



The demise of oil and the rise of cleantech

—

where are the opportunities in MENA energy?

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Catalyst MENA Clean Energy Fund (CMCF) invests in Renewables in the MENA region and investors primarily include European governments.

The MENA region is now on track to be a mega-market for solar PV, and is an under developed mega-market in the potential to apply renewable energy and energy efficiency more broadly including to the conventional desalination and energy sectors. Solar is a commercially viable source of Renewable Energy in the region and is growing at a very fast pace. In Jordan solar power costs more than 40% less than conventional power generation using fossil fuels.

Catalyst has over 12 years track record and experience in the MENA region, and is one of the first developers of a solar PV IPP's in the region, with a PPA signed in 2014.

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COUNTRY	PROJECT	SECTOR	CAPACITY	
Jordan	Falcon Ma'an	Solar PV	23 MW	<i>Operational</i>
Jordan	Confidential	Solar PV	14.5 MW	<i>Agreement signed</i>
Jordan	Confidential	Solar PV	34 MW	<i>In negotiation</i>
Jordan	Shamsuna	Solar PV	10 MW	<i>Operational</i>

81.5 MW

Falcon Ma'an

Falcon Ma'an Solar Power

Commissioned in October 2016



PROJECT DETAILS

Falcon
Ma'an
Solar PV,
Jordan

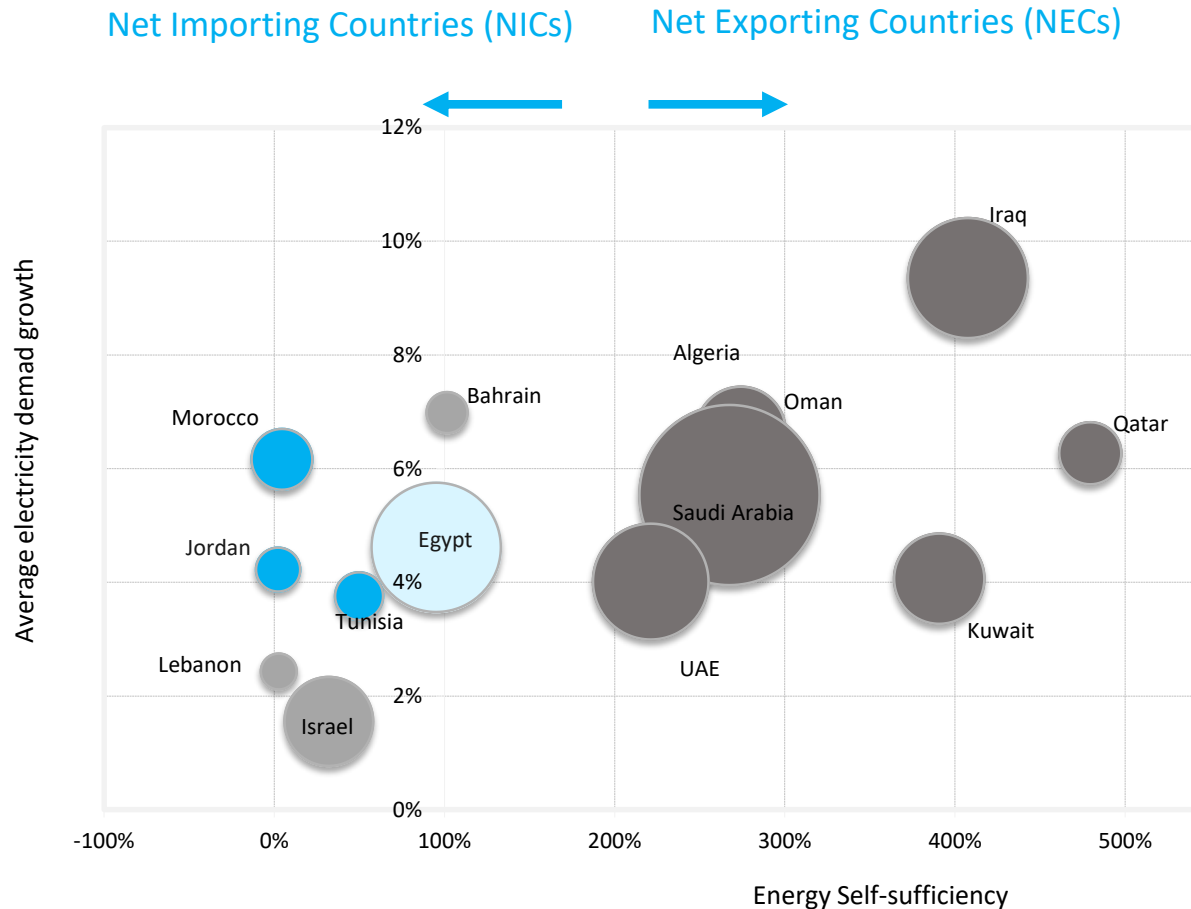
- ▶ 23MW, 1 plant
- ▶ PPA NEPCO in 2014
- ▶ Commercial operation since October 2016
- ▶ Lenders Include IFC, FMO, Arab Bank, OFID

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MENA regional energy snapshot

MENA COUNTRIES ENERGY SELF-SUFFICIENCY VS DEMAND GROWTH



Source: Bloomberg New Energy Finance, 2016 MENA Outlook (30 November 2016)

Note: size of bubble represents total installed power capacity in 2015

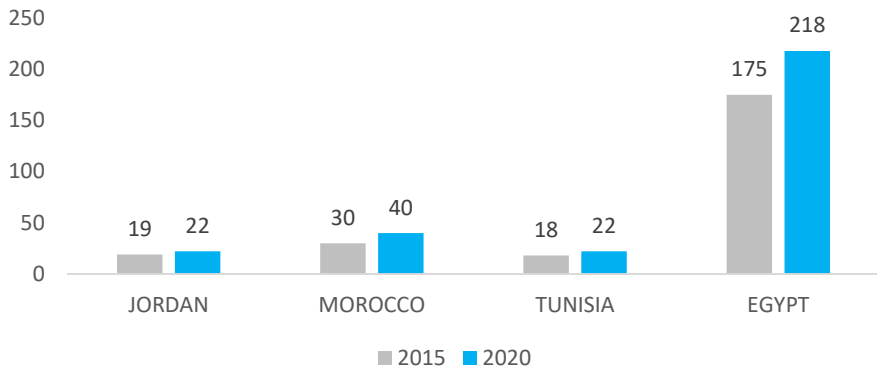
MENA REGION

- ▶ Annual electricity demand growth of 5-8% per annum
 - ▶ 23GW of power added in 2015 – but only 1.3GW was renewable energy
 - ▶ World class resources, falling costs and competitive auctions are driving down the costs of renewables
 - ▶ Yet solar PV still accounts for less than 1% of energy capacity
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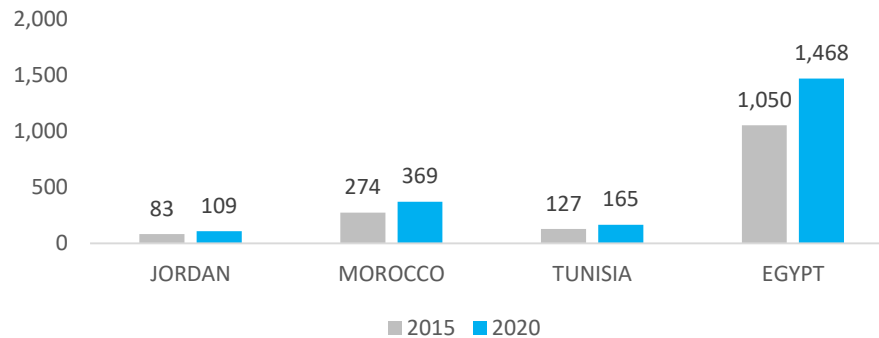
NET IMPORTING COUNTRIES (NICS)

- ▶ NICS are pushing renewable energy development to diversify highly import-dependent energy mix and address power deficit
 - ▶ Countries such as Jordan and Morocco have track record in attracting private developers, Egypt began recently.
 - ▶ Investors remain wary of political and currency risk
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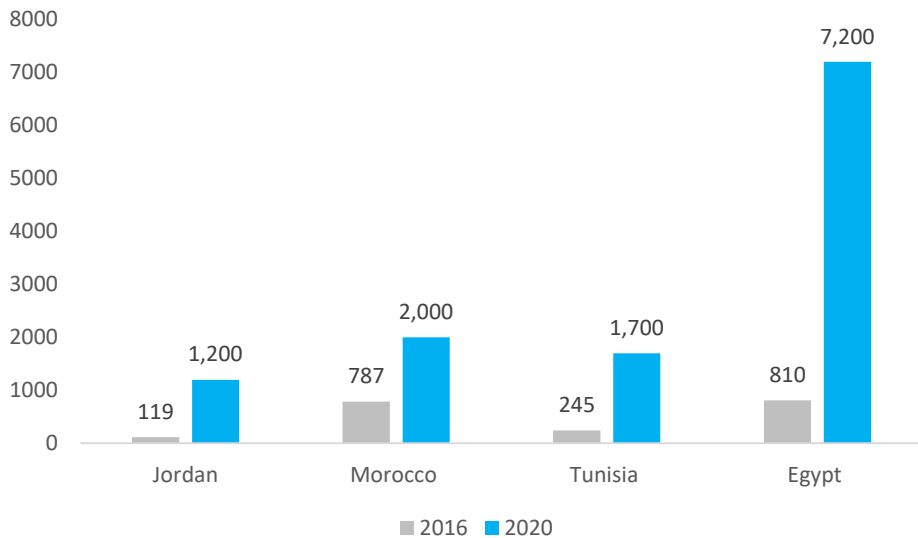
ELECTRICITY DEMAND, TWH



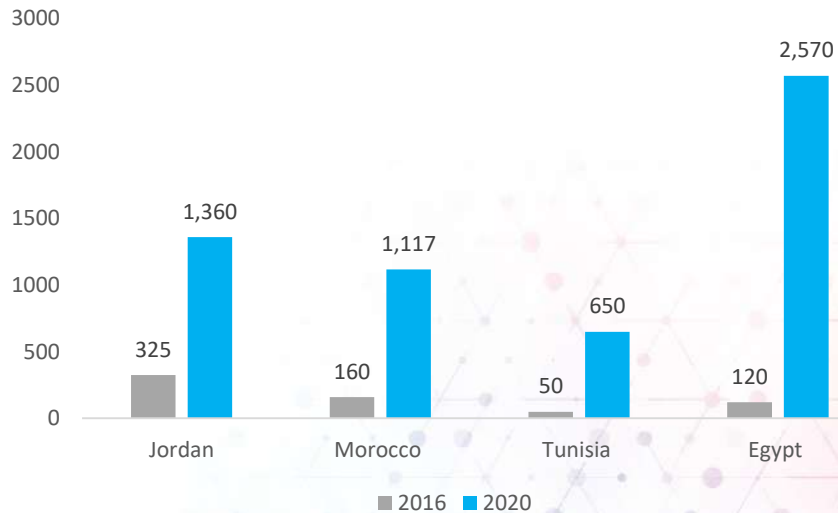
GDP (PPP), USD BILLION



WIND CAPACITY, MW



SOLAR CAPACITY, MW



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NET EXPORTING COUNTRIES (NECS)

- ▶ NECs are still focusing on using hydrocarbons, despite fiscal pressure caused by low oil prices
- ▶ However, the removal of subsidies reveals true cost of fossil fuels, facilitating competition with renewables on an economic basis
- ▶ UAE leading followed by KSA and Kuwait in RE programs

MENA regional energy market drivers

STRUCTURAL GROWTH

- ▶ MENA populations are growing 1.9% pa from 665 million in 2016 to 730 million in 2021
- ▶ GDP is set to grow 6.5% pa from USD 2,867 billion to USD 3,937 billion in the same period

ELECTRICITY DEMAND

- ▶ Deregulation / liberalization of energy markets
- ▶ Peak demand rising 9% pa with increasing penetration of ventilation and A/C systems
- ▶ Increasing demand for water and decreasing groundwater resources mean that electricity demand for desalination will triple to 122 TWh in 2030

RENEWABLE ENERGY

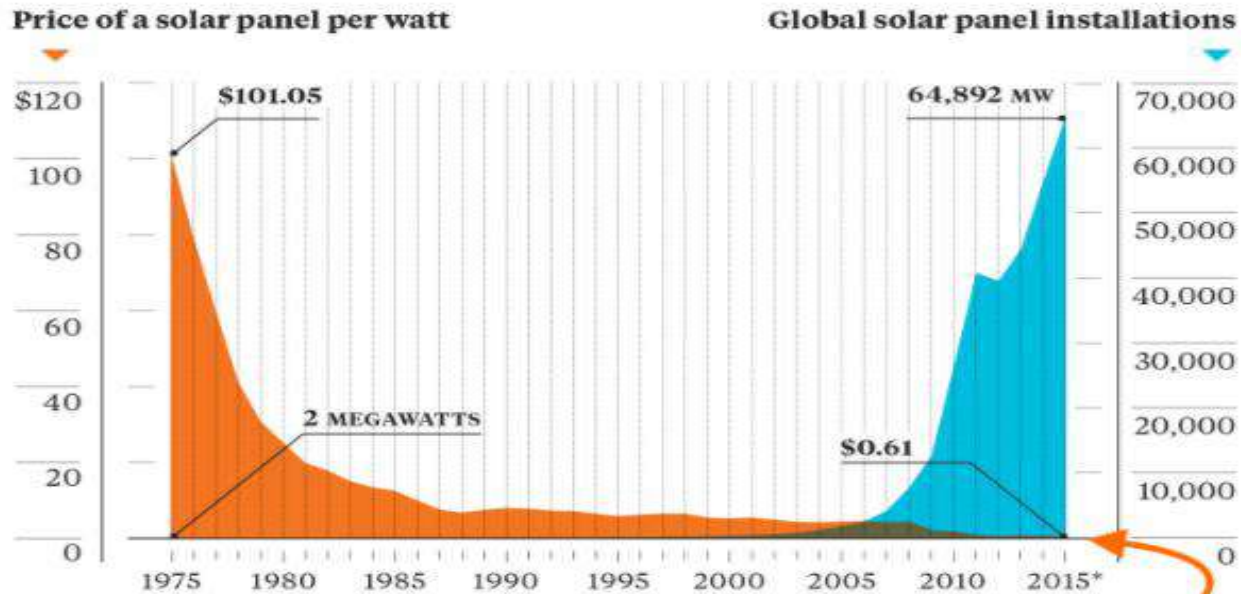
- ▶ Diversification of energy mix (away from imported fossil fuels) and removal of fossil fuel subsidies
- ▶ Cost competitiveness with oil and gas plants
- ▶ International agreements to reduce CO2 emissions

OPPORTUNITY FOR SOLAR PV

- ▶ MENA markets have highest levels of solar irradiation (average 2,199 kWh/m²)
- ▶ LNG importing countries can now generate baseload electricity more cheaply from PV than from CCGT
- ▶ Solar is the fastest technology to install and has lowest environmental impact

Solar Panel Pricing and Solar Market Growth, Storage is Next

As prices have dropped, installations have skyrocketed.



*Estimate. Sources: Bloomberg, Earth Policy Institute, www.earth-policy.org

Down to \$0.447 in August 2016

Storage Next: In 2014, the global market of grid connected batteries amounted to 360MW; a figure which is expected to achieve a CAGR of 50.2% by 2023 thus reaching a total volume of 14 GW.

Storage

Total electricity storage capacity appears set to triple in energy terms by 2030, if countries proceed to double the share of renewables in the world's energy system.

The cost reduction potential for new and emerging electricity storage technologies is significant. The total installed cost of a Li-ion battery could fall by an additional 54-61% by 2030 in stationary applications.

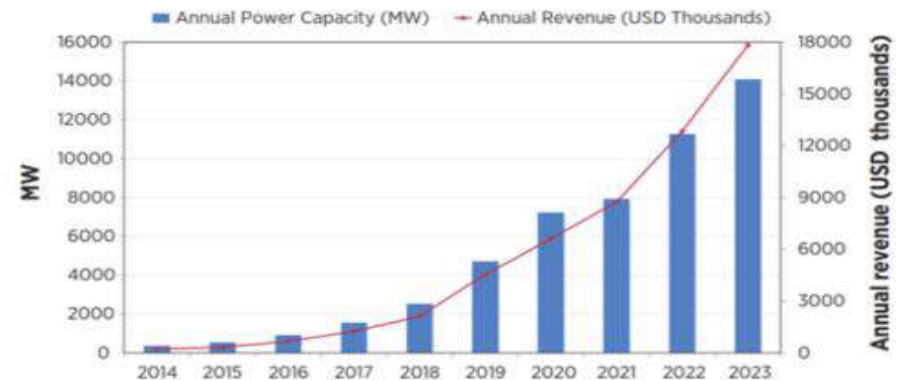
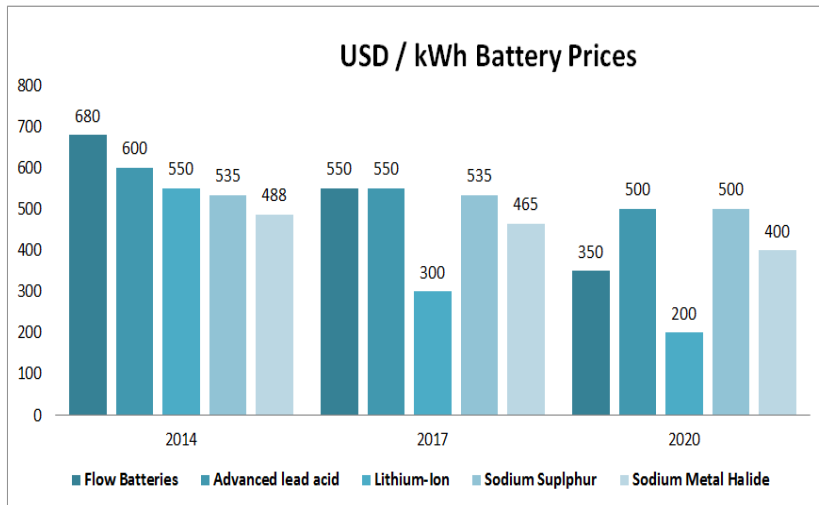
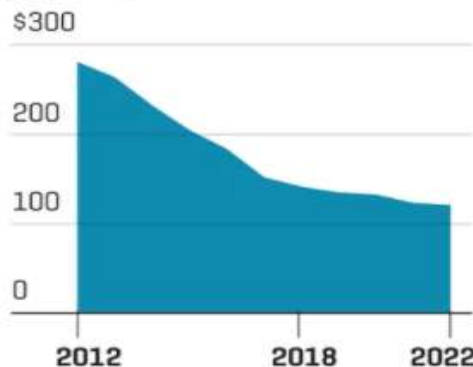


Fig. 2. Global market prospective for battery storage (source: IRENA, 2015¹⁰)

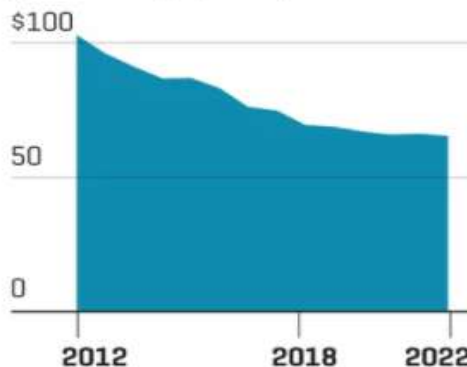
In terms of the services battery electricity storage systems could provide, the economics of behind-the-meter storage opportunities — notably when paired with new PV installations — could make this application the largest driver of battery storage growth. Behind-the-meter storage could become the primary-use case for 60-64% of total BES energy capacity in stationary applications in 2030.

The costs of alternative energy sources like solar and wind power, as well as of batteries such as those that power electric cars, have fallen dramatically, putting pressure on oil producers.

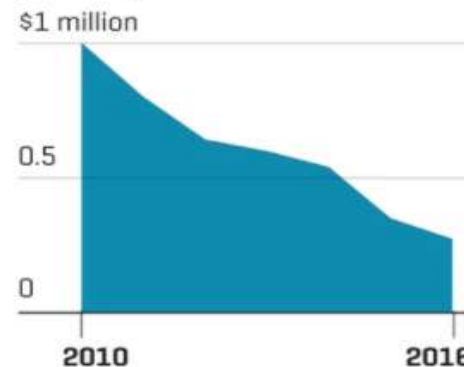
COST OF SOLAR PV ELECTRICITY (\$/Mwh)



COST OF WIND POWER (ONSHORE, \$/Mwh)



COST OF LITHIUM-ION BATTERY (\$/Mwh)



SOURCES: IEA (DATA FOR SOLAR AND WIND SHOWS LEVELIZED COST OF ELECTRICITY (LCOE) IN 2016 DOLLARS. DATA FOR SOLAR PV IS FOR COMMERCIAL SYSTEMS); BLOOMBERG

Challenges

Current price of storage systems stand at below US\$ 300 / Kwh for a lithium ion technology. At this current price range, installing a storage system is becoming feasible for on-grid applications and already feasible for certain off-grid systems.

On the bright side, this technology is very quickly developing in terms of both prices and cycle life times. As noted in the adjacent graph, the Lithium ion prices for example are expected to drop by 55% between 2014 – 2017 and further 66% by 2020 ultimately standing at US\$ 200 / Kwh in 2020 as opposed to US\$ 550 / Kwh in 2014

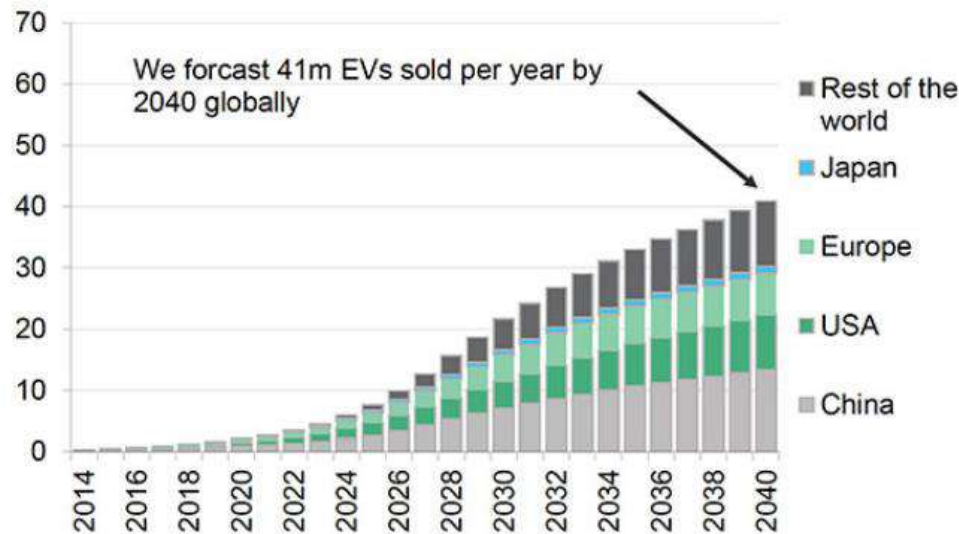
Based on Catalyst's engagement in an integrating storage system with a PV power plant, in one specific case it was noted that in order for storage systems to reach economic feasibility a study provided by DNV GL indicated that prices of the storage system should stand at US\$ 125 / Kwh or below. Catalyst estimates, that this figure is realistically more around anything below US\$ 200 /Kwh for higher value applications.

Power Market Growth versus Oil: Example Electric Vehicle outlook and impact

Regulatory pressures on internal combustion engines (ICEs), combined with technological improvements in electric powertrains and batteries, are driving a surge of demand for electric vehicles (EVs). Most incumbent car manufacturers are rolling out models, joined by new entrants without ICE legacies. Worldwide sales of pure battery EVs (excluding hybrids) grew by approximately 45 percent in 2016.

source:<https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/trends-in-electric-vehicle-design>

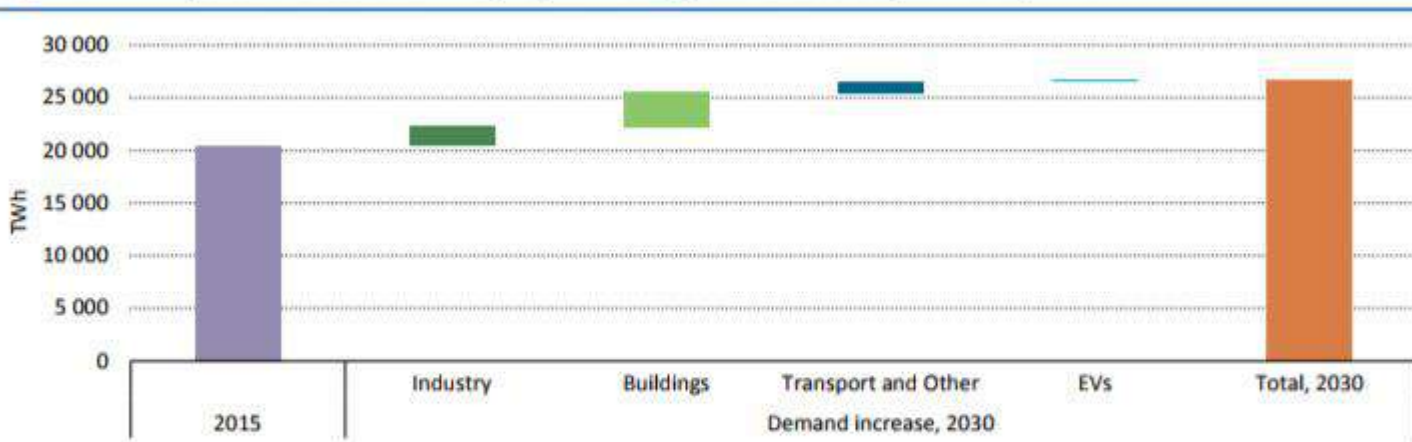
Figure 11: BNEF global EV sales forecast by geography, 2015–2040 (m vehicles per year)



Source: Bloomberg New Energy Finance, Marklines

When new loads are incorporated into the grid, this translates into guaranteeing both sufficient energy and capacity are available on demand. IEA analysis shows the additional energy demand from EV loads is sizeable but largely manageable (IEA, 2017b). In the IEA 2DS, the additional generation required to meet the EV and PHEV demand amounts to **1.5% of the total electricity demand by 2030** – which would represent only 6% of the increase in demand due to new loads from electrification in industry and the residential and commercial sectors. (Global EV outlook 2017)

Figure 17 • Impact of electric car deployment on global electricity demand, 2DS



Source: IEA (2017b).

Key point: The additional energy demand from electric car loads is sizeable but largely manageable in comparison with total energy use and additional loads arising from the industry, other transport and buildings sectors

Thank You

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