
- Asset and inventory tracking
- Cross asset/industry data sharing



IDENTITY MANAGEMENT

- Eligibility for social tariffs
- Safety authorizations and permit to work
- Fraud detection



SMART CONTRACTS

- Electric vehicle charging
- Peer-to-peer trading
- Demand side management

Centralised Utilities industries inc. water & power will be transformed

Source: How Utilities Are Using Blockchain To Modernize The Grid, Oliver Wyman, Harvard Business Review

Potential Disruptive Factors/ Technology

- **Abundance of RE resources will revolutionise international trade in renewables-based chemicals and fuels**
- **Innovations in battery capacity and energy storage**
- **Lower cost of renewables + lower cost, efficient storage => rapid change in energy mix & displacement of fossil fuel**
- **Electric vehicles & autonomous cars in “smart” cities & beyond**
- **AI and Blockchain technologies**
- **Waste-to-energy**
- **Innovative financing in Clean Energy and Cleantech**
- **Energy & Water digitization in the form of AI & Machine Learning**

Takeaways for MENA/GCC Transformations

- **‘New Oil Normal’ heightens risk that fossil fuel assets will become stranded**
- **Energy Efficiency low hanging fruit: remove subsidies, integrate networks**
- **Accelerate RE investments: use fossil fuel for export and new materials**
- **Focus on Cleantech investments, innovation and commercial conversion**
- **Massive ‘soft’ and ‘hard’ investments will be required by industry, prosumers, governments in RE and A1-Blockchain: need to develop well articulated strategies regarding AI-Blockchain-Energy**
- **Decarbonisation, ‘Green economy’ present enormous opportunities for economic diversification and technological innovation**
- **Develop tech alliances, R&D partnerships with EU, China & Cleantech innovators**

CEBC Activities 2017-2018

- Women in Clean Energy Event in partnership with the MENA New Energy Summit (April)
- Networking: Members Only Iftar (June)
- Webinar on How to Harness the Immense Electric Vehicle Opportunity (July)
- Webinar on The Solar Dispatchability Challenge: Identifying the Best Technologies to Secure Ready Dispatchability to Renewable Energy (August)
- Clean Energy Finance Workshop: Green Bonds and Sukuk and Crowdfunding for Renewable Energy Projects (September)

CEBC Activities 2017-2018

- Collaboration with government partners to deliver high calibre events focused on education and knowledge sharing: 3 day conference program CEBC organised on behalf of DEWA as part of WETEX/Dubai Solar Show (October)
- Webinar on How Digitization and customer centricism will boost energy industry profit through the whole supply chain (December)
- Webinar on Exploring the Impact of Blockchain in the Clean Energy Industry (January)
- Participation in the World Future Energy Summit in Abu Dhabi and IRENA International Congress (January 2018)

CEBC Activities 2017-2018

- ***Clean Transportation Working Group*** focusing on new energy vehicles
- ***Climate Finance Working Group*** which aims to lobby financial and governmental organisations in the MENA region to educate them on the market needs to encourage get them to take action to facilitate and create access to financing. The Working Group will focus on the preparation of white papers and policy recommendations and will be led by CEBC members
- ***Clean Energy Policy Working Group*** which aims to lobby governmental organisations to educate them on what works well in some countries and what could be developed in addition to existing policies. It will also focus on recommending changes for regulations that are not resulting in market growth.

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nsaidi@cleanenergybusinesscouncil.com

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<http://www.cleanenergybusinesscouncil.com>