ENERGY STORAGE

CATALYST FOR THE ENERGY TRANSITION

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CENG MBA

AGENDA

- Background
- What is Energy Storage?
- The Energy Transition & Storage
- How do we get to the Transition?
- Conclusions

BACKGROUND

PROFESSIONAL

- Senior Energy Storage Consultant – DNV UK
- BESS Project Manager £80M BESS - Statera Energy
- BESS & PV Site Engineer £150M - METKA EGN
- Infrastructure Site Engineer £200M - Natta

ACADEMIC

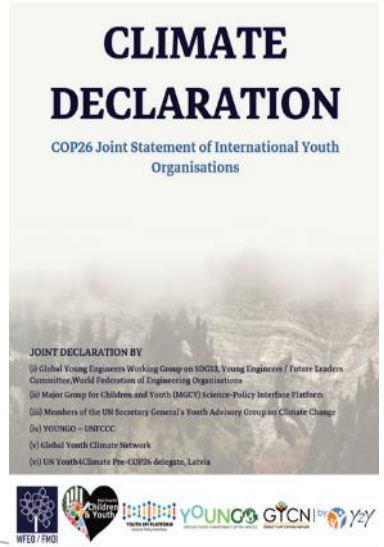
- Imperial College London - MEng
- Institution of Civil Engineers UK – CEng & Carbon Champion
- Technical Chamber of Greece – CEng
- Aspen Institute UK – Rising Leaders Fellow

World Federation of Engineering Organizations
Fédération Mondiale des Organisations d'Ingénieurs
Committee on Young Engineers / Future Leaders

YOUNG ENGINEERS FUTURE LEADERS

- **COP26** – UNFCCC side event on science-policy divide, first ever Youth Joint Statement for the Climate
- Capacity Building for young engineers globally
- **COP27** – UNFCCC Side Event with FIDIC, CPA
- Youth Empowerment framework for Leaders launched 2024
- **COP28** – UNFCCC Side Event, Capacity Building Hub collaboration, Resilience Hub Collaboration, Global Renewables Alliance

CAPACITY-BUILDING HUB



Commonwealth Sustainable Energy Transition Youth

- Energy Access - Clean Cooking - Energy Literacy
- Policy advocacy to governments for a **Just** Energy Transition
- Sustainable Energy Toolkit 2023
- Capacity Building (Commonwealth Model Carbon Tax Law, Policy Recommendations, Energy Storage)
- Children & Youth Challenge 2023
- Youth Energy Transition Commission (with ENEL Group, SE4All, SDG7 Constituency, IRENA, YounGo)

- COP27 and COP28 bilaterals with Secretary General, representatives from UK, Canada, Nigeria, India, Seychelles, Barbados, Uganda, South Africa, …

WHAT IS ENERGY STORAGE

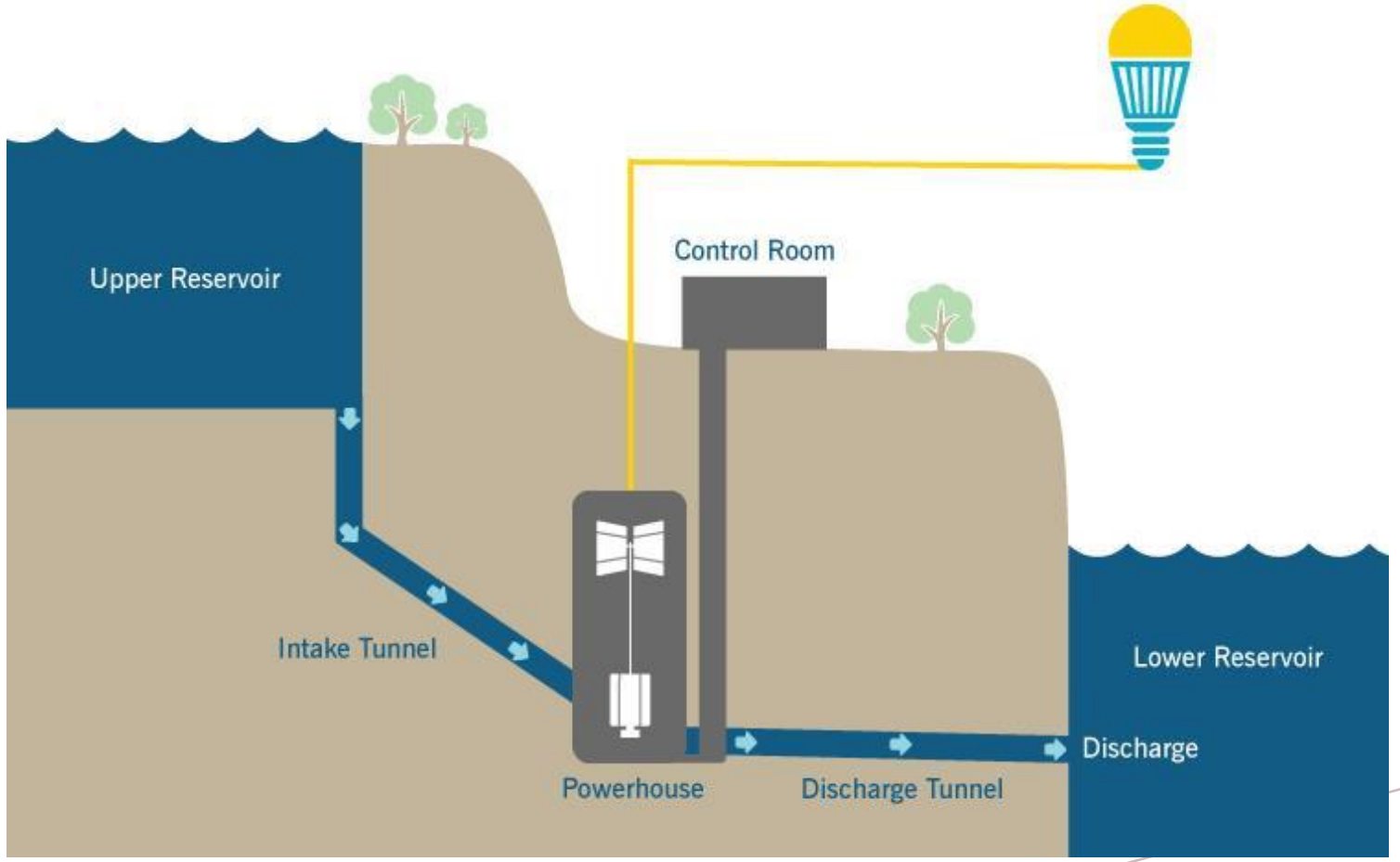
AND WHY SHOULD YOU CARE?

TYPES OF ENERGY STORAGE

"Storage is a way of moving energy through time " – Unknown storage mastermind

MECHANICAL

- Pumped Hydro
- CAPS
- Thermal Storage
- Gravity




GRAVITY STORAGE
Arbedo-Castione, Switzerland, Energy Vault

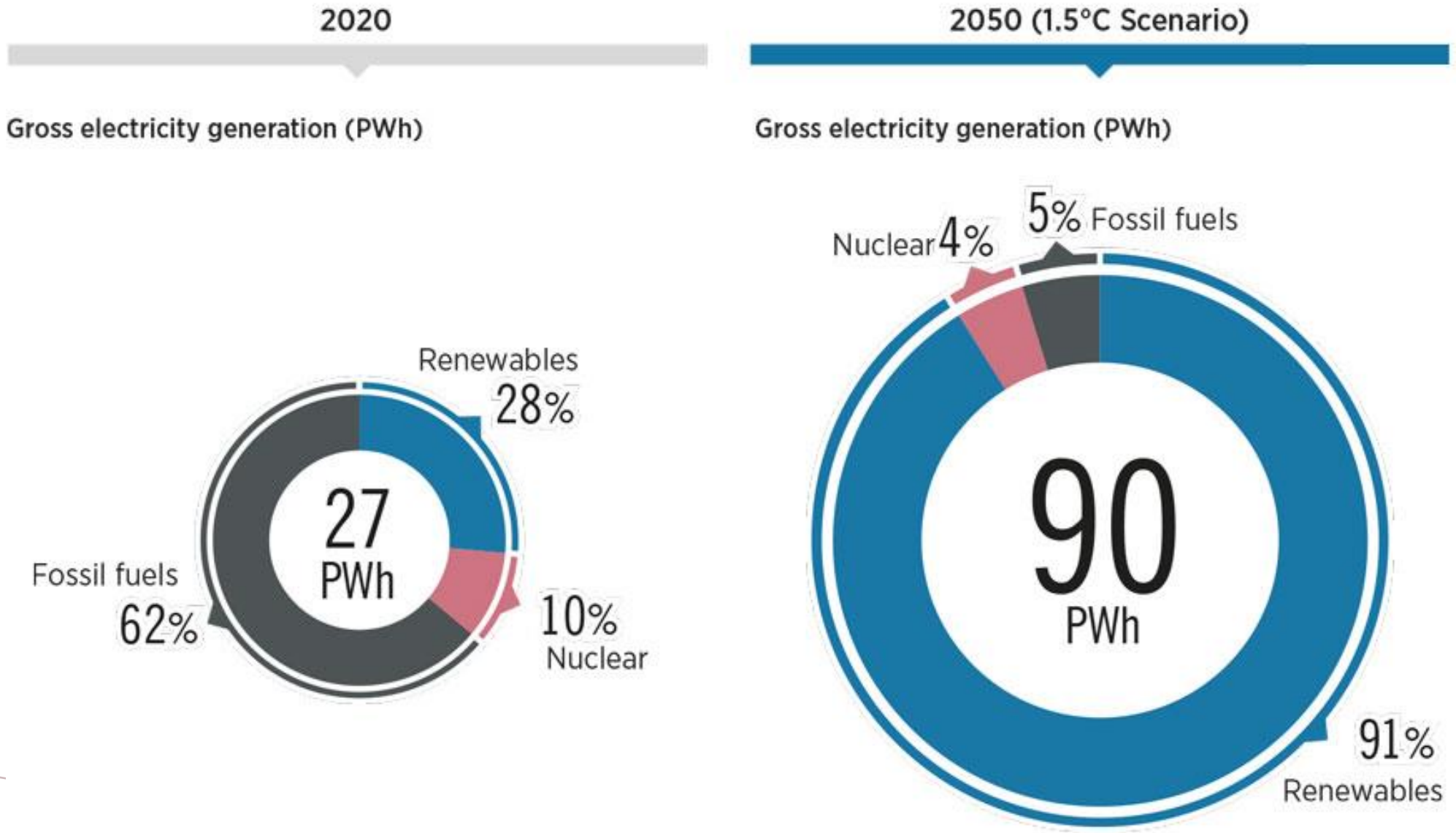
TYPES OF ENERGY STORAGE

CHEMICAL

- Fossil Fuels
- Hydrogen
- Flow Batteries
- **Traditional Batteries - BESS** (Li-Ion, Lead, Sodium Ion)
  - Short – mid duration storage
  - Fast response
  - Known and safe technology

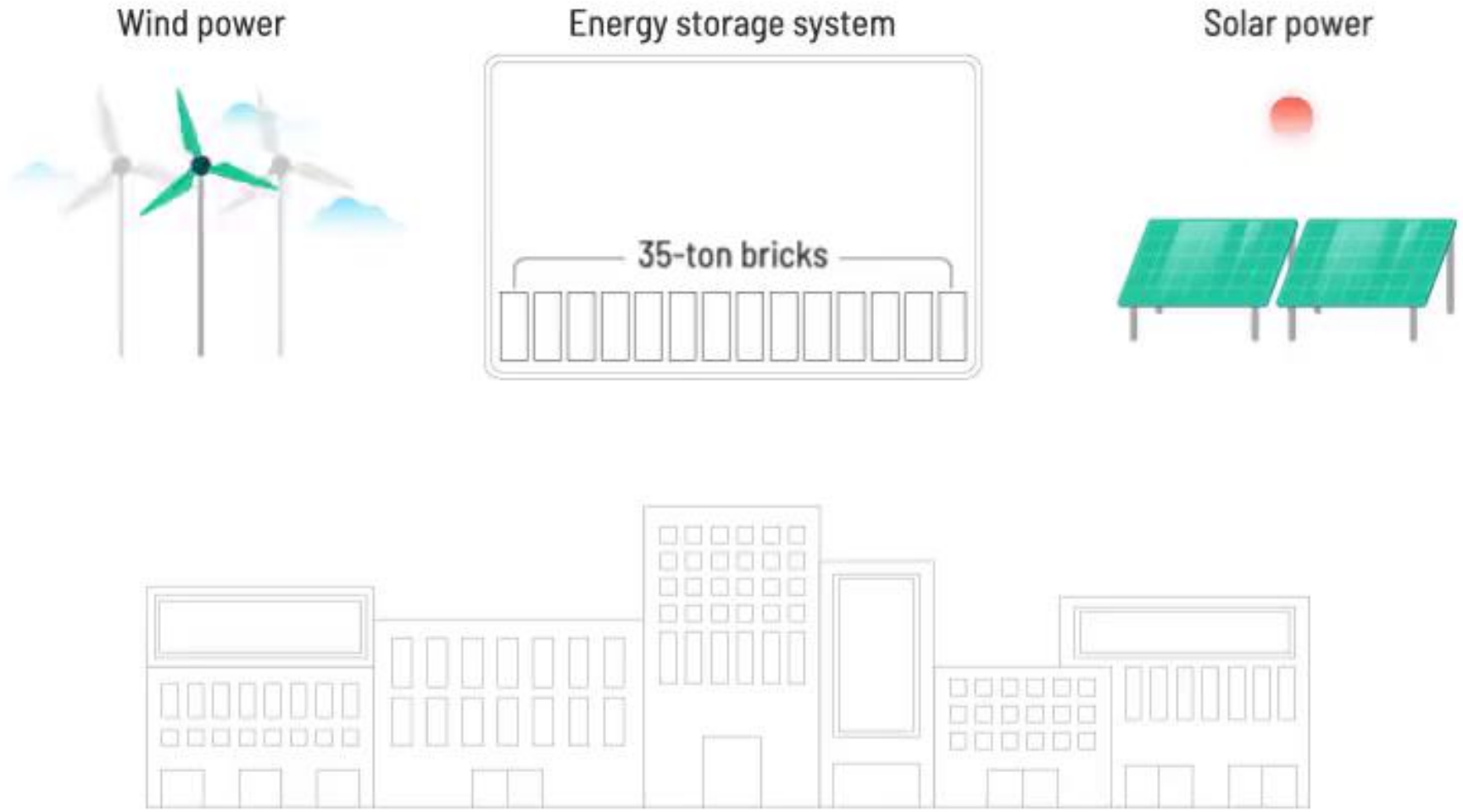
"Electrification is the only way to decarbonisation" – Everyone working for NetZero 2050

WHY DOES STORAGE MATTER?



How Energy Vault's gravity-based energy storage system works

Renewable energy is stored by lifting the bricks, and released by lowering them. An AI-powered management system determines the optimal time to discharge the energy, depending on levels of supply and demand.

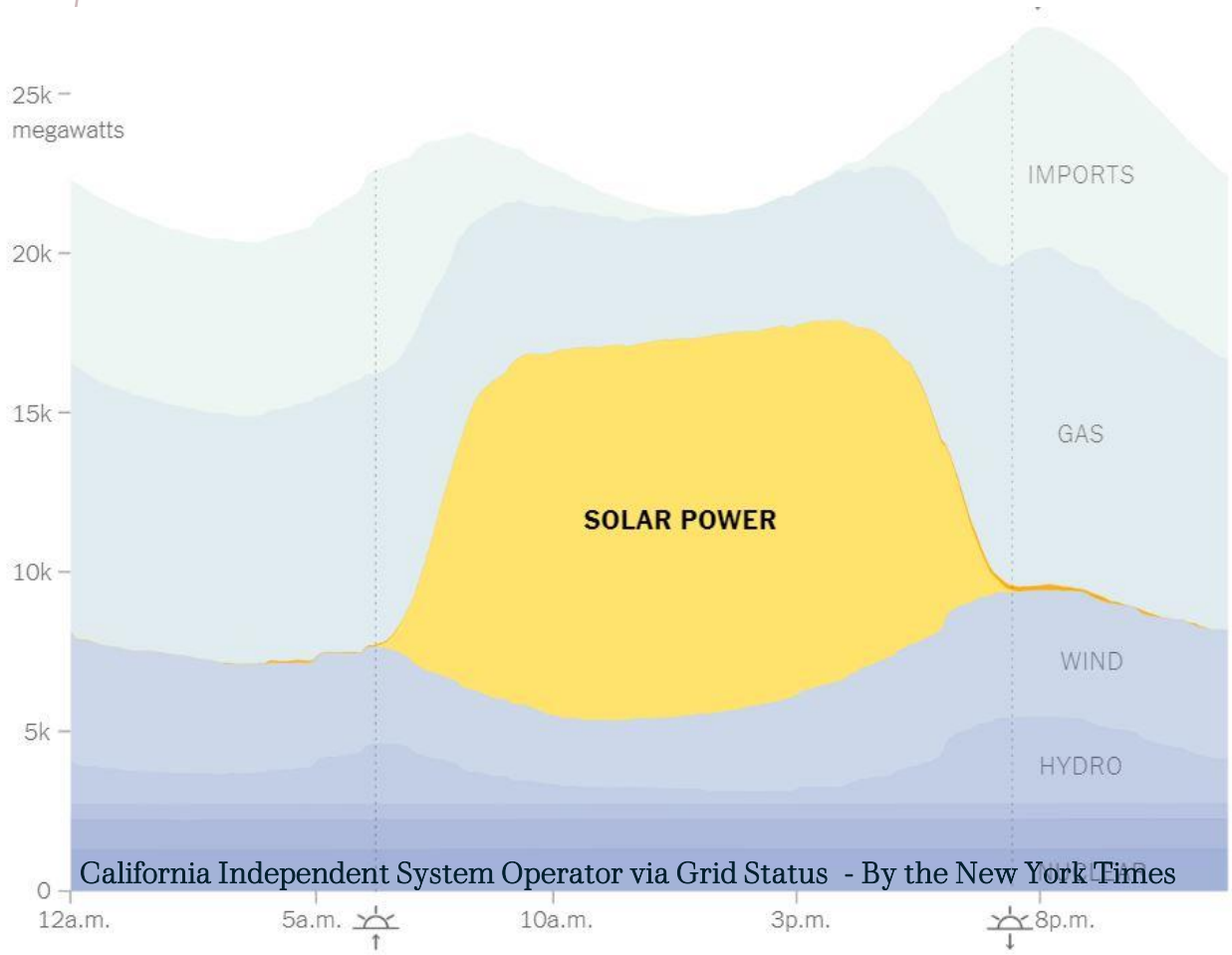


Source: Energy Vault
Graphic: Woojin Lee, CNN

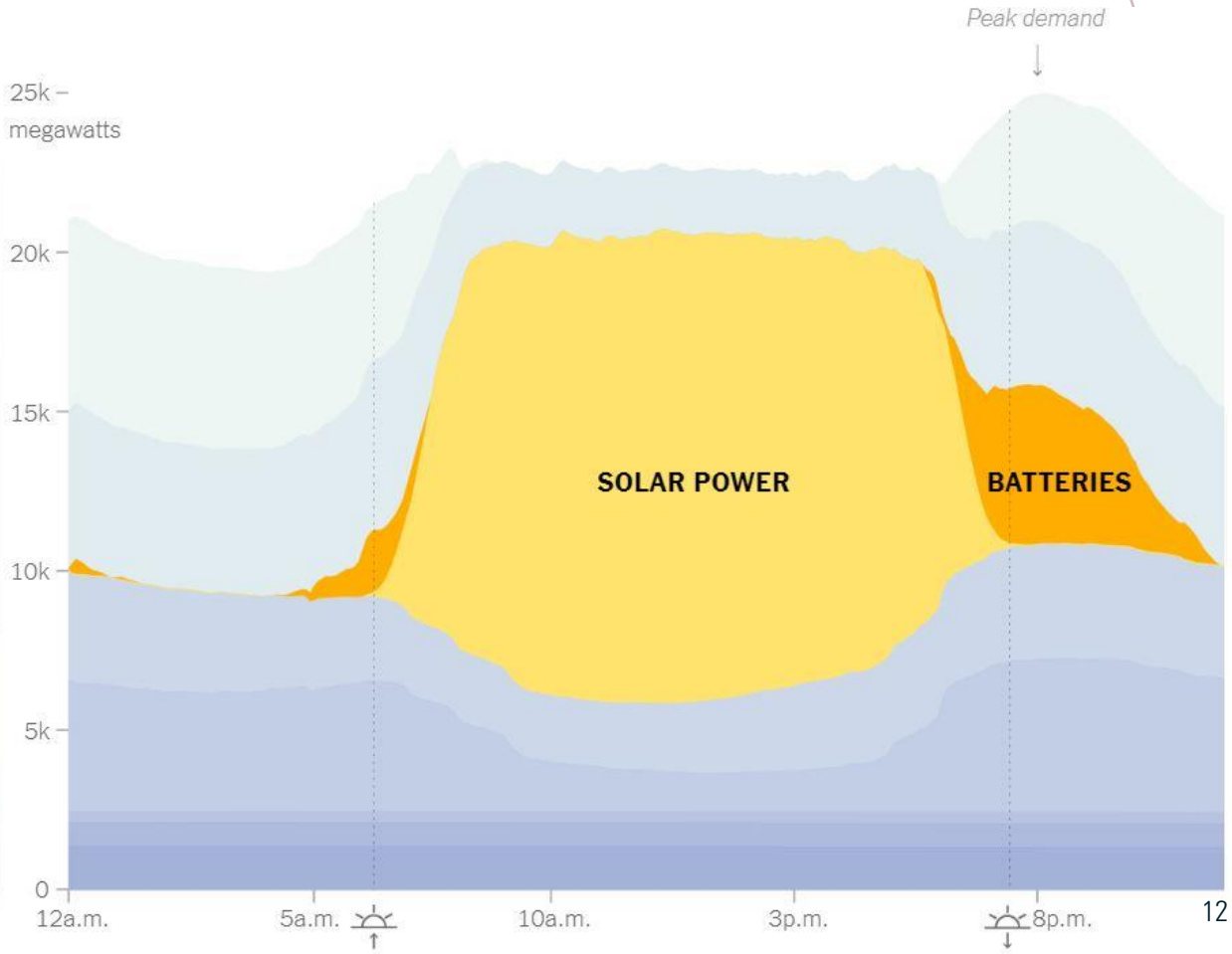
BALANCING THE GRID

How California powered itself in April 2021 …

Average daily generation, by fuel type

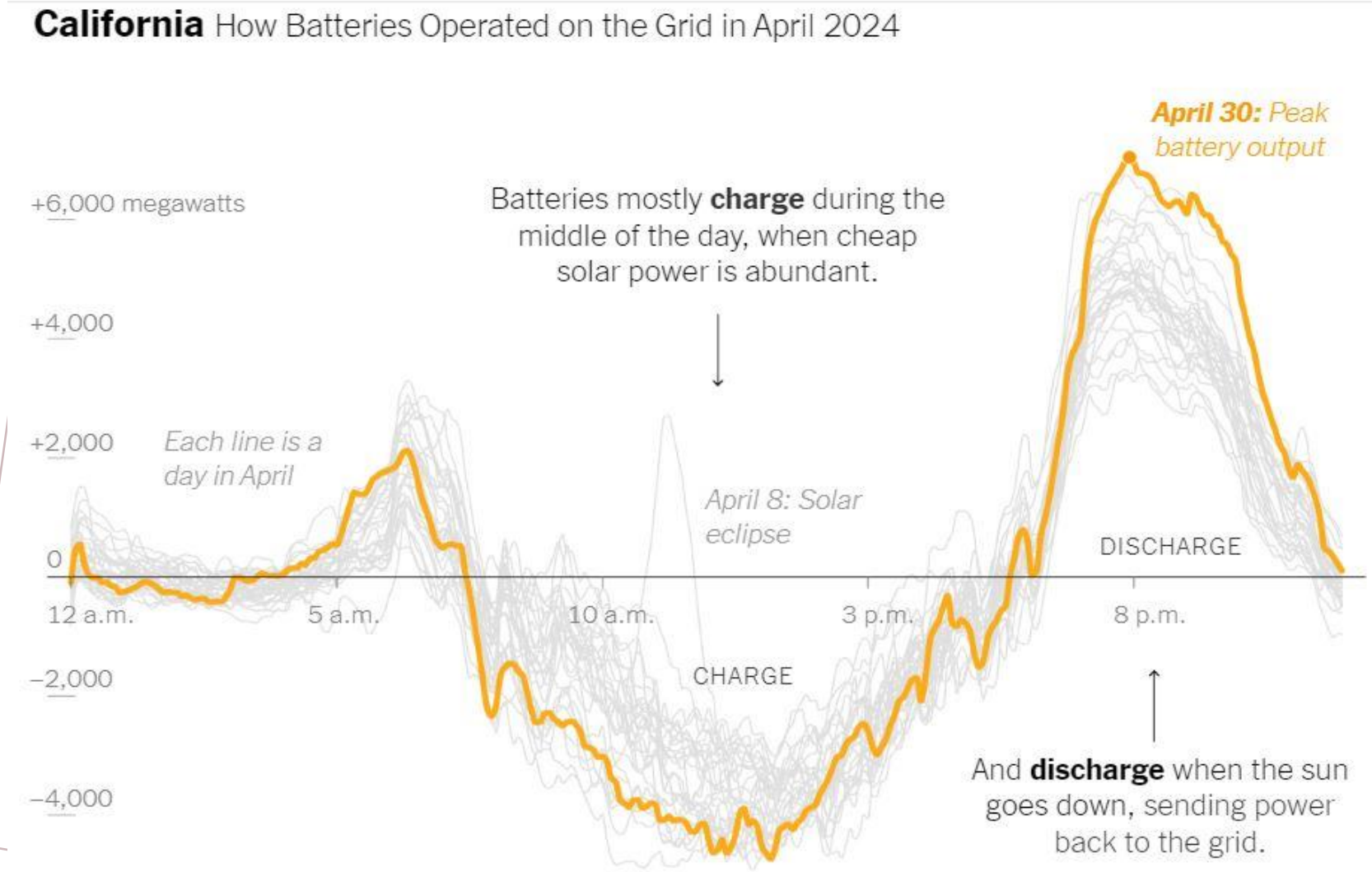


and in April 2024.



California Independent System Operator via Grid Status - By the New York Times

TRANSITIONING TO A R.E.S.-BASED GRID



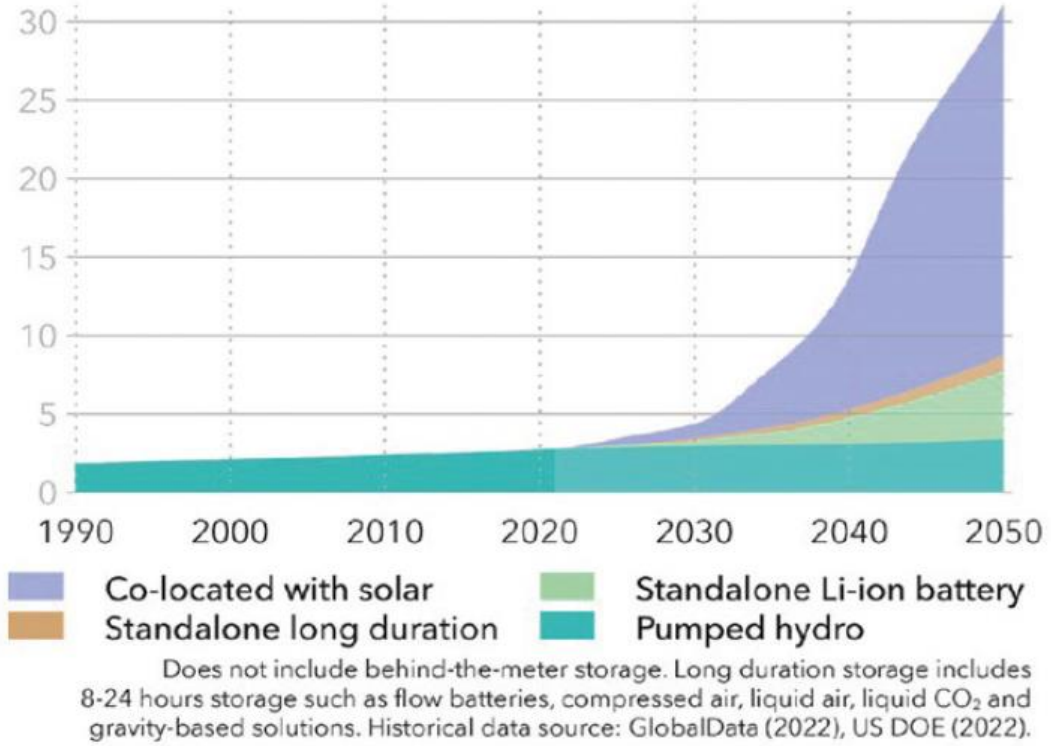
- Reserve Capacity for Demand / Supply balancing
- Voltage and Frequency Control

Solving the Energy Trilemma

- Renewables penetration (*Sustainability*)
- Consumer Cost reduction (*Affordability*)
- Energy Security (*Reliability*)

STORAGE DEPLOYMENT

DNV Battery Scorecard 2024
World Utility-scale electricity Storage capacity [TWh]



IRENA – World Energy Transition Outlook 2023
Key performance indicators for the power sector: Planned Energy Scenario and 1.5°C Scenario in 2030 and 2050

		Historical	2030		2050	
		2020	PES	1.5°C Scenario	PES	1.5°C Scenario
Total generation (TWh)	Global	26 991	36 119	40 140	52 436	89 878
	G20	22 616	29 560	32 408	41 867	66 273
Battery storage (GW)	Global	17	227	359	1 583	4 098
	G20	16	172	278	1 181	2 925

2112% Increase Globally in Storage GW by 2030 from 2020 levels, to meet 1.5C

WHY AREN'T WE GOING FAST ENOUGH

… when we really, REALLY, have to ?

Enabling infrastructure

Policy and regulations

Skills and institutional capacity

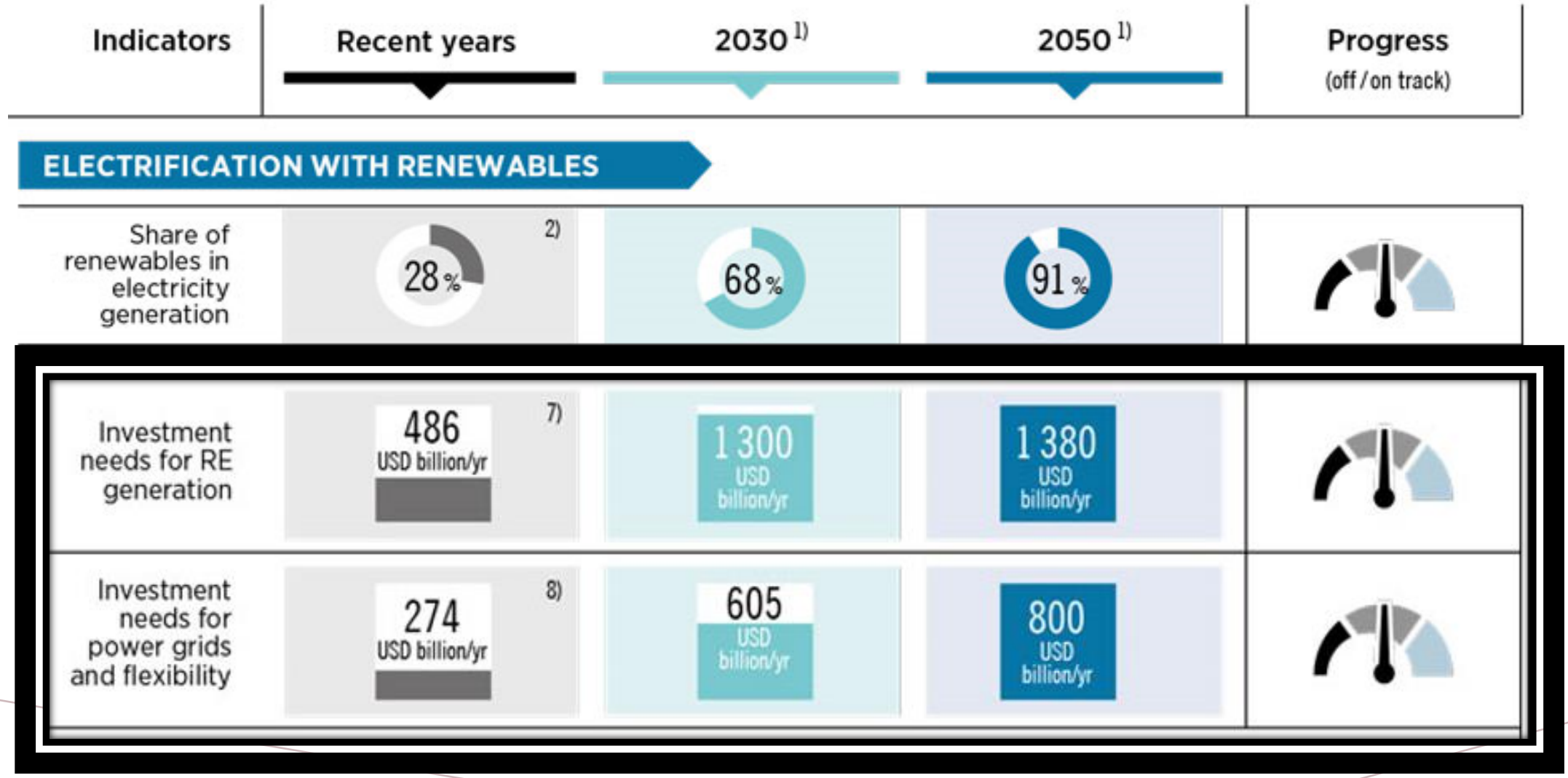
Barriers

- **Insufficient infrastructure to connect renewable energy to markets**, including energy storage and grid integration infrastructure.
- **Lack of readiness of the distribution infrastructure** for electricity, gases and fuels.
- **Unpreparedness of end-use sector facilities** to switch to renewables.

- **Policy and regulatory frameworks that are still shaped around fossil fuels,** offering insufficient public funding for energy transition support.
- **Lack of integrated planning for energy production and consumption.**
- **Insufficient attention to the socio-economic dimension**, including a lack of industrial policy for viable supply chains.

- **Misalignments between fossil fuel job losses and renewable job gains** (skills-related, sectoral, spatial, temporal).
- **Skills gaps** due to inadequate education and training opportunities; uneven access for women, youth, minorities; and unmet reskilling and upskilling needs. Also lack of awareness of opportunities.
- **Job quality issues**, including wages, occupational health and safety, and overall

INVESTMENT NEEDS TO MOVE FASTER TOWARDS...



HOW DO WE GET TO THE ENERGY TRANSITION?

Solutions

Forward-looking planning, modernisation and expansion of supporting infrastructure both on land and sea to facilitate the development, storage, distribution, transmission and consumption of renewables.

Infrastructure should facilitate national, regional and global strategies for new supply-demand dynamics.

Design policy and regulatory frameworks that facilitate deployment, integration and trade of renewables-based energy, improve socio-economic and environmental outcomes and promote equity and inclusion.

These need to enable the energy transition at various levels, from local to global, and reflect new supply-demand dynamics.

Awareness- and capacity-building of institutions, communities and individuals to acquire requisite skills and knowledge to drive and sustain the energy transition.

This includes co-ordination between educational institutions and industry. Strengthened institutions, social dialogue and collective bargaining will help bring about greater socio-economic benefits.

CONCLUSIONS

- Storage ticks all 3 boxes for the Energy Trilemma:
  - ✓ Achieves **affordability** through higher Renewables Penetration in the Grid
  - ✓ Unblocks **sustainability** through flexibility for Renewables Intermittency
  - ✓ Unlocks **Reliability** through energy reserves through mid- and long-duration storage

- **Grid** remains the 'elephant in the room' for the Energy Transition and will continue to challenge progress internationally

- **Governments** and **institutions** must advocate for increased trade of renewable-based energy through effective regulation
  - Incentivise efficiency gains and electrification
  - Deter carbon emissions and 'business-as-usual' approaches to energy generation

- Build **awareness** in institutions, communities and individuals to increase their capacity in sustainable energy generation and consumption practices, and increase their **competence** for the Energy Transition

'We must raise nation-level ambition to break the chokehold fossil fuel lobbies have on governments' – UN ASG for Climate, Selwin Hart

THANK YOU