
Morgan Lewis
REACHING NET ZERO
TOGETHER:
ENERGY TRANSITION CHALLENGES AND OPPORTUNITIES
Energy Storage Solutions
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Agenda

- Energy Storage and Its Role in Curbing Climate Change
- Biden Administration Plans and US Tax Policies to Encourage Energy Storage
- Global Energy Storage Trajectory
  - Middle East
  - Europe
- Questions


Energy Storage and
Its Role in Curbing
Climate Change
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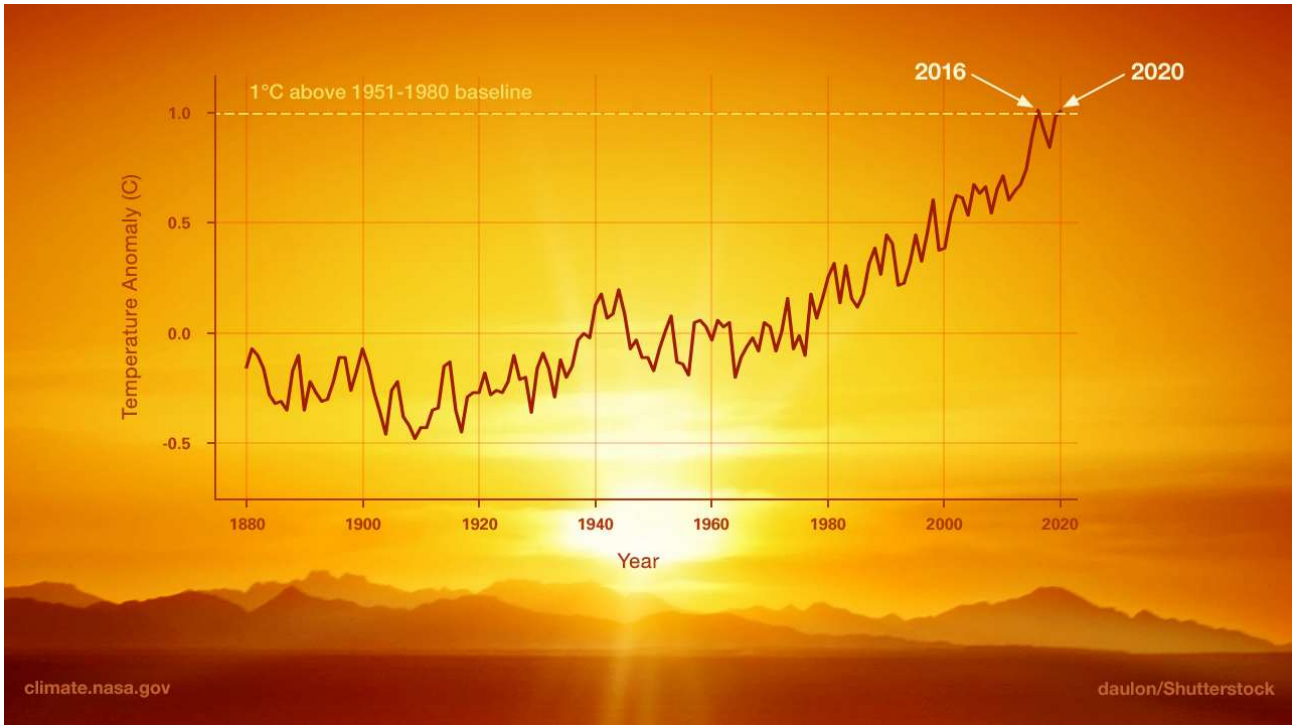
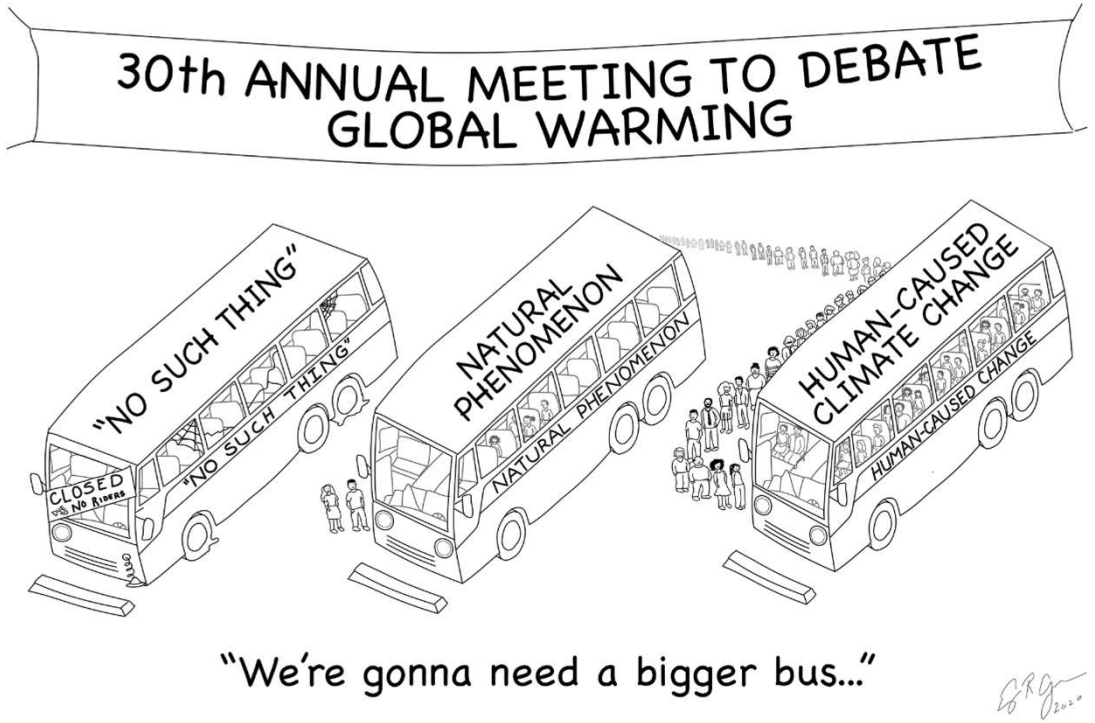
What is Climate Change and Global Warming?

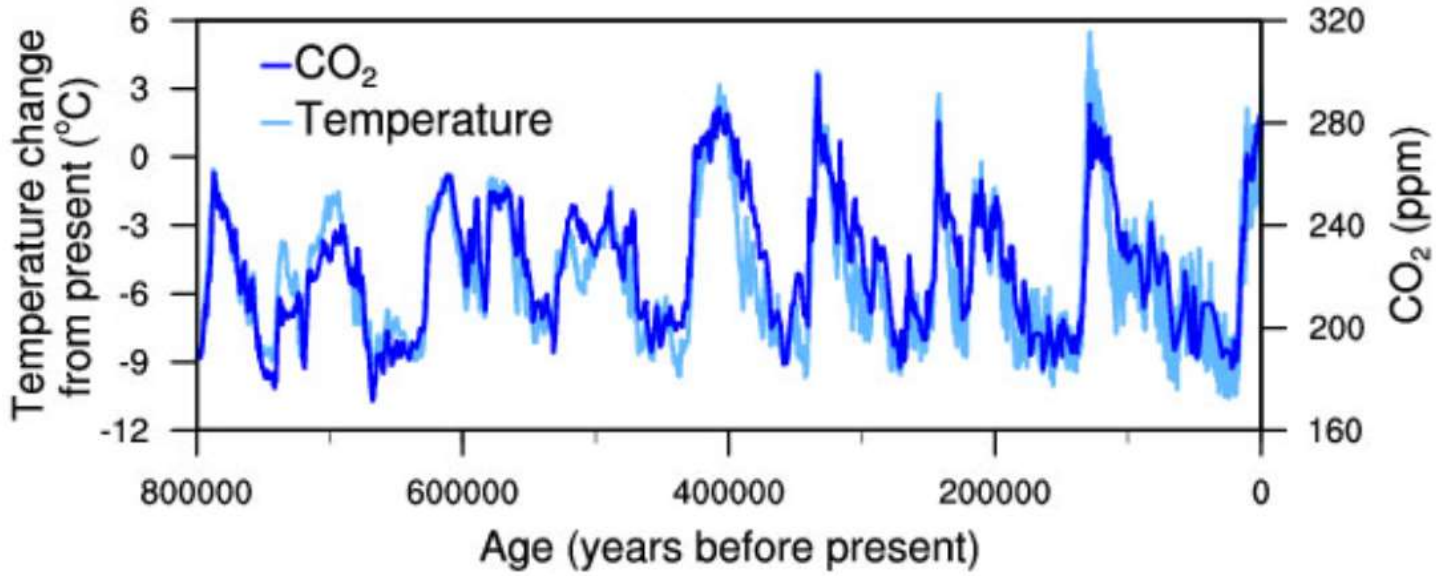


What is the Cause of Climate Change?



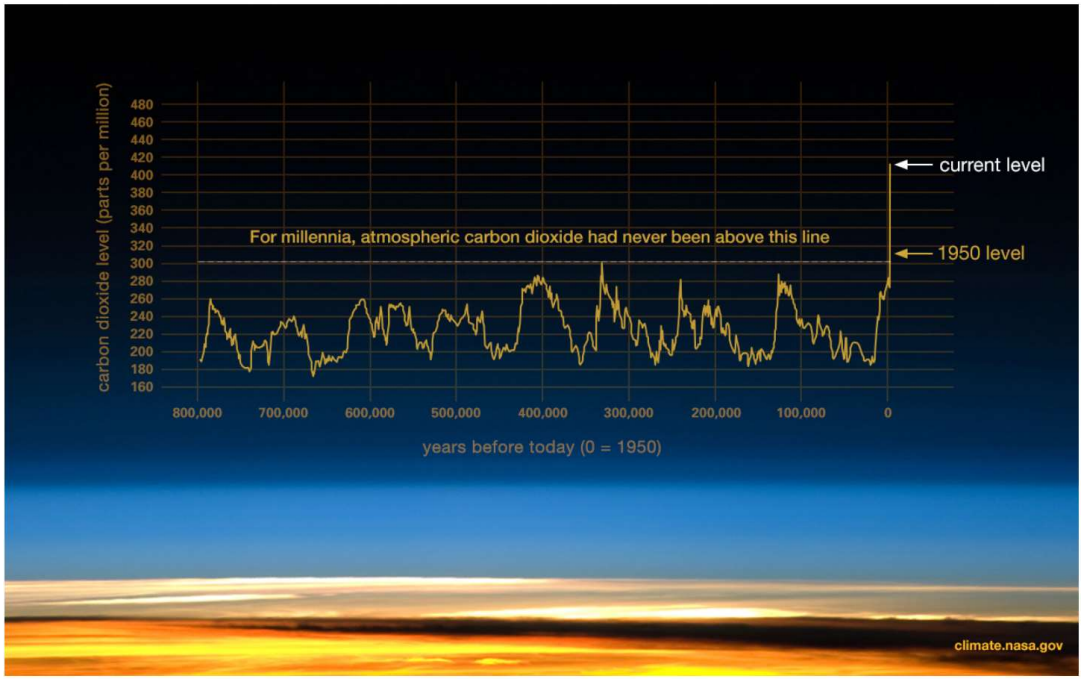
NOAA Climate.gov cartoon by Emily Greenhalgh.

Relationship of CO_2 and Global Climate



Temperature change (light blue) and carbon dioxide change (dark blue) measured from the EPICA Dome C ice core in Antarctica (Jouzel et al. 2007; Lüthi et al. 2008).

Mankind Is Driving Climate Change

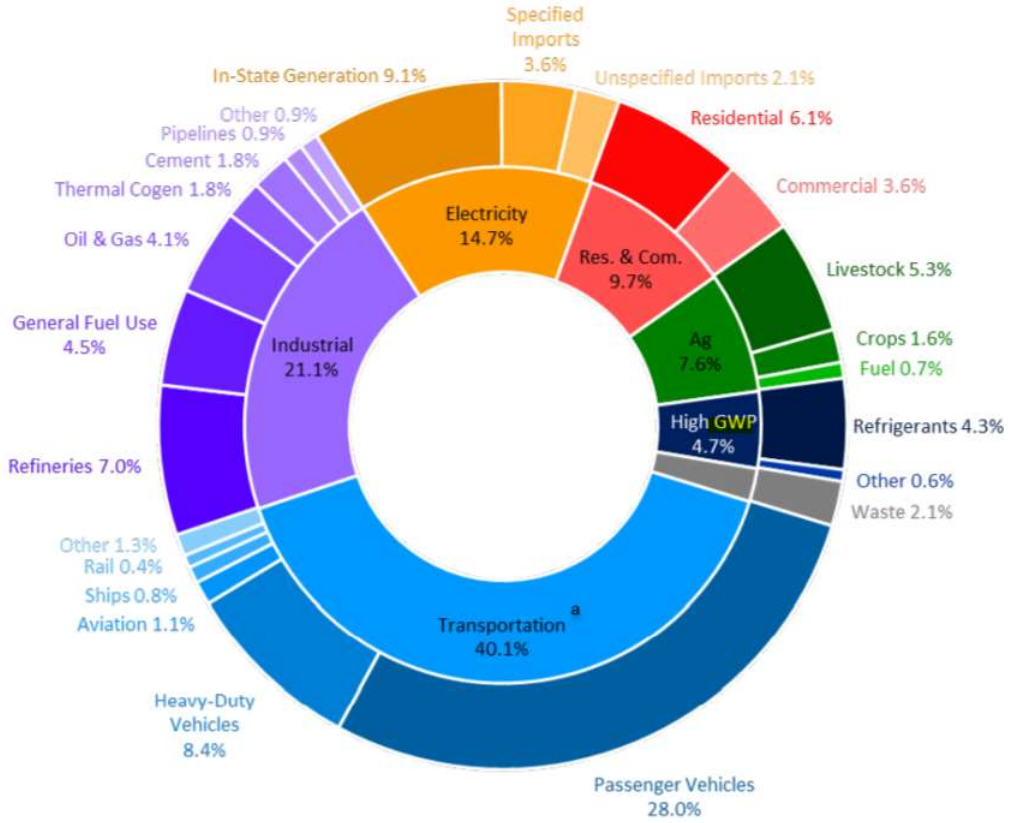


This graph, based on the comparison of atmospheric samples contained in ice cores and more recent direct measurements, provides evidence that atmospheric CO_2 has increased since the Industrial Revolution. (Credit: Luthi, D., et al.. 2008; Etheridge, D.M., et al. 2010; Vostok ice core data/J.R. Petit et al.; NOAA Mauna Loa CO_2 record.) Find out more about ice cores (external site).

Energy Storage and Climate Change

- How can Energy Storage help mitigate the cause of climate change?
- How can Energy Storage mitigate the impacts of climate change?

Emissions by Sector



a The transportation sector represents tailpipe emissions from on-road vehicles and direct emissions from other offroad mobile sources. It does not include emissions from petroleum refineries and oil production.

Source: California Air Resources Board California Greenhouse Gas Emissions for 2000 to 2017, https://ww3.arb.ca.gov/cc/inventory/pubs/reports/2000_2016/ghg_inventory_trends_00-16.pdf

Energy Storage – Transportation Sector

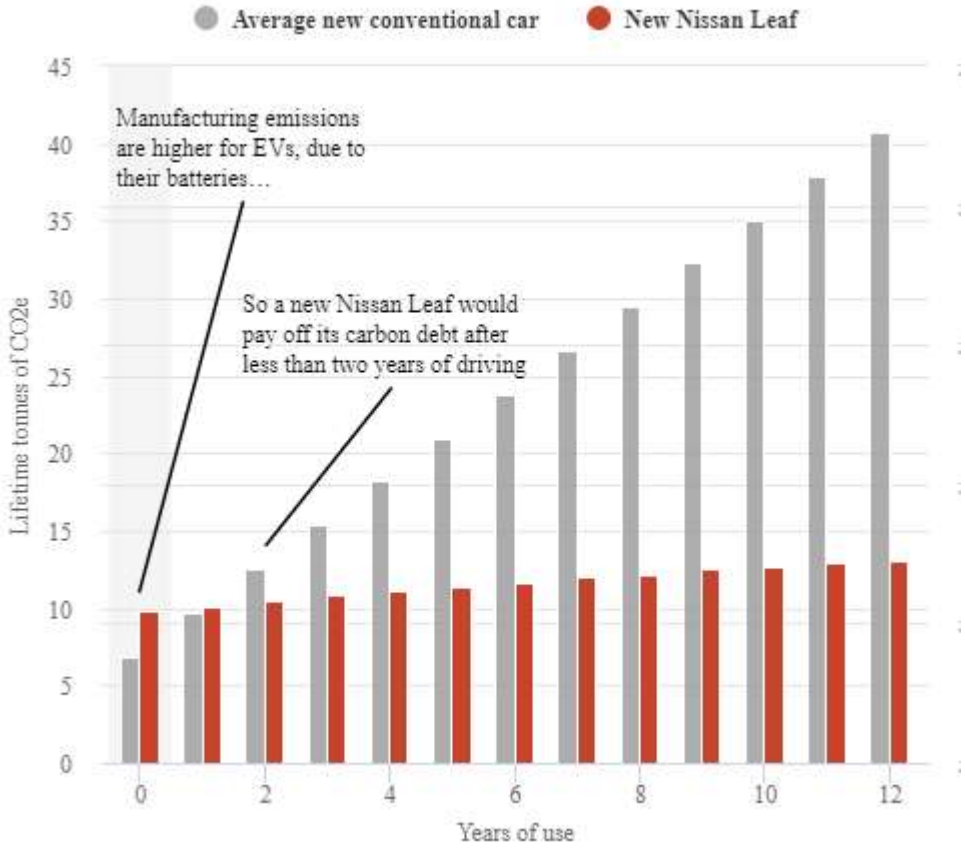
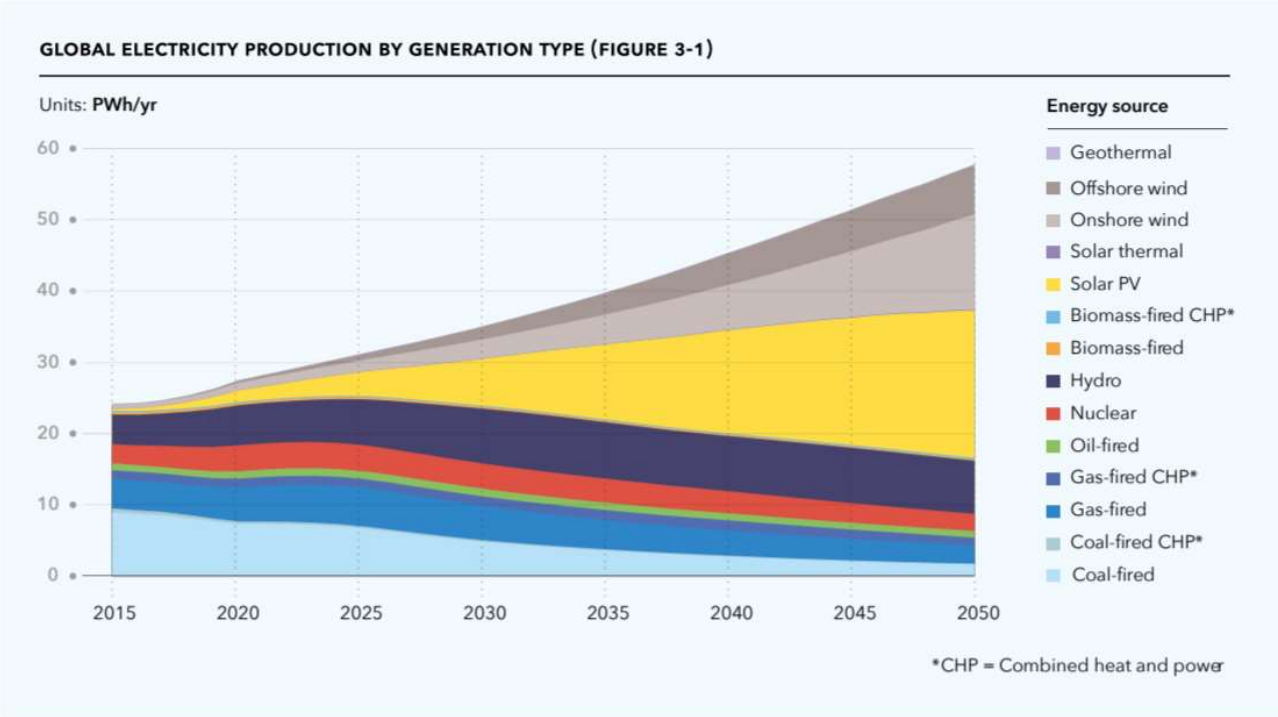


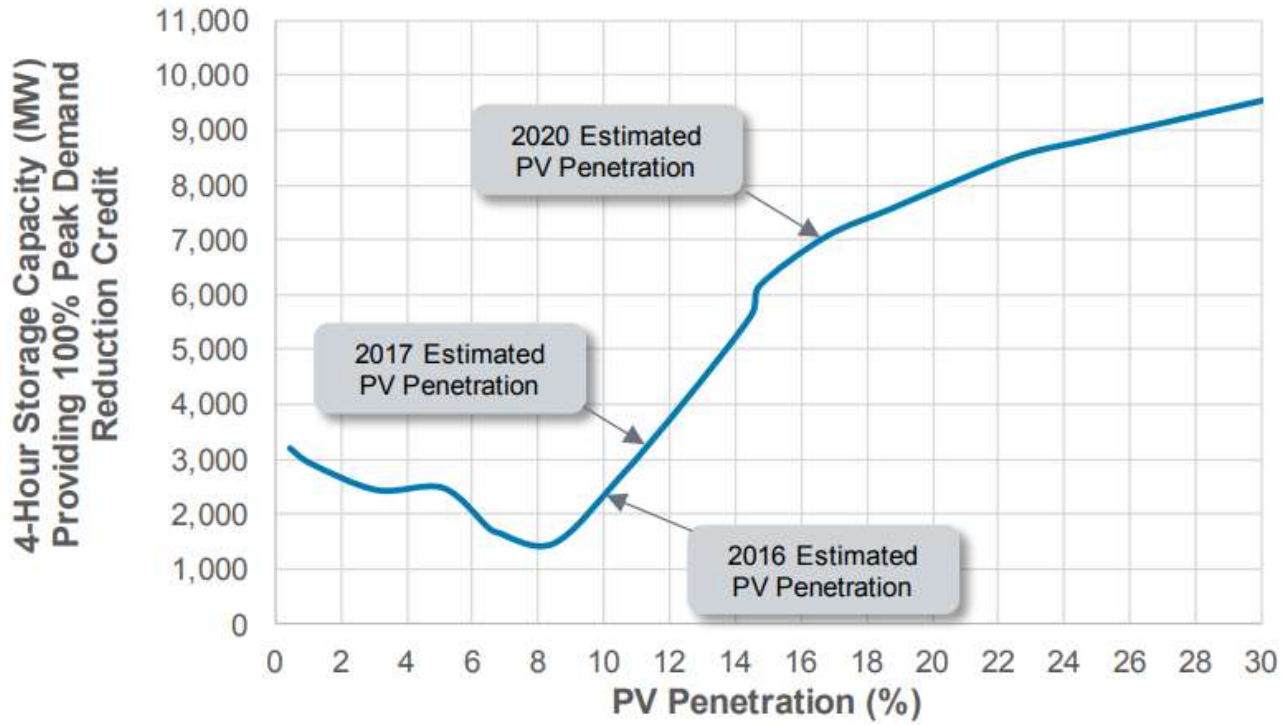
Chart by Carbon Brief

Growth of Renewable Energy Generation



Source: DNV-GL - RENEWABLES, POWER AND ENERGY USE FORECAST TO 2050.
https://www.ourenergypolicy.org/wp-content/uploads/2017/09/DNV-GL_-Energy-Transition-Outlook-2017_renewables_lowres-single_0109.pdf

"The wind energy and solar energy industries are writing checks that energy storage is going to cash."



Effects of Climate Change

The potential future effects of global climate change include more frequent wildfires, longer periods of drought in some regions and an increase in the number, duration and intensity of tropical storms. Credit: Left - Mellimage/Shutterstock.com, center - Montree Hanlue/Shutterstock.com.

Energy Storage – Mitigating Climate Change Impacts

- **Grid Resiliency the ability to prepare for and adapt to changing conditions and withstand and recover rapidly from disruptions**

Decoupling GHG & Economic Growth – California

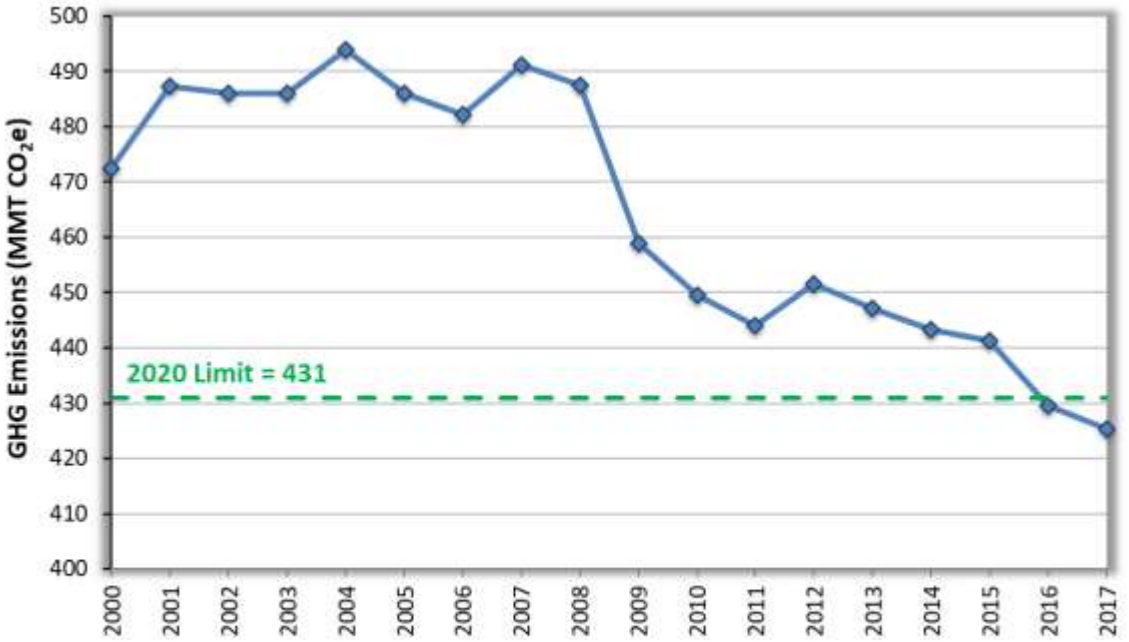
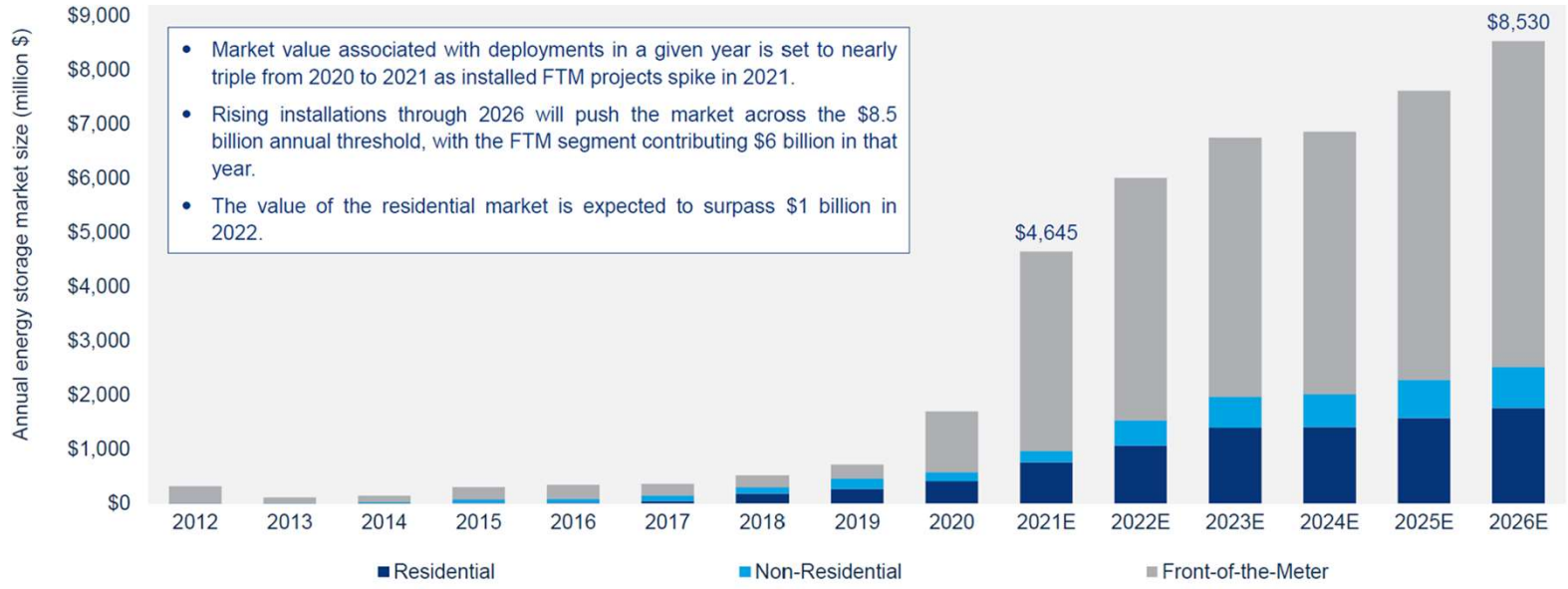


Figure 1. California GHG Emissions Trends. This figure shows the emission trends between 2000 and 2017 as compared to the 2020 statewide GHG limit of 431 $MMTCO_2e$.

Growth of Energy Storage

U.S. annual energy storage market size, 2012-2026E (million $)



Source: Wood Mackenzie Power & Renewables. Note: Market size is reported as energy storage system deployment revenue (product of deployments and installed system prices).

Biden Administration Plans and US Federal Tax Policies to Encourage Energy Storage

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Current Investment Tax Credit Rules – In General

- The Investment Tax Credit ("ITC") under Section 48 of the U.S. Internal Revenue Code (the "Code") provides a dollar-for-dollar credit against federal income tax in an amount equal to a percentage of the tax basis of a qualifying energy property placed in service during the year.
- Under current law, ITC eligibility and the ITC rate applying to a solar or wind power facility initially depends on when construction on the facility is considered to have "begun" for tax purposes.
- Potential for recapture of ITC if the ITC property is disposed of or ceases to be ITC property within 5 years of being placed in service.

Current Investment Tax Credit Rules – Application to Energy Storage

- In large part based on 30+ year old Treasury Regulations, a stand-alone energy storage facility is not eligible for ITC.
- However, battery storage integrated into an otherwise ITC-eligible solar or wind facility may be eligible for the ITC based on the IRS's view adopted in prior nonbinding private letter ruling guidance.
- Grid charging restrictions during ITC recapture period under "dual use equipment" rules.
  - 75% "cliff" rule

Selected Legislative Proposals – The Biden-Harris Budget Plan

- Expand ITC to apply to stand-alone energy storage technology that stores energy for conversion to electricity and has a capacity of not less than 5 kilowatt hours.
- ITC rate would apply at 30% for eligible property for which construction begins after 2021 and before 2027. After 2026, the credit rate would begin to phase down to zero over 5 years.
- Ability to elect a cash payment in lieu of the ITC (i.e., direct pay option)

Selected Legislative Proposals – Growing Renewable Energy and Efficiency Now (GREEN) Act

- Introduced in the House of Representatives by Ways and Means Committee Chair Thompson (D – CA) in February 2021.
- Legislation would extend 30% ITC to "energy storage technologies"
  - Includes equipment that uses batteries and other storage technology to store energy for conversion to electricity and has a minimum capacity of 5 kWh, or to store energy to heat or cool a structure
- Energy storage technology property would be eligible for the 30% ITC for projects that begin construction prior to 2027. The ITC then phases down to 26% in 2027 and 22% in 2028.
- Direct payment option but subject to 15% haircut. Special permissive rules for governmental and tax-exempt entities.

Selected Legislative Proposals – Clean Energy for America Act

- Introduced in the Senate by Finance Committee Chair Ron Wyden (D-Ore.) in April 2021.
- More extensive overhaul of architecture of energy tax credits.
- Would create new 30% "clean electricity business investment credit" for investment in "grid improvement property," which includes "energy storage property."
  - Energy storage property is property (1) which receives, stores, and delivers electricity, or energy for conversion to electricity, provided that such electricity is sold to or stored for an unrelated person by the taxpayer, (2) which has a capacity of not less than 5 kilowatt-hours, and (3) which is placed in service after 2021
- Provides for enhanced credit up to 50%, including attributable to qualified investments located in certain disadvantaged or energy communities and/or that meet certain domestic content requirements.
- Credit phaseout depending on annual greenhouse gas emissions from the production of electricity in the United States
- Direct payment option
- Permissive rule for regulated utilities to be eligible for tax credit for large-scale grid improvement property without needing to adopt normalization method of accounting.


Global Energy
Storage Trajectory –
Middle East
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Introduction

- With renewable energy targets being publicized by various countries in the Middle East, regional utilities are seeking to address the intermittency of renewable energy supply with viable energy storage solutions.
- In the Middle East, the most promising energy storage technologies include battery storage, thermal, pumped-hydro and green hydrogen.

Batteries

- Interest in batteries has been driven by battery technology advancement and a reduction in prices in recent years. These factors can enable energy storage deployment to support renewables grid integration especially at times of peak demand, such as Middle Eastern summers.
- Both lithium-ion and sodium-sulphur batteries have been and are being deployed in the Middle East.
- In the United Arab Emirates (UAE), Abu Dhabi was a Middle East pioneer in exploring large scale deployment of battery storage systems. By 2016, it deployed 108 MW of sodium-sulphur battery energy storage systems across its distribution network in one of the largest EPC energy storage projects in the world. The batteries work to level the electricity load curve and defer generation investments through peak shaving. The batteries are able to store energy for six hours.

Batteries

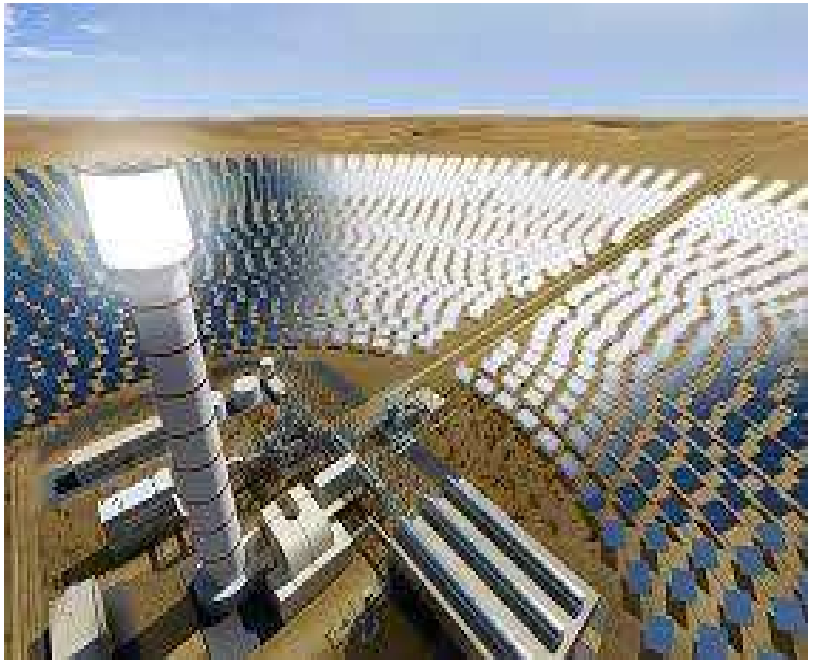
- In 2019 / 2020, there were discussions in Abu Dhabi to include battery storage in the Al Dhafra solar project which is a 2GW photovoltaic (PV) independent power producer (IPP) project in Abu Dhabi. However, the sponsors decided not to proceed with this option.
- Jordan has implemented energy storage projects but on a smaller scale. In February 2019, Philadelphia Solar's 23 MW Solar PV with 12.6 MWh Lithium-Ion storage project came online as the Middle East's first utility scale combined solar and storage project.
- In addition, Jordan issued an RFI in July 2017 for the development of stand-alone energy storage projects in two phases, with the first to be a 30MW / 60MWh electricity storage plant. The phase one plant would be used for ramp-rate control of PV and wind power generators in the local area and to shift renewable energy generated off-peak to times of peak demand. However, in April 2020, Jordanian government representatives confirmed that tendering for this innovative energy storage system in the Middle East has been cancelled.

Batteries

In Saudi Arabia, the Red Sea Development Company is developing a resort complex powered by wind and solar energy, and using a 1,000 MWh battery storage facility. The project consortium is led by ACWA Power. The battery storage system will support energy resilience across the site, including powering facilities at night-time and ensuring power if outages occur across its networks.

Thermal

- Thermal energy storage, combined with Concentrating Solar Power (CSP), is already being developed in the Middle East.
- In the UAE, state utility Dubai Electricity & Water Authority (DEWA) is developing the $4.4 billion Noor Energy 1 solar thermal project which will be the world's largest CSP plant and includes a 100 MW CSP tower plant, 260-meter high receiver tower, three 200 MW parabolic trough CSP systems, 250 MW of PV capacity and 15 hours of molten salt CSP storage capacity. The project was awarded in 2017 to ACWA Power.



Pumped Hydro

- Other energy storage projects in the Middle East include pumped-hydro storage. Dubai is moving ahead with the region's first pumped hydro storage project. In August 2019, DEWA awarded a construction contract for the 250 MW Hatta pumped storage hydroelectric power station.
- The project will use water stored in the Hatta Dam, near the Oman border, which can store up to 1,716 million gallons of water. The project will involve the construction of an upper reservoir, which will be able to hold up to 880 million gallons. The upper reservoir will be located 300m above the dam level. During off-peak hours, turbines will use solar energy to pump water from the dam to the upper reservoir.
- According to experts, pumped-hydro systems may offer more opportunities on a larger scale for places like Lebanon, Iraq and Oman than the rest of the region because of weather patterns and geography.

Green Hydrogen

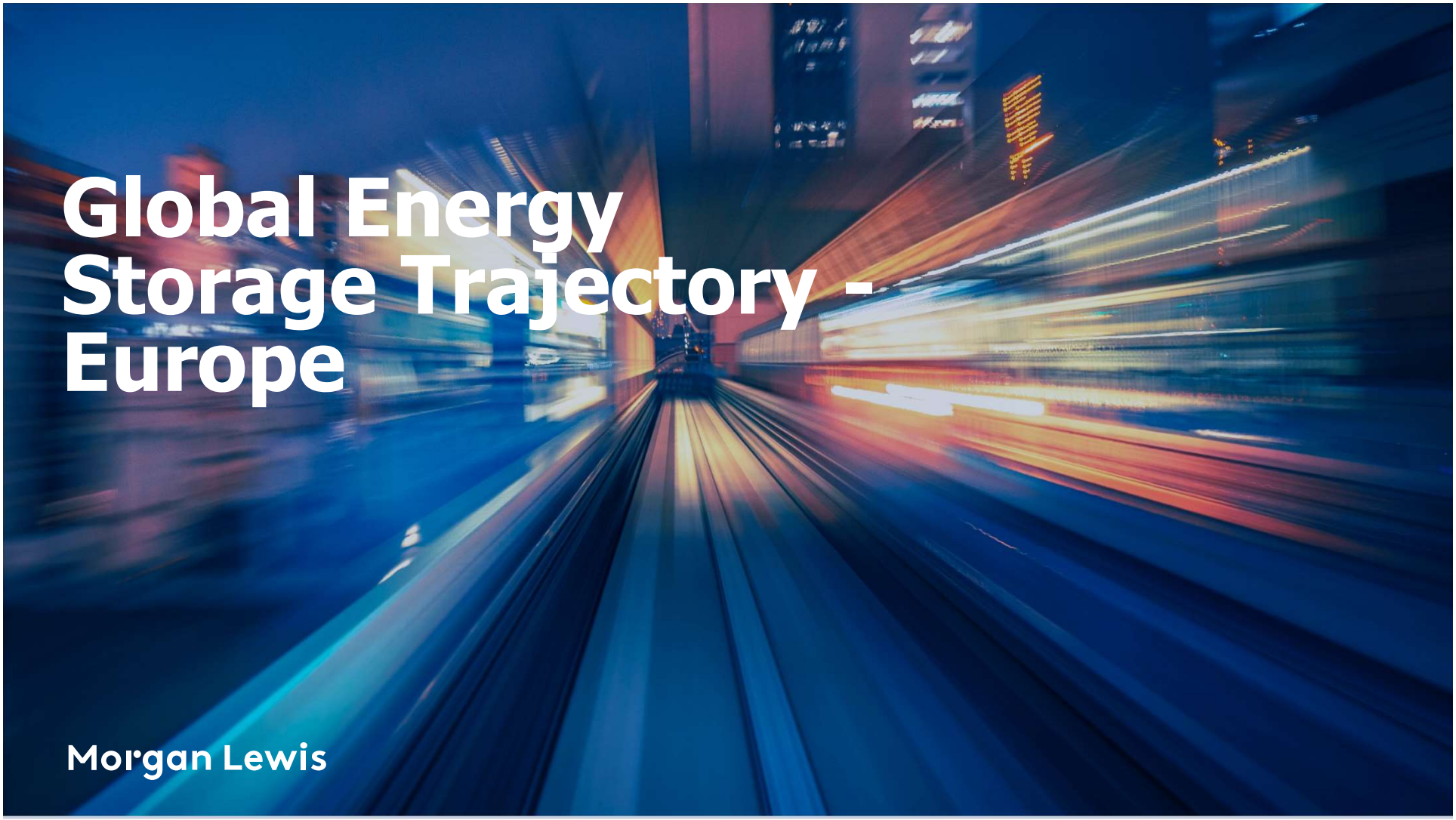
- In May 2021, a Dubai-based pilot project was inaugurated by DEWA in collaboration with Dubai Expo 2020 and Siemens Energy as the first industrial scale, solar-driven green hydrogen facility in the Middle East and North Africa. The plant is based at Dubai's Mohammed bin Rashid al-Maktoum (MBR) solar park.
- According to Siemens energy, the plant has been built to accommodate future applications and test platforms for the different uses of hydrogen, including potential mobility and industrial uses.
- Daylight solar power from the MBR park will enable the pilot project to produce about 20.5 kilograms an hour (kg/hr) of hydrogen at 1.25MWe of peak power. The system allows for buffering renewable energy production, both for fast-response applications, as well as for long-term storage.

Green Hydrogen

In Saudi Arabia, Air Products & Chemicals announced plans in July 2020 to build a green hydrogen plant powered by 4 gigawatts of wind and solar power which will be the world's largest project. The $5 billion plant will be jointly owned by Air Products, ACWA Power and Neom, a new mega-city planned near Saudi Arabia's borders with Egypt and Jordan and will produce 650 tons of green hydrogen daily.

Conclusion

- Energy storage is critical because the clean energy transition in the region will not be realized through renewable energy projects alone.
- According to Masdar, a leading global developer and operator of utility-scale renewable energy projects based in the UAE, unless grid infrastructure and power storage technology are enhanced, increasing the supply of intermittent renewable energy could heighten the risk of power outages, and the need for fossil fuel peaker plants at times of high demand.
- As such, the addition of significant variable renewable energy capacity to grids across the region will increase the importance of storage in maintaining a continuous and flexible power supply.
- Nuclear and combined-cycle gas turbines (CCGTs) will continue as reliable providers of baseload energy but that reliance will be reduced over time as flexible energy storage solutions are adopted to integrate renewables. Also, costs will also need to come down further for energy storage projects to develop further in the region.
- Overall, there is a lot of exciting development and potential for energy storage deployment in the Middle East.


Global Energy
Storage Trajectory -
Europe
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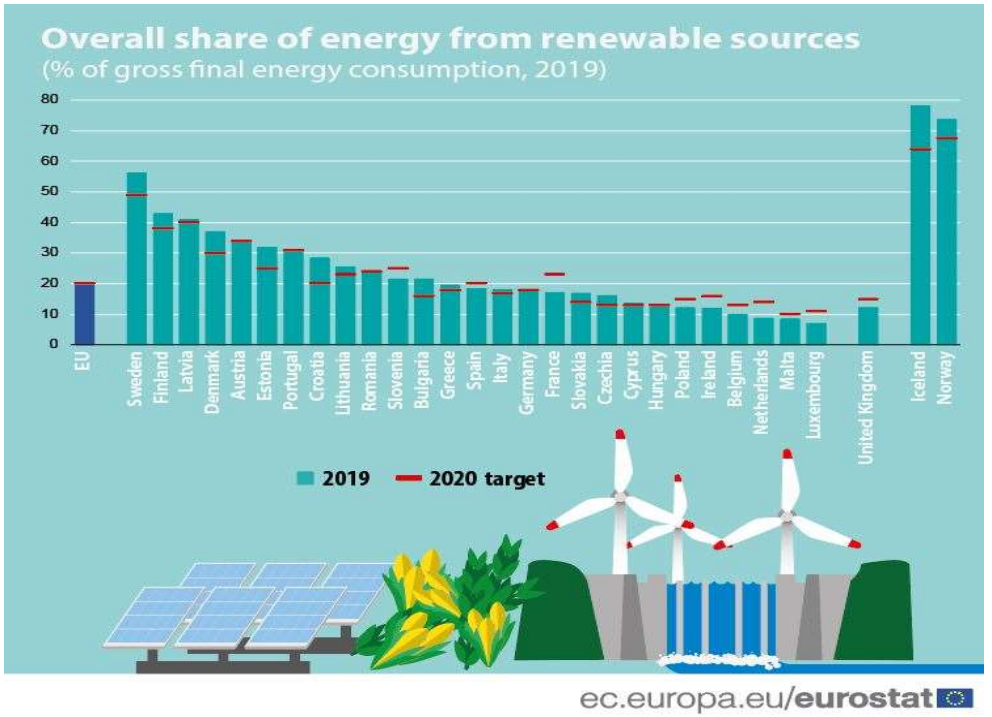
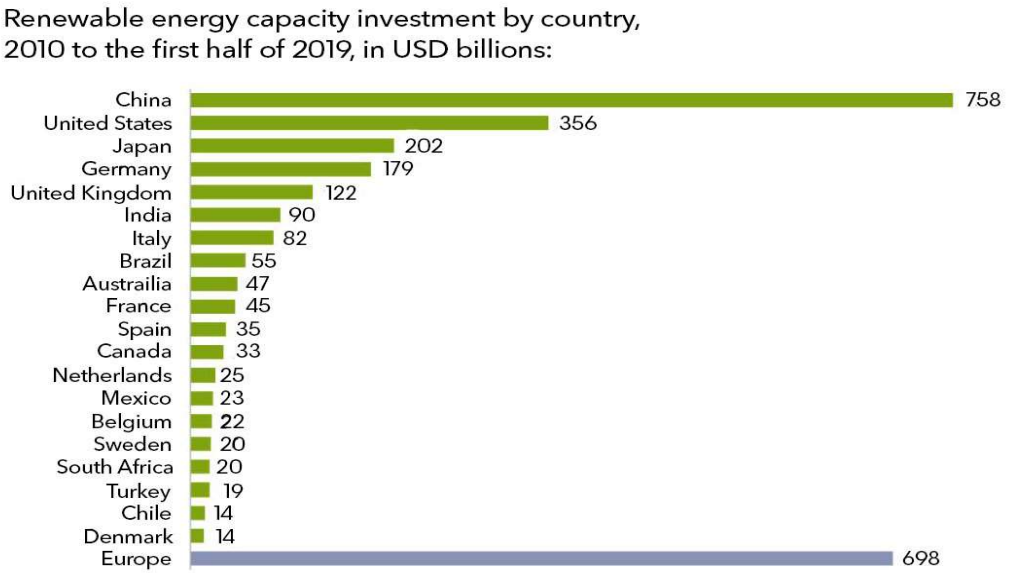
Renewable Energy in Europe

According to Eurostat, by 2017 eleven European Union countries had already achieved their 2020 targets.



Growth in Renewable Energy Capacity

Global investment in renewable capacity in 2010-2019 was close to $2.5 trillion, with China leading the charge.



Source: Global Trends in Renewable Energy Investment 2019, based on data from BloombergNEF

Energy Storage in Europe

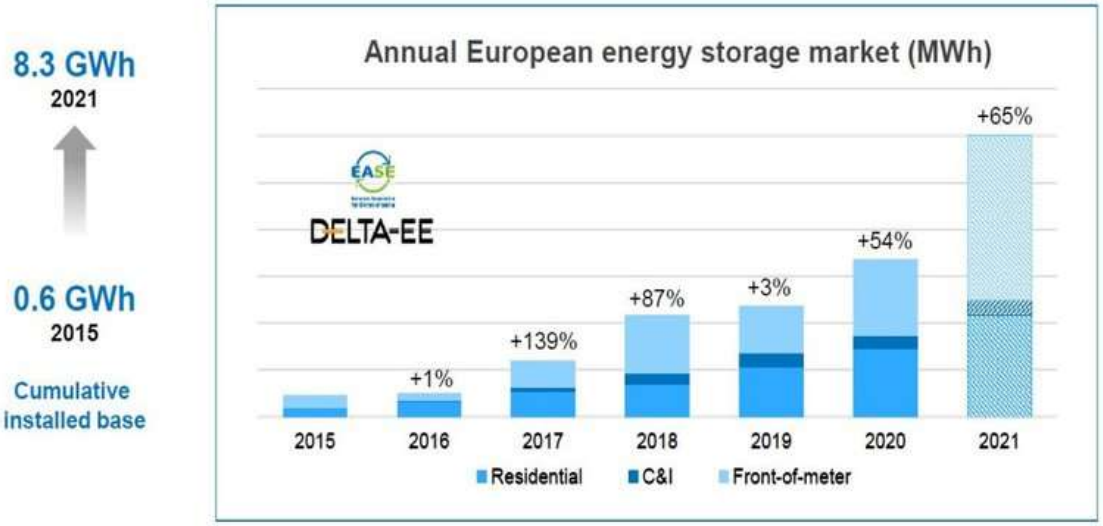
- For grid reliability we need a way to store electrons so that they can be deployed when they are needed.

- Europe is starting to realise that as the dependence on renewable energy from wind and solar increases, the need for energy storage becomes more urgent.

Growth in European Energy Storage

EMMES 5.0 market data and forecasts

Electrical energy storage*



European energy storage is expected to double in 2021, but according to Wood Mackenzie, although Europe outpaces both China and the US for renewable energy capacity growth, it is still further behind in recognising the importance of energy storage in that transition.

Opportunities for Growth

- 95% of global storage capacity is still through pumped hydro but investment in new pumped hydro plants has waned because the business model no longer makes sense.
- Instead, we are seeing the use of batteries increasing as production costs go down and battery capacity goes up, driven largely by technological innovations.
- AI is opening up even greater opportunities, e.g. through the development of smart energy storage software that can predict demand peaks and availability of supply.

European Battery Alliance

The European Commission expects battery storage to be a key enabler of a low carbon economy.

European Battery Alliance was established in 2017– the aim is to build up battery technology and production capacity in the EU but also impose mandatory requirements for all batteries in the EU market:

- use of **responsibly sourced materials**
- restrictions on use of **hazardous substances**
- minimum content of **recycled materials**
- **performance** and durability and labelling
- meeting collection and **recycling** targets

Challenges to Growth

- **Technological challenges:** Battery technology is evolving at a very high pace, raising the risk of obsolescence.
- **Economic challenges:** The ownership and location of the storage will affect the business case for its development – is it being installed at the point of generation or end customer? Or along the transmission or distribution lines?
- **Regulatory challenges:**
  - Given that storage both charges and discharges electricity, will it be treated as both a consumer and seller and thereby subject to double costs (such as charges for supply to the battery and then again supply to the end consumer)?
  - Will battery storage projects be treated as regulated infrastructure projects?
- **Financing challenges:** Long term offtake arrangements and clearly defined revenue stream needs to be identified, without which project financing will not be available.

Biography

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Neeraj Arora represents sponsors, financial institutions, and utilities in connection with the development, acquisition, disposition, and financing of significant infrastructure projects, including conventional (gas and coal) and renewable (energy storage, solar, wind, biomass, and geothermal) power generation projects, transmission lines, and pipelines, and advises clients seeking innovative business opportunities related to climate change. Neeraj partners with clients to successfully execute bank and institutional investor debt financing transactions (including tax equity bridge loans), equity investments and joint ventures, and project mergers and acquisitions, as well as a broad array of project development commercial transactions.

Biography

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Casey S. August's practice focuses on US federal tax planning and implementation matters. Representing clients across industries, he advises on structuring and documentation issues for mergers and acquisitions, energy project financings, joint venture collaborations, and intellectual property transfers. Casey also counsels clients on issues involving choice of entity and cross-border structuring and planning, as well as on IRS private letter ruling submissions and securities filings.

Biography

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Ayesha Waheed practices principally in the project finance, infrastructure, and natural resources practice. She represents developers and lenders in oil and gas, power generation, and infrastructure projects, and has experience in all aspects of structuring, negotiating, and drafting finance and commercial documents in connection with international project financings and privatizations. She counsels companies that are developing and deploying new energy resources, including renewable energy.

Ayesha is admitted to practice in New York and England & Wales.

Biography

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Chadi Salloum represents sovereign entities, multinational companies, regional utilities and financial institutions in a broad range of transactions, including corporate commercial, mergers and acquisitions, joint ventures, restructurings, renewable energy and other projects, private equity, privatizations, spinoffs, strategic alliances, tender offers, initial public offerings, rights offerings, and private placements of equity, equity-linked, and debt securities. He also advises clients on policy, regulatory, and governance matters and reporting obligations. Chadi is admitted to practice in New York.

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