Grid-Scale Energy Storage– Market Applications Outlook

EIA Annual Conference, Washington DC

June 5th, 2018

FLUENCE

A Siemens and AES Company

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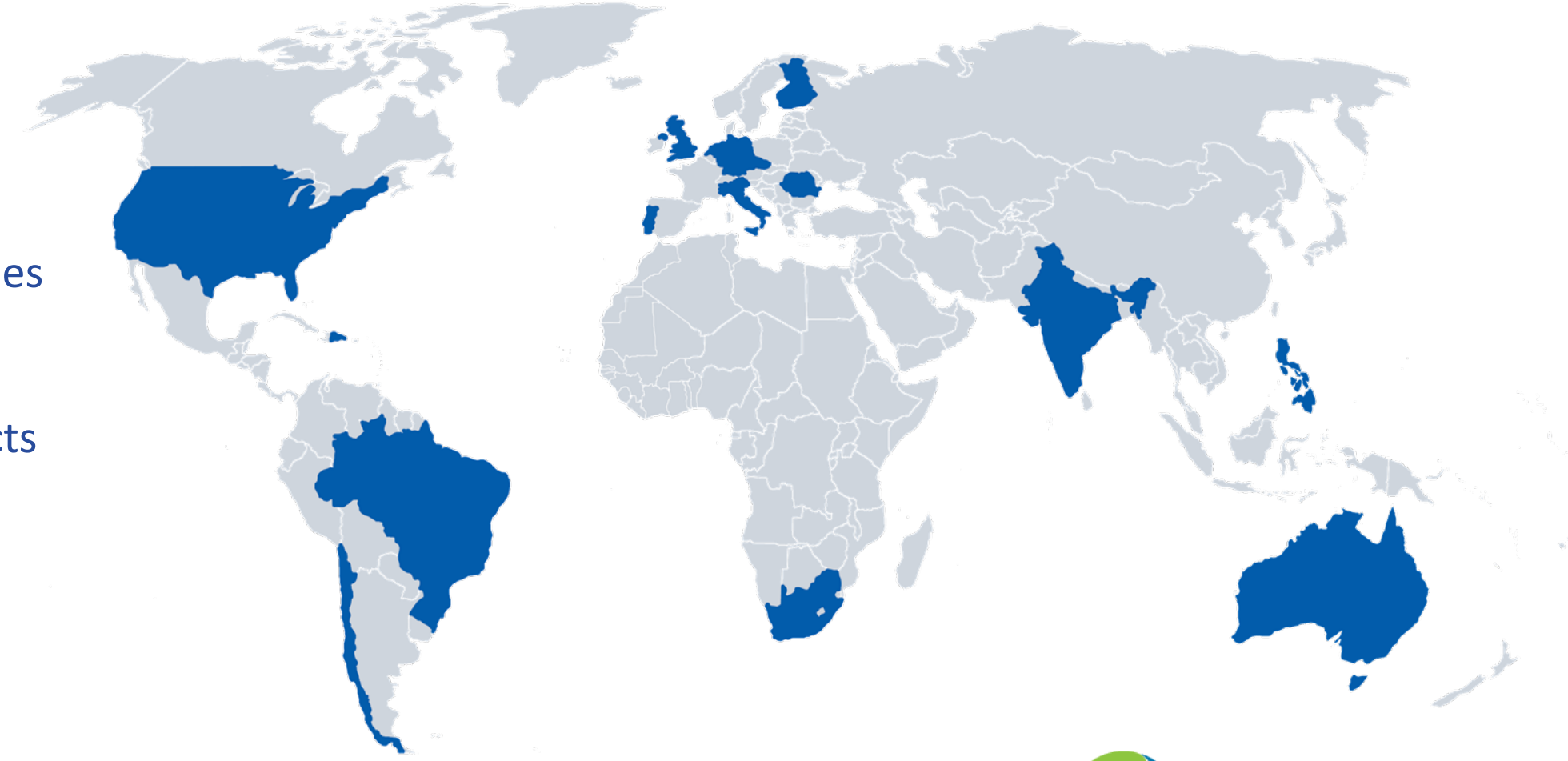
Fluence is the global leader in energy storage

- 10+ Years
- 16 Countries
- 60+ Projects
- 500+ MW



Created and backed by two industry powerhouses

SIEMENS
Ingenuity for life

+

AES
we are the energy

Fluence brings unmatched experience at scale from the partner you can trust

EXPERIENCE

10+ years of experience in energy storage from two proven industry pioneers

- World's leading storage provider
- Deployed or been awarded 57 projects, in 16 countries, 500+ MW

SCALE

Complete technology and service offerings delivered worldwide

- Proven technology platforms that address full spectrum of applications
- Delivery & integration in 160 countries
- Comprehensive services including financing

THE RIGHT PARTNER

Deep understanding of modern power markets, customer needs, and local market challenges

- Collaborate with customers to solve their energy challenges
- Avoid pitfalls of inexperienced packagers and integrators
- Strong financial backing and industry staying power

Created and backed by two industry powerhouses

SIEMENS Ingenuity for life + AES we are the energy

Fluence: Proven technology platforms and comprehensive services

Built on a rock-solid foundation of 10+ years of lessons learned in designing, deploying, and operating complete energy storage solutions for commercial & industrial customers, utilities and developers

Technology Platforms

Siestorage®

Lightning fast energy.
Trusted for critical loads.

Advancion®

Unmatched dependability.
Designed to evolve.

SunFlex Energy Storage™

Maximum solar yield.
Delivered when you want it.

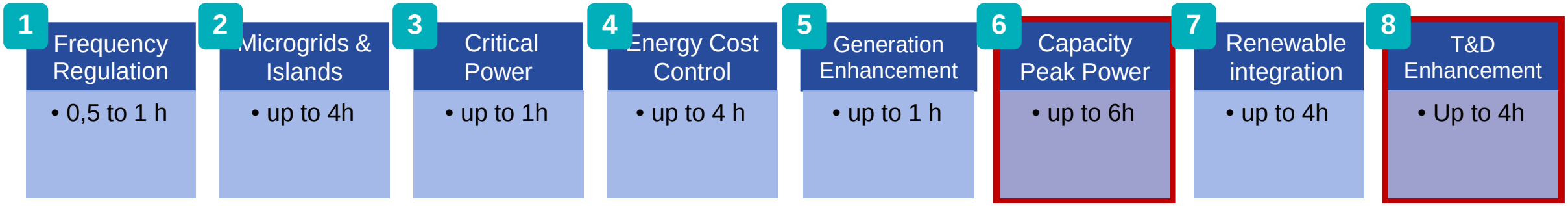
Services

- **Advisory & Analytics**
- **Financing**
- **Deployment**
- **Asset Lifecycle**
- **Education & Training**

8 proven applications for grid-scale energy storage

Today's focus

Multiple economic drivers



30 MW of energy storage for San Diego Gas & Electric, California, United States

Capacity Peak Power

- Largest energy storage project in North America
- 30 MW / 120 MWh
- Contract to online in 6 months
- Sited on 1 acre, where a power plant could not be permitted

Capacity Peak Power

Southern California Edison

Long Beach, California, United States

100 MW / 400 MWh

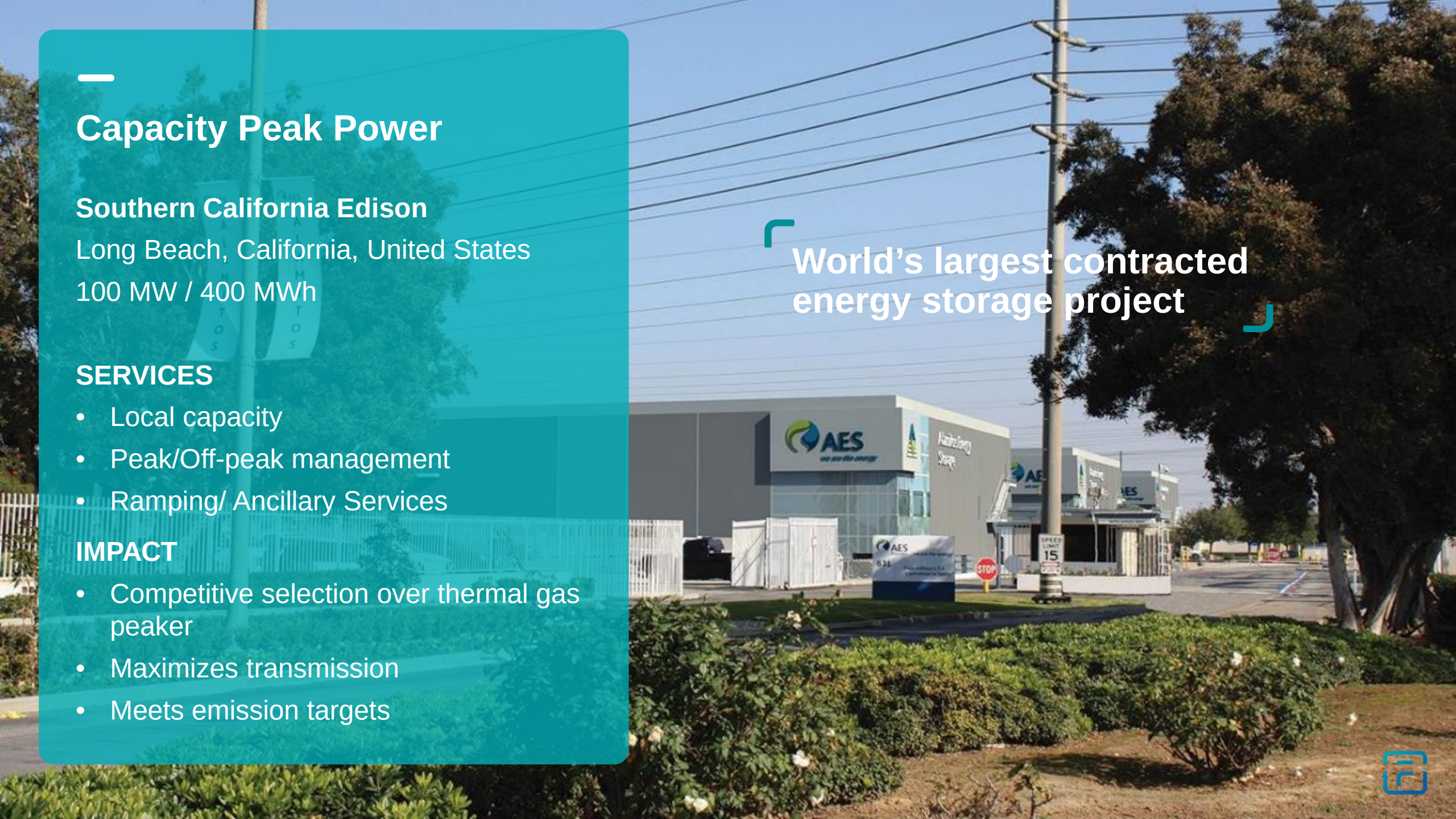
SERVICES

- Local capacity
- Peak/Off-peak management
- Ramping/ Ancillary Services

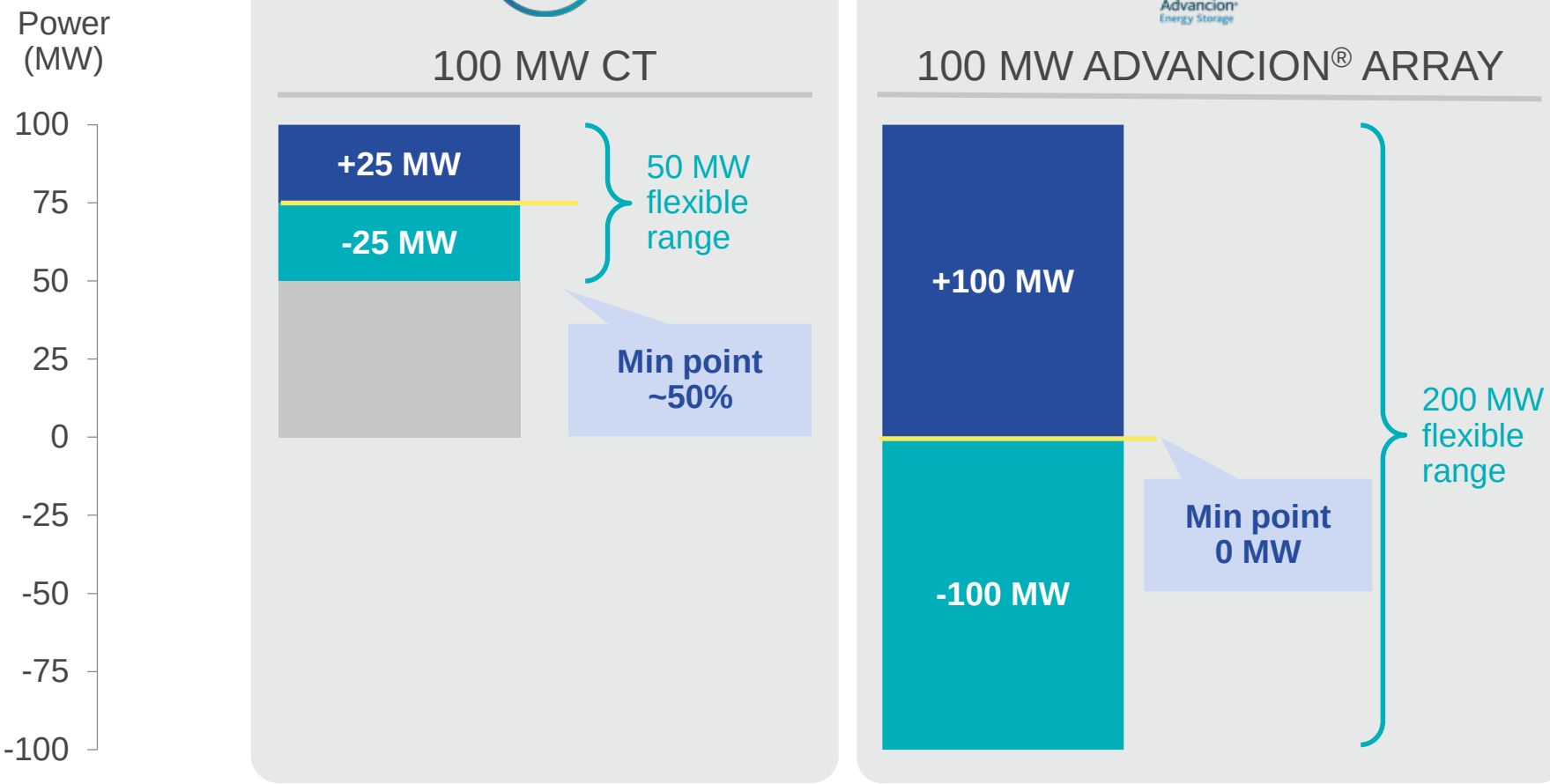
IMPACT

- Competitive selection over thermal gas peaker
- Maximizes transmission
- Meets emission targets

World’s largest contracted energy storage project



Up to 4 x the effective resources and unique operational and siting advantages over thermal peakers



ADVANTAGES OF BATTERY STORAGE

Fast ramp (<2 sec)

Unlimited starts / stops (no cost)

No emissions or water use

Ease of permitting

Rapid deployment

Always synchronized

Public Service New Mexico and Portland General Electric show two ways of depicting the value of storage to their network

PUBLIC SERVICE NEW MEXICO (PNM)

- Reduced renewables curtailment
- Reduced lost load

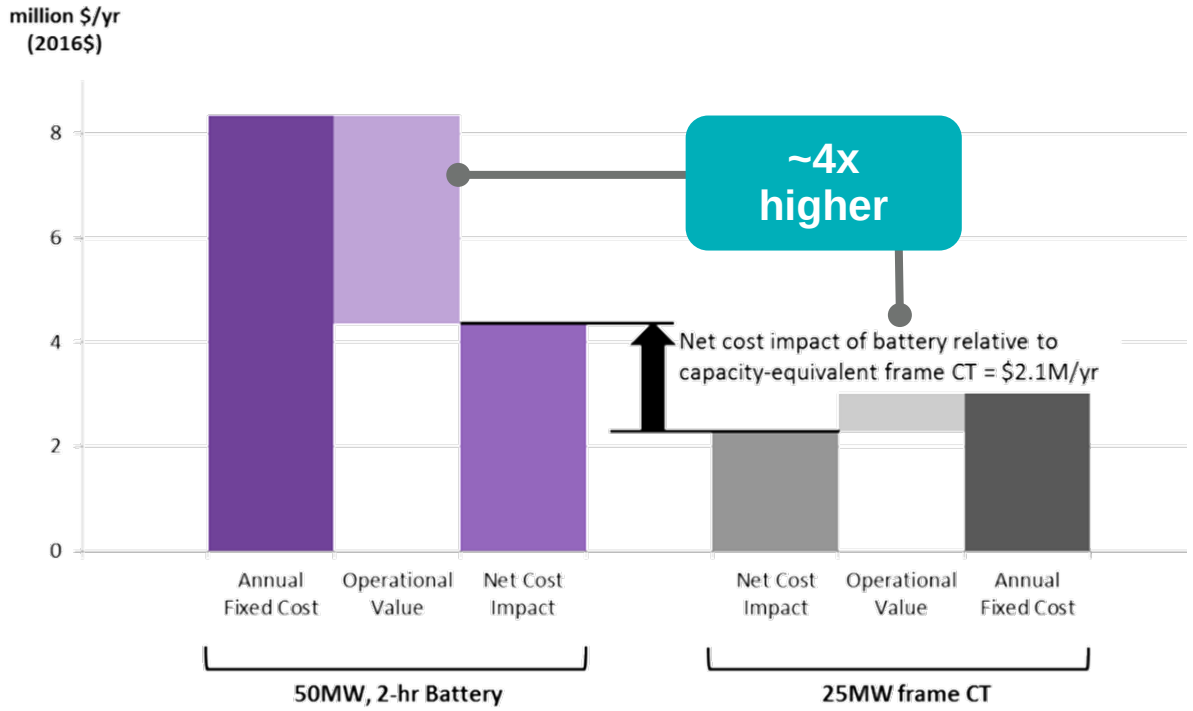
PNM Balance Area Costs

	Millions
Base Case	520.07
Base Case and 2 LM6000 (80 MW)	517.14
Base Case and 100 MW 2-hour storage	503.79
Base Case and 100 MW 4-hour storage	500.73
Base Case and 100 MW 6-hour storage	500.6

~3% reduction

PORTLAND GENERAL ELECTRIC (PGE)

- Storage: ~4x higher operational benefits
- 2-hr storage vs. fossil comparison



Best practices are emerging in assessing the value of storage within utility network

BEST PRACTICE	DESCRIPTION	RESOURCES AND EXAMPLES
NET COST OF CAPACITY CALCULATION	• This approach assesses the benefits and costs of storage and peakers, fully accounting for system needs, market rules, and technical performance • Requires sub-hourly load data to fully capture dispatch patterns	• ESA IRP primer (v2.0 to be released in soon)
LOSS OF LOAD EXPECTATION DUE TO LACK OF FLEXIBLE CAPACITY	• Load loss can be due to lack of flexible resources is a threat, particularly as intermittent renewables increase penetration • Best practice modeling breaks out Loss of Load Expectation for both aggregate capacity shortfall as well as lack of flexible capacity	• Indicative modeling solutions include Astrape's SERVM, E3's RECAP

Utilize all-source procurements to ensure maximum customer benefits across the potential solution set

GUIDING PRINCIPLES

Define the underlying need and performance requirements without specifying technical solution

Define evaluation methodology

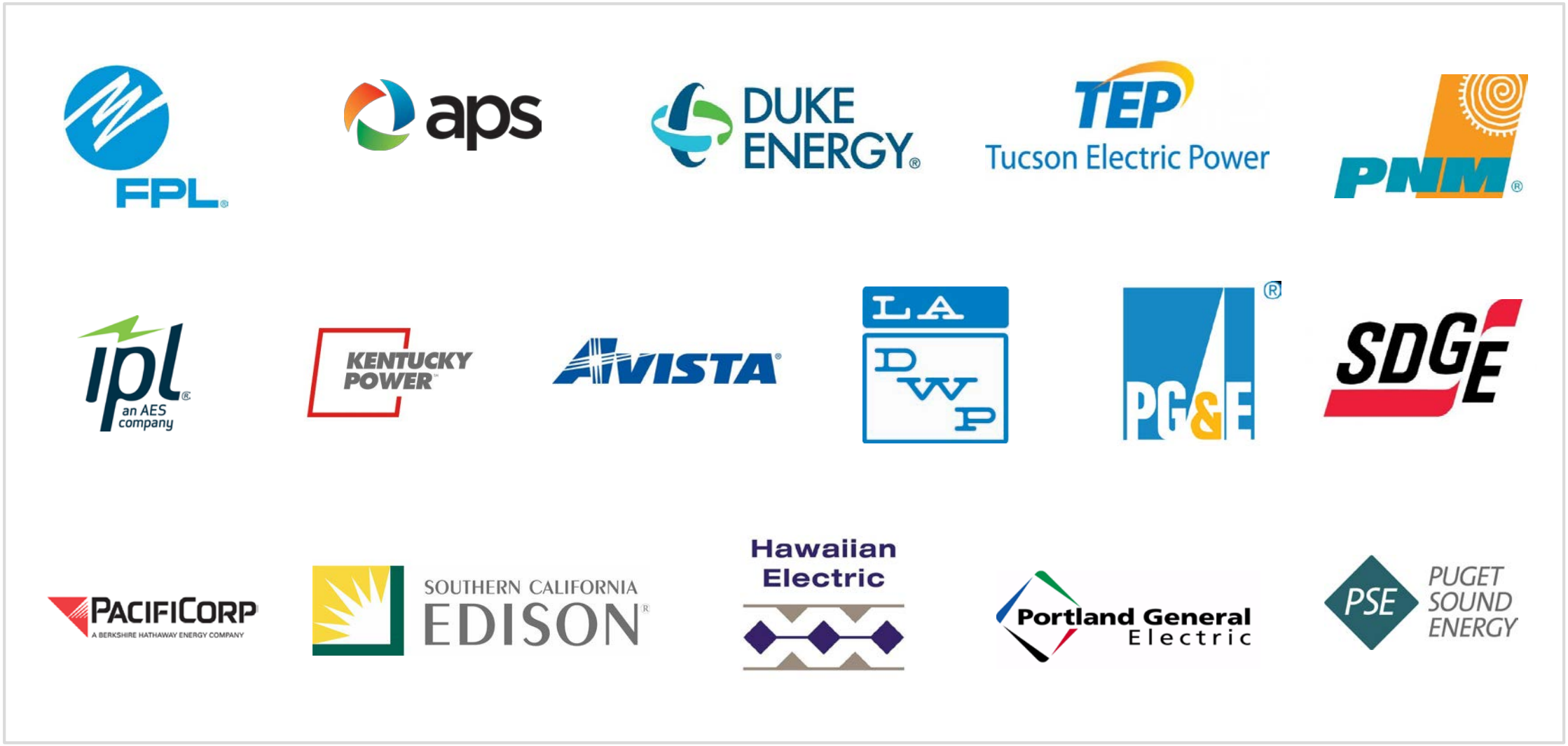
Solicit competitive bids across technologies and **pick the winner(s) based on performance and evaluation criteria**

IN PRACTICE

(PNM's 2023 Generation RFP)

PNM's 2017 IRP has identified the **need for additional flexible capacity as the result of the planned retirement of SJGS and the growth of variable energy resources ("VERs") on PNM's system**. This RFP is intended to address the need for the addition of 456 MW of identified capacity by no later than June 1, 2023. **The exact MW capacity requirement and the types and sizes of resources** best suited to meet PNM's capacity, energy, and reliability requirements **will be determined through selected modeling and analysis of the resources bid in response to this RFP**, their respective capacity factors, and their ability to satisfy a maximum Loss of Load Event (LOLE) metric of ≤0.2 for both capacity and flexibility within PNM's system.

A growing number of utilities are incorporating storage into their planning and procurement processes



Source: Published IRPs and RFPs

Transmission Enhancement

Punkin Center, Arizona

2 MW / 8MWh

Arizona Public Service (APS)

SERVICES

- Transmission upgrade deferral
- Peak management

IMPACT

- Power reliability at half the cost of a transmission

Distribution Enhancement

Buckeye, Arizona

2 MW / 2 MWh

Arizona Public Service (APS)

SERVICES

- Peak demand management
- Renewable integration

IMPACT

- Support rooftop solar growth
- Manage local feeder reliability
- Alternative to substation upgrades

Thank you

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