IEA Energy Storage Technology Roadmap Launch

Didier Houssin, Cecilia Tam and Melissa Lott
International Energy Agency

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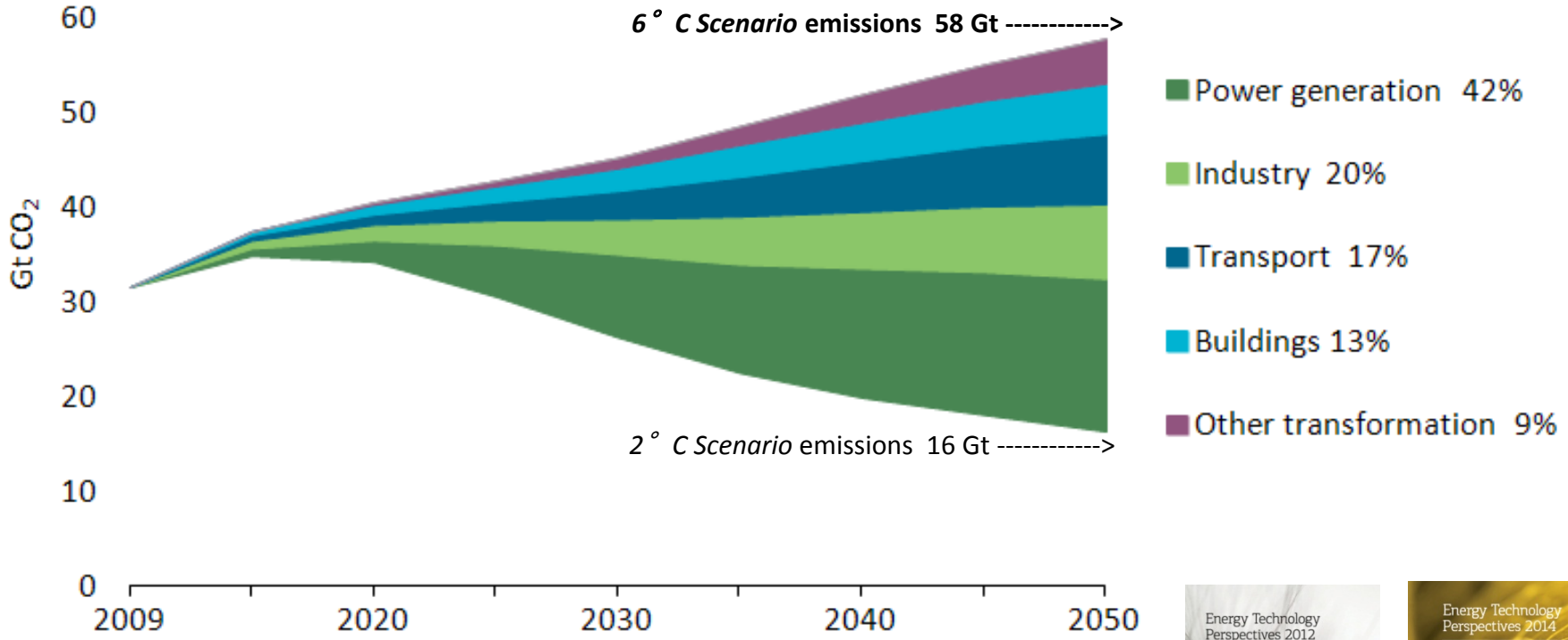
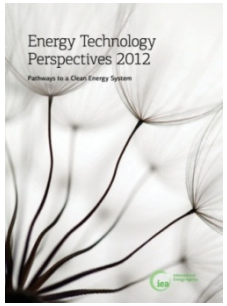
IEA Flagship Publication, Energy Technology Perspectives



Source: Energy Technology Perspectives 2012

- 6° C Scenario – business-as-usual; no adoption of new energy and climate policies
- 2° C Scenario - energy-related CO_2-emissions halved by 2050 through CO_2-price and strong policies



ETP 2014 – Release May 2014

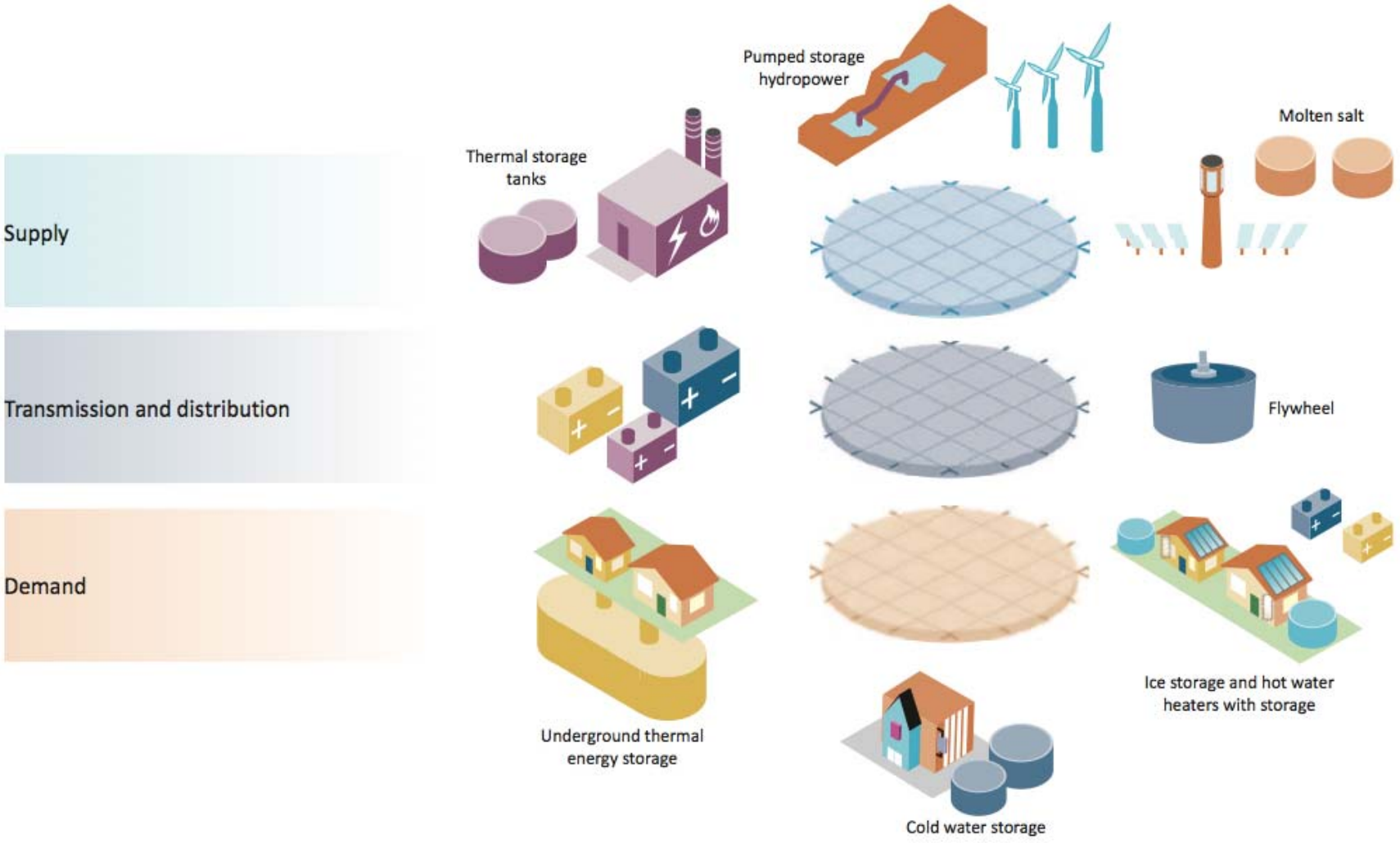
Technology roadmaps provide answers

- Engage cross-section of stakeholders
- Identify a baseline
- Establish a vision
- Identify technical, regulatory, policy, financial, public acceptance barriers
- Develop implementation action items for stakeholders

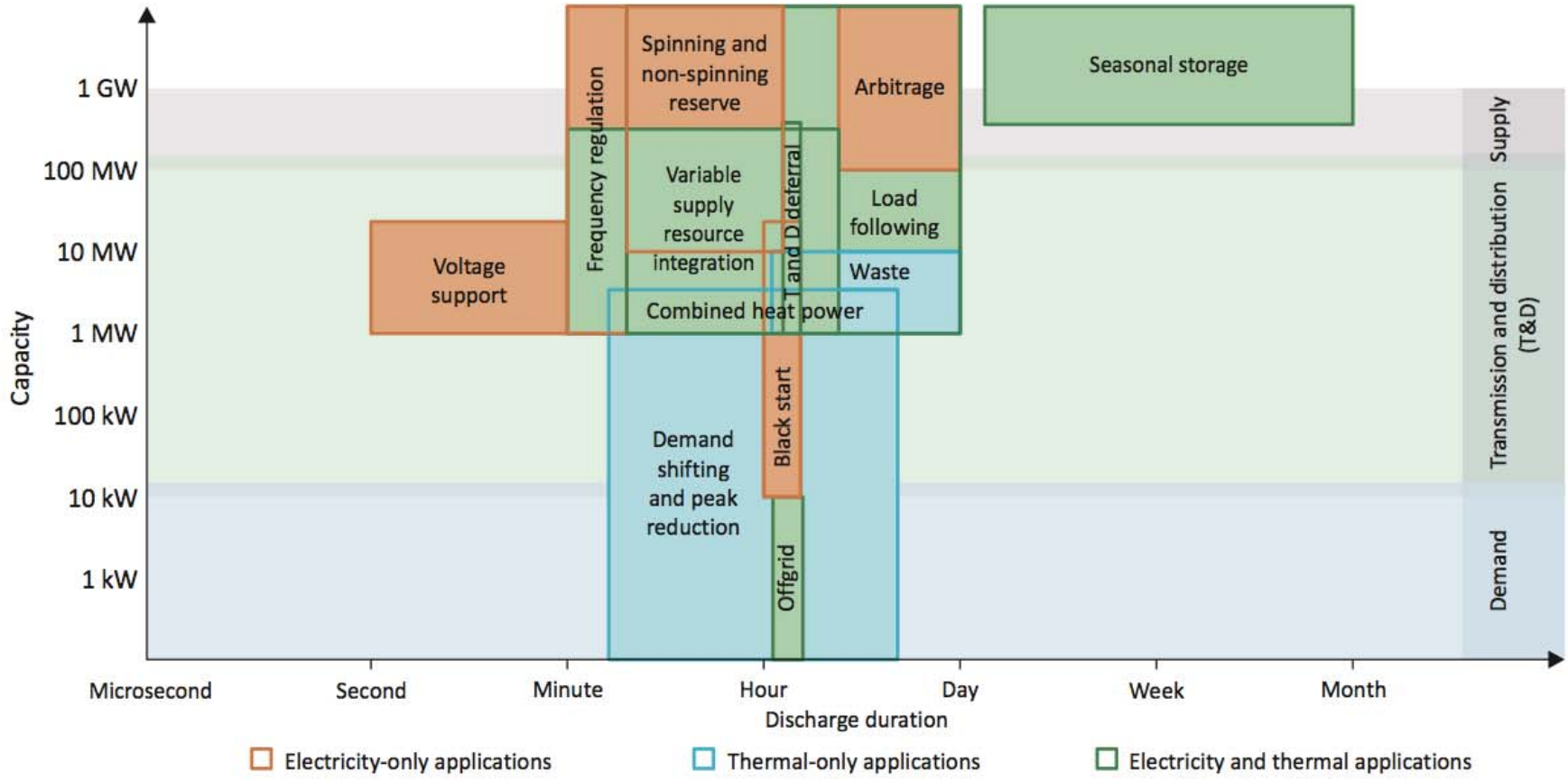
Role of storage in the energy system

- Improving energy system resource use efficiency
- Helping to integrate higher levels of variable renewable resources and end-use sector electrification
- Supporting greater production of energy where it is consumed
- Increasing energy access
- Improving electricity grid stability, flexibility, reliability and resilience.

Storage can help to better integrate our electricity and heat systems

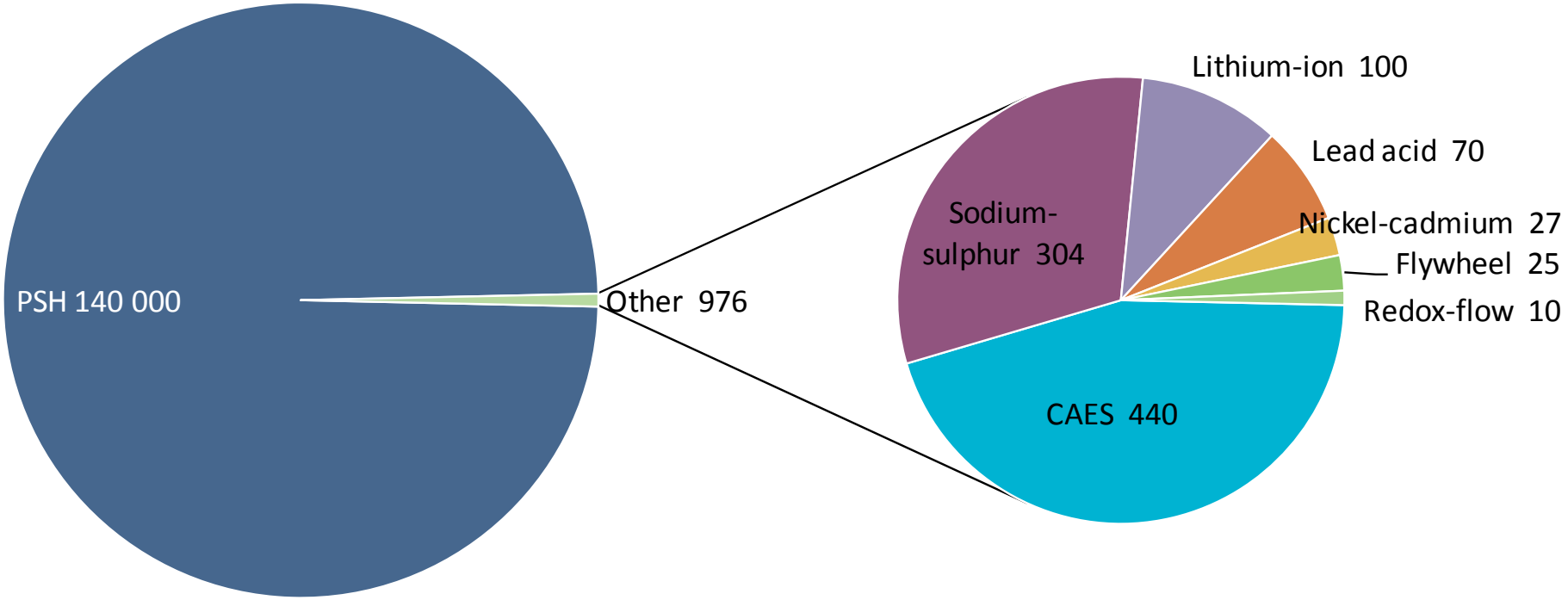


Electricity and thermal storage can provide a wide range of applications

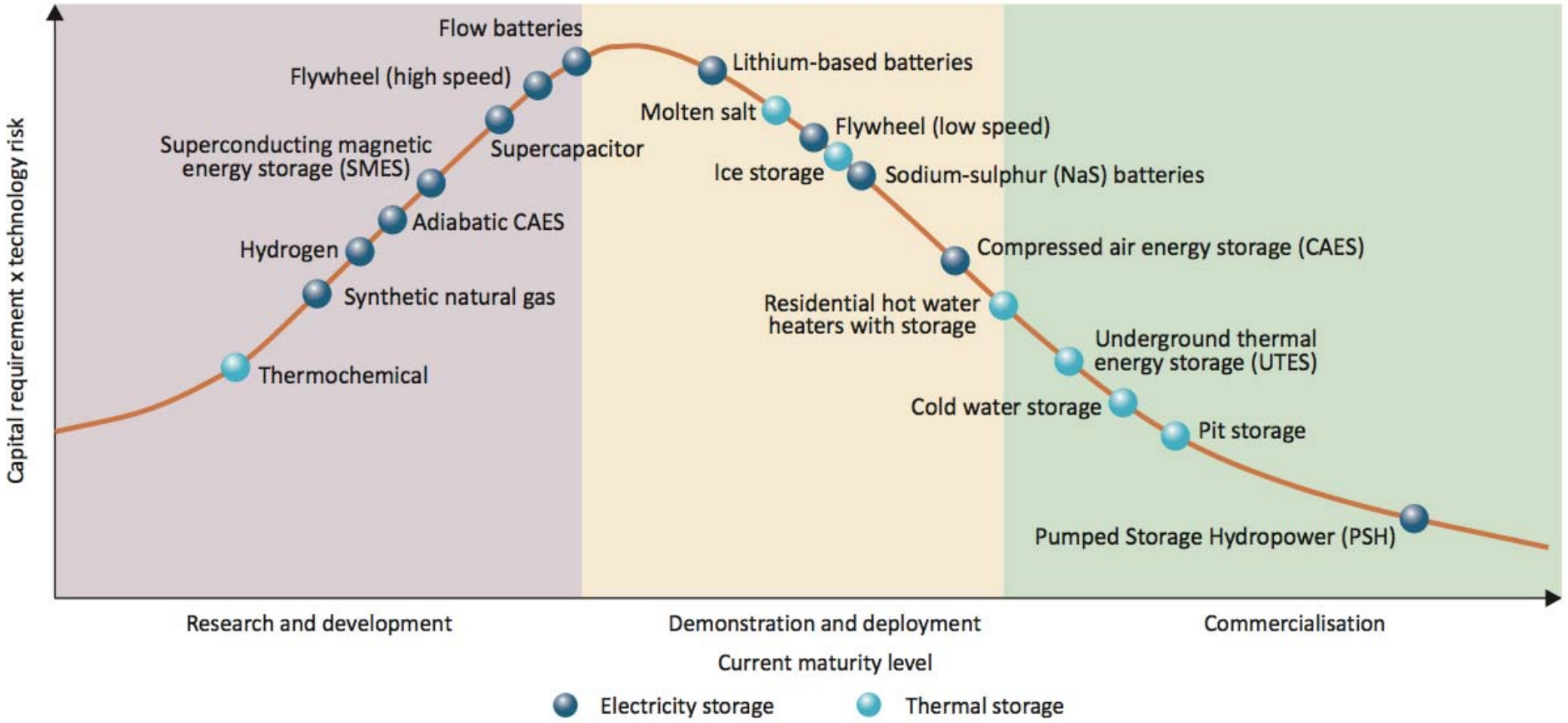


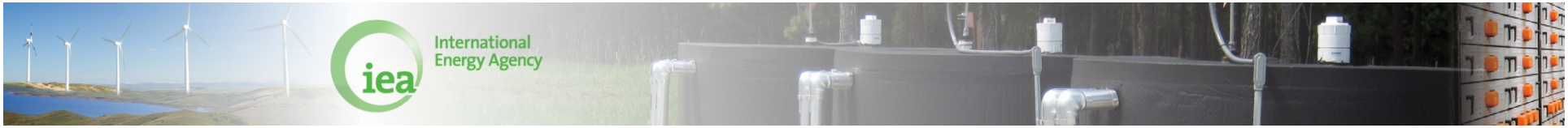
Current grid-connected electricity storage dominated by Pumped Storage Hydropower

Installed capacity in MW



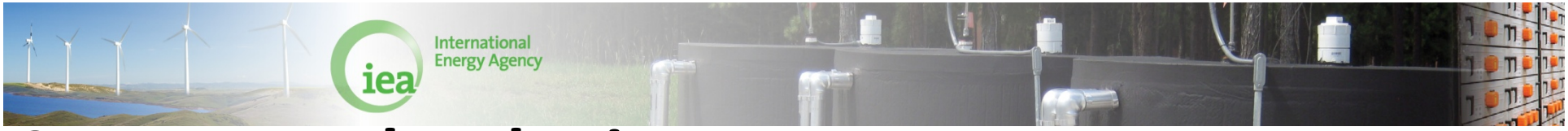
A wide range of storage technologies exists at different stages of maturity





Storage technologies current status

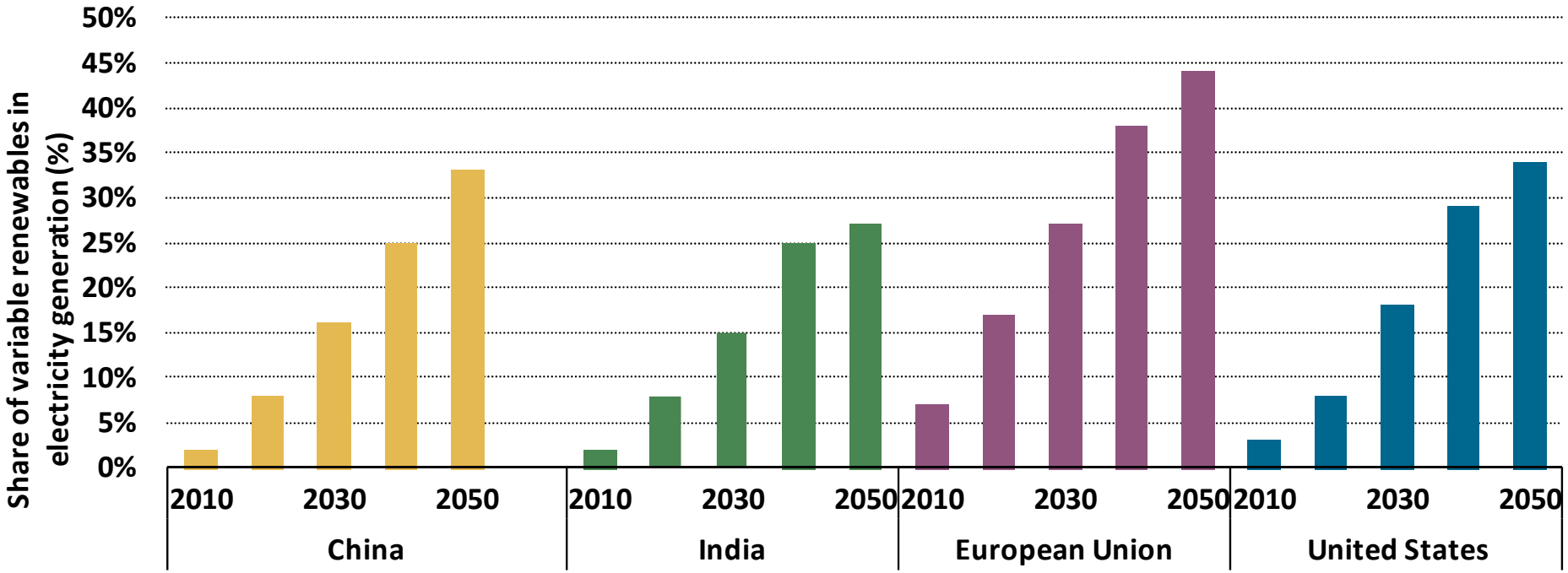
Technology	Location	Output	Efficiency (%)	Initial investment cost (USD/kW)	Primary application	Example projects
Pumped storage hydropower	Supply	electricity	50-85	500 - 4 600	long-term storage	Goldisthal Project (Germany), Okinawa Yanbaru Seawater PSH Facility (Japan), Pedreira PSH Station (Brazil)
Underground thermal energy storage	Supply	thermal	50-90	3 400 - 4 500	long-term storage	Drake Landing Solar Community (Canada), Akershus University Hospital and Nydalen Industrial Park (Norway)
Compressed air energy storage	Supply	electricity	27-75	500 - 1 500	long-term storage, arbitrage	McIntosh (Alabama, USA), Huntorf (Germany)
Pit storage	Supply	thermal	50-90	100 - 300	medium temperature applications	Marstal district heating system (Denmark)
Molten salts	Supply	thermal	40-93	400-700	high-temperature applications	Gemasolar CSP Plant (Spain)
Batteries	Supply, demand	electricity	75-95	300 - 3 500	distributed/ off-grid storage, short-term storage	NaS batteries (Presidio, USA and Rokkasho Futamata Project, Japan), Vanadium redox flow (Sumimtomo Office, Japan), Lead-acid (Notrees Wind Storage, USA), Li-ion (AES Laurel Mountain, USA and Community Energy Storage, Canada), Lithium Polymer (Autolib, France)



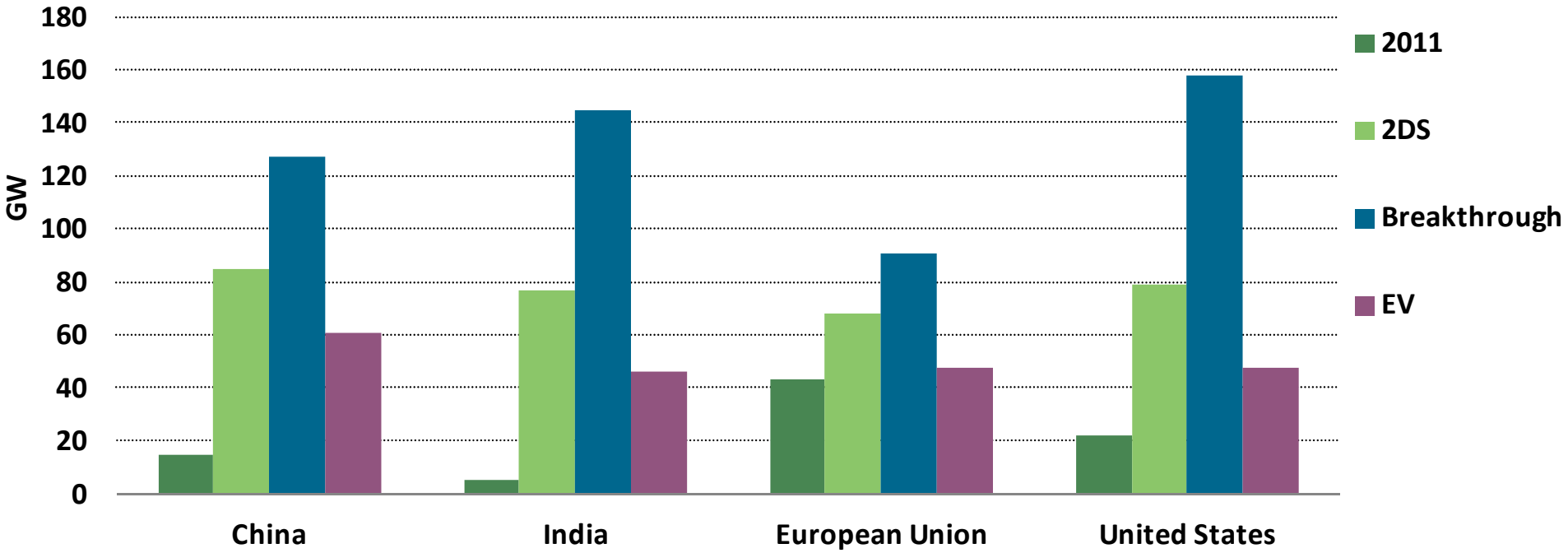
Storage technologies current status

Technology	Location	Output	Efficiency (%)	Initial investment cost (USD/kW)	Primary application	Example projects
Chemical – hydrogen storage	Supply, demand	electrical	22-50	500-750	long-term storage	Utsira Hydrogen Project (Norway), Complementary Systems H2Herten (Germany)
Flywheels	T&D	electricity	90-95	130 - 500	short-term storage	PJM Project (USA)
Supercapacitors	T&D	electricity	90-95	130 - 515	short-term storage	Hybrid electric vehicles (R&D phase)
Superconducting magnetic energy storage	T&D	electricity	90-95	130 - 515	short-term storage	D-SMES (United States)
Solid media storage	Demand	thermal	50-90	500 - 3000	medium temperature	Residential electric thermal storage (USA)
Ice storage	Demand	thermal	75-90	6 000 - 15 000	low-temperature	Denki University (Tokyo, Japan) , China Pavilion project (China)
Hot water storage	Demand	thermal	50-90	-----	medium temperature	Peak demand reduction in France, TCES (United States)
Cold-water storage	Demand	thermal	50-90	300-600	low-temperature	Shanghai Pudong International Airport (China)

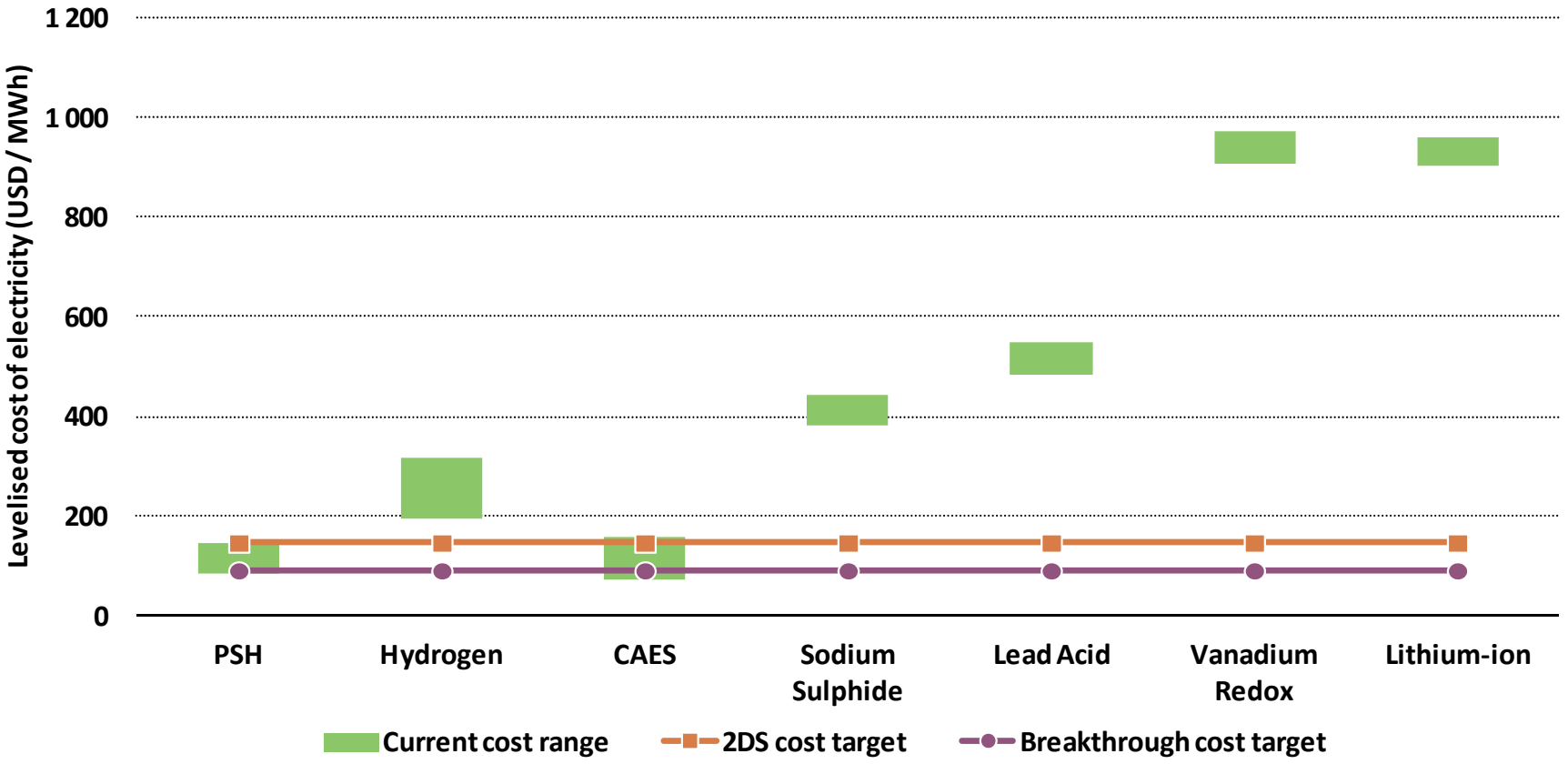
Storage can help to integrate higher levels of variable renewables

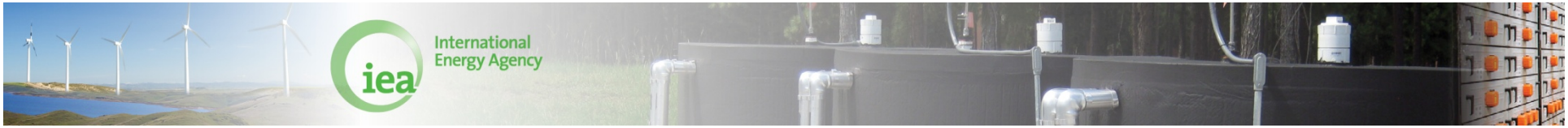


2DS vision for storage in the electricity systems



Sharp Declines in Costs Needed





Actions spanning across technologies and applications

This roadmap recommends the following actions:		*Proposed timeline*
Address data challenges for existing storage projects.	Create an accessible global dataset of energy storage technology project overviews, including information on system specifications, cost and performance with contextual details.	Concentrated effort in the short term (2014-17).
	Quantify waste heat availability and opportunities, including details on waste heat quantity, quality, and location for both resources and potential demand.	Concentrated effort in the short term (2014-17).
Address data challenges for use in assessing future energy storage potential.	Build a comprehensive dataset of renewable generation production with high levels of granularity to allow for assessment across a wide range of energy storage technology applications throughout the year.	Concentrated effort in the short term (2014-20).
	Assess global potential for energy storage deployment in the context of the ETP 2DS vision (technology-independent evaluation).	Longer-term effort (2020-30) after compilation of necessary datasets.
	Quantify distributed energy storage potential in buildings, e.g. domestic hot water heaters, commercial refrigeration centres.	Concentrated effort in the short term (2014-20).
Establish international and national data co-operation to foster energy storage research, monitor progress and assess the R&D bottlenecks.		2018
Support research, development and demonstration (RD&D) projects that incorporate the use of both electricity and thermal energy storage (i.e. hybrid systems) to maximise resource use efficiency, with emphasis on optimising the location/application factor.		Medium-term effort (2020-50).

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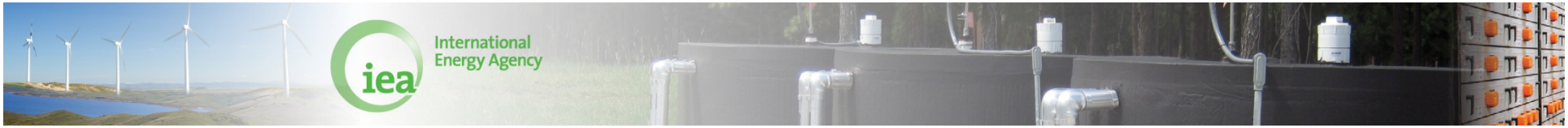


Policy and regulatory frameworks

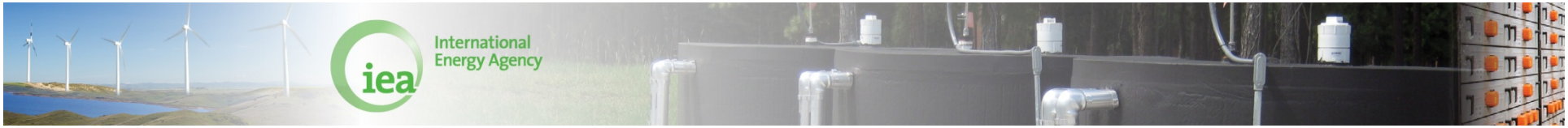
This roadmap recommends that the following actions be taken:	*Milestone*
Eliminate price distortions and increase price transparency for power generation and heat production, e.g. time-of-use pricing schemes, pay-for-services (heating, cooling, quick response, etc.) models.	2020
Enable benefits-stacking for energy storage systems.	2020
Government support of energy storage use in off-grid and remote communities.	2025
Support of the rapid retrofit of existing energy storage facilities to increase efficiency and flexibility, where these retrofits appear warranted.	2030
Inclusion of energy storage technologies as options for supplying energy and power services, and support for their continued development through government-funded R&D programmes.	2030

Roadmap Key Findings

- Storage can support energy system decarbonisation
- Some technologies already competitive, others (particularly electricity storage) still too expensive
- Additional R&D still needed to reduce costs
- Optimal role for storage varies widely across regions
- Power markets are ill-equipped to compensate storage for suite of services they can provide
- Thermal energy storage systems could make better use of wasted heat

Key actions over the next 10 years

- Retrofit existing storage facilities
- Develop markets and regulatory environments that enable accelerated deployment i.e benefits-stacking
- Support targeted demonstration projects and R&D
- Establish a comprehensive set of international standards
- Establish international and national data co-operation
- Complete regional assessments to quantify the value of storage in specific regions and energy markets



DOWNLOAD THE ROADMAP AND ANNEXES AT:

http://www.iea.org/publications/freepublications/publication/name,36573,en.html

FOR ADDITIONAL INFORMATION CONTACT:

TechnologyRoadmapsContact@iea.org