

Capacity Credit for Energy-Limited Resources

Use of ELCC in the PSCo ERP

ESIG Fall Conference

October 7, 2021

What We Are Discussing

**2021 Effective Load Carrying Capability Study of Existing and
Incremental Renewable Generation and Storage Resources**
on the
Public Service Company of Colorado System
in support of its
2021 Electric Resource Plan Filing

aka “The ELCC Study”

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Hearing Exhibit 114, Attachment KLS-2_ELCC Study Report
Proceeding No. 21A-____E
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**2021 Effective Load Carrying Capability Study of Existing and
Incremental Renewable Generation and Storage Resources**
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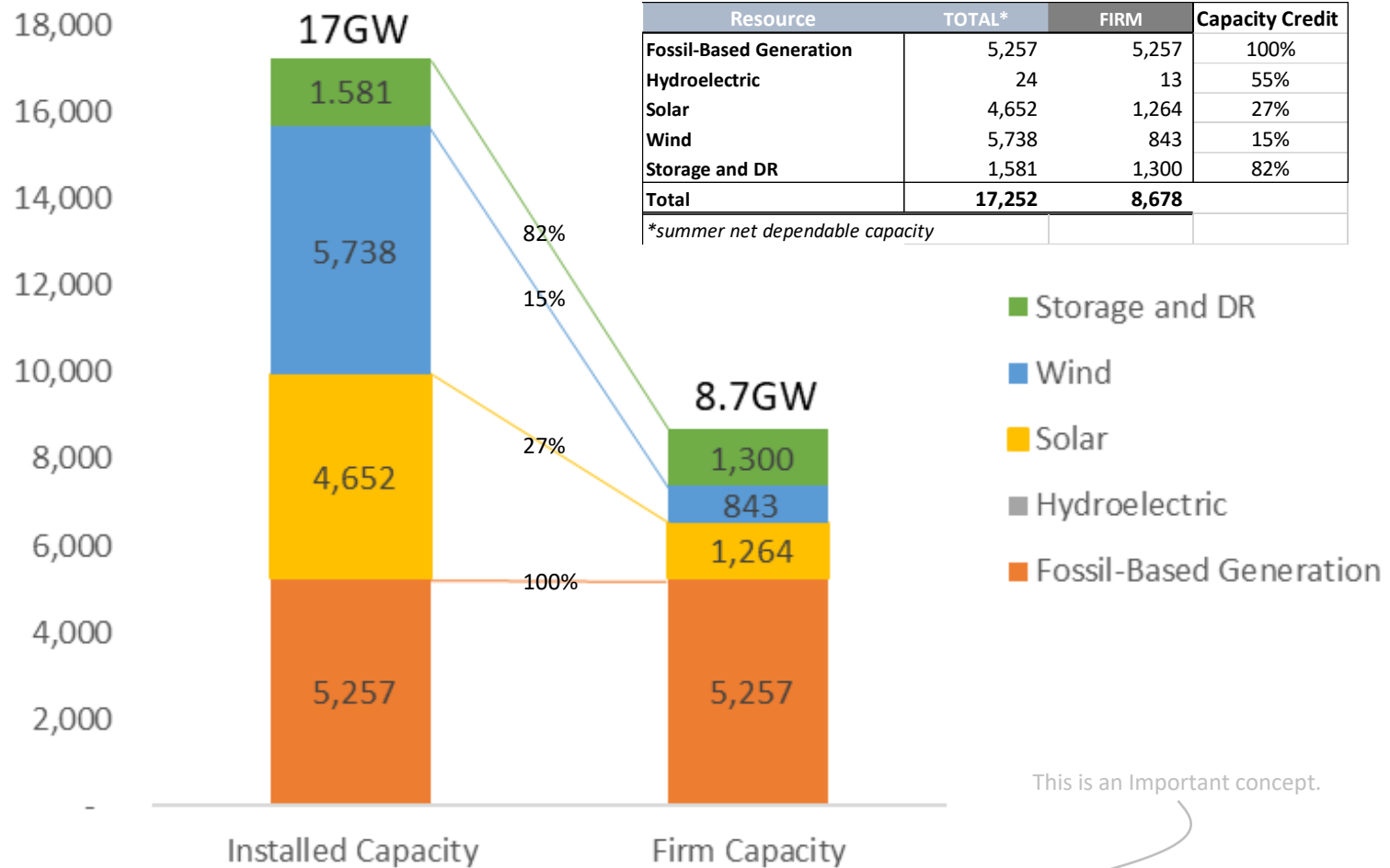
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A Primer: Firm Capacity

PSCo 2030 Preferred Plan



Installed Capacity x Capacity Credit = Firm Capacity

This is an Important concept.

Capacity Credit

- The amount of the installed capacity that counts as firm capacity, often expressed as a percentage (firm/installed)

like this

- Could be a rule of thumb (4hrs = 100%)
- Regulatory designation
- Approximate Generation Method
- **Effective Load Carrying Capability (ELCC)**
 - This is the gold standard

Resource	TOTAL*	FIRM	Capacity Credit
Fossil-Based Generation	5,257	5,257	100%
Hydroelectric	24	13	55%
Solar	4,652	1,264	27%
Wind	5,738	843	15%
Storage and DR	1,581	1,300	82%
Total	17,252	8,678	

*summer net dependable capacity

ELCC is a mathematical method for determining a *reliability-based* capacity credit

The Dataset

- Effective Load Carrying Capacity...
 - 2023 thermal generation capacity, scheduled outages, Hx EFORs
 - Hourly load and renewable generation for six annual periods (2014-2019) carefully grown to 2023 levels and beyond
 - Hourly DR and storage dispatch to maximize LOLP reduction.
 - Calculations are for *incremental* resources of a system flush with wind, solar, and dispatchable energy-limited resources (ie DR, ES)
-

Like Effects Like

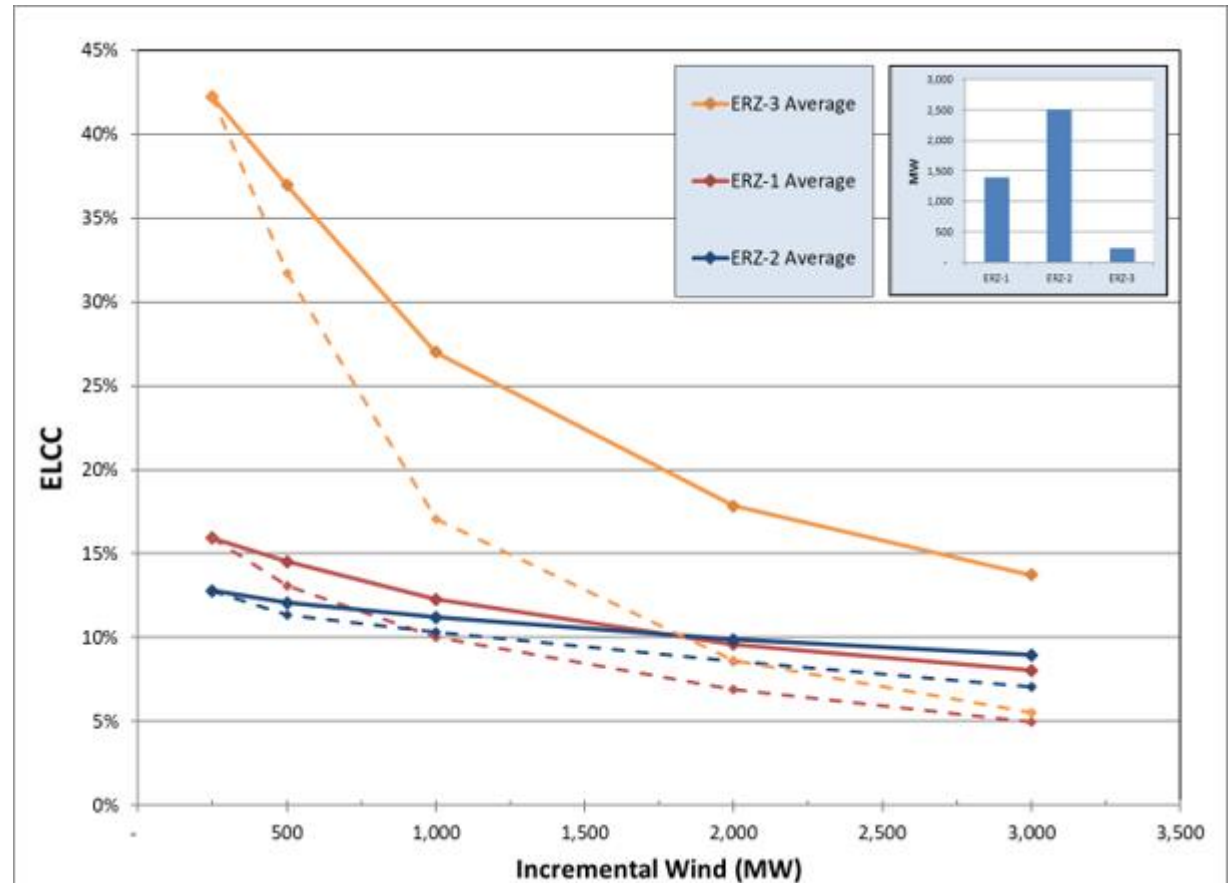
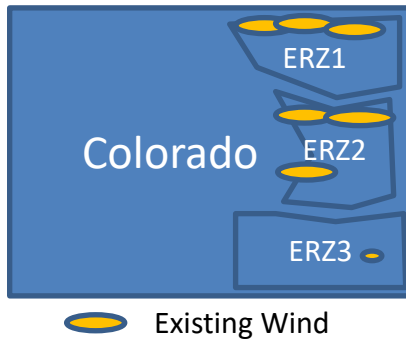
What you will learn...

ELCC changes with increasing penetration of like resource

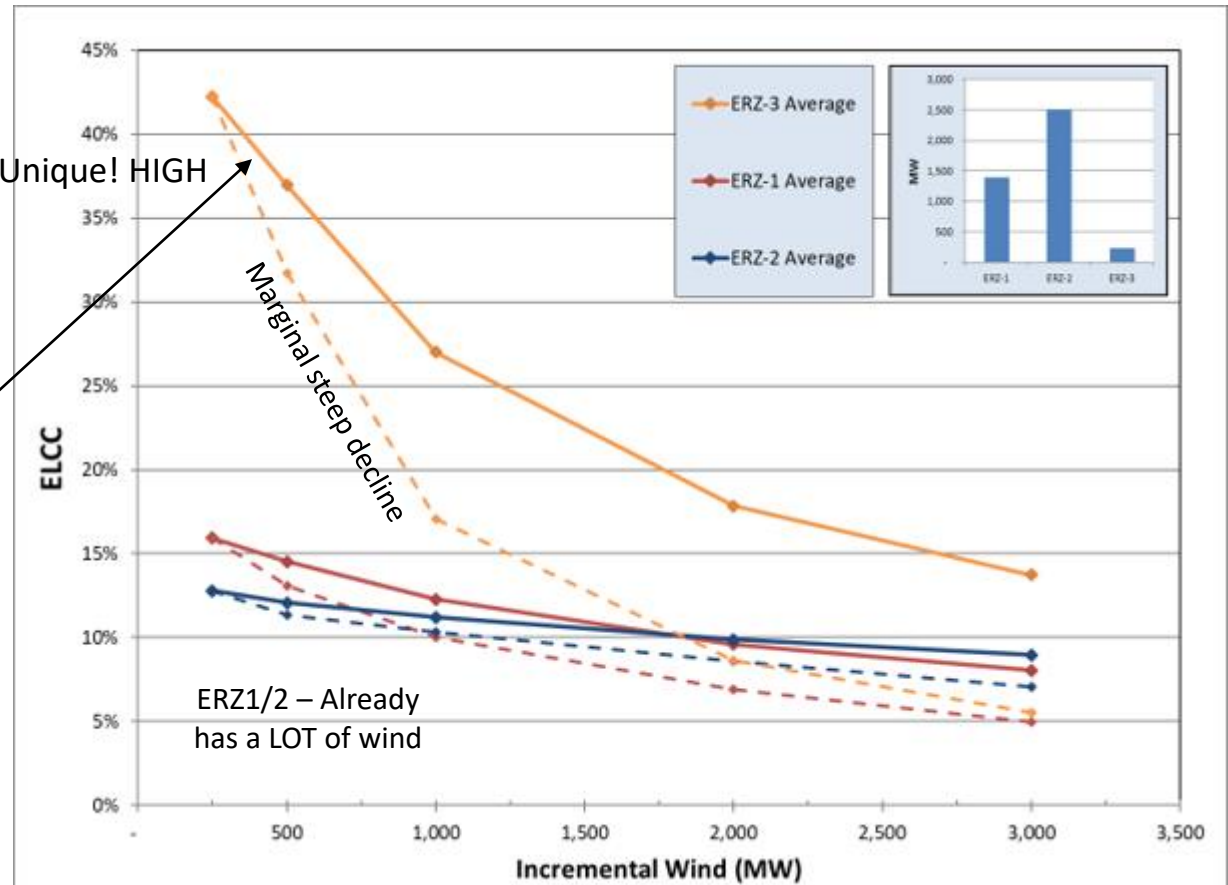
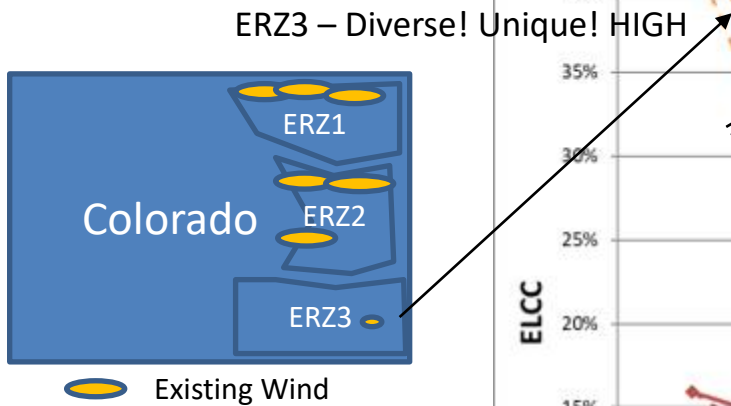
Diversity Matters

RE sited in the same location drives down ELCC faster than a geographically diverse portfolio.

Incremental Wind

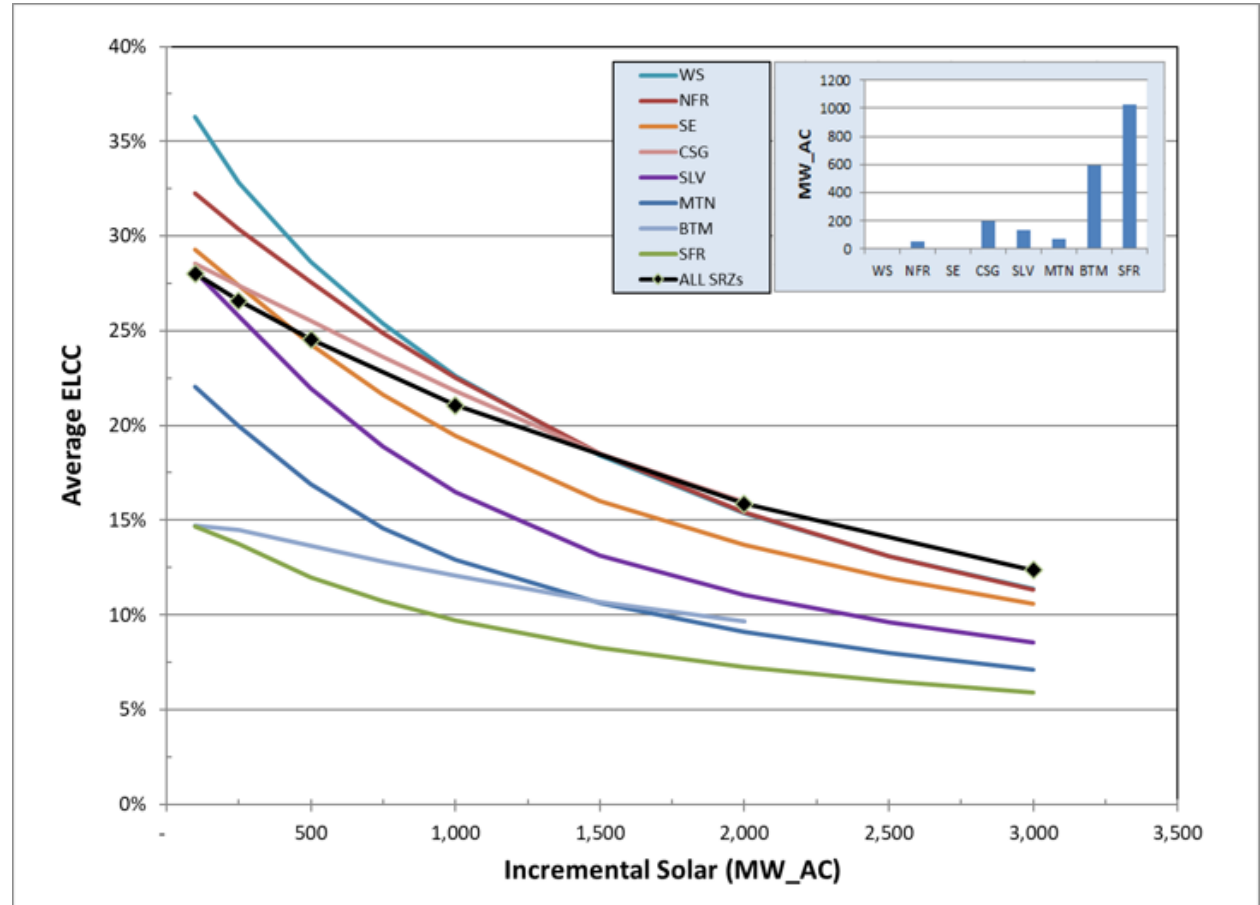
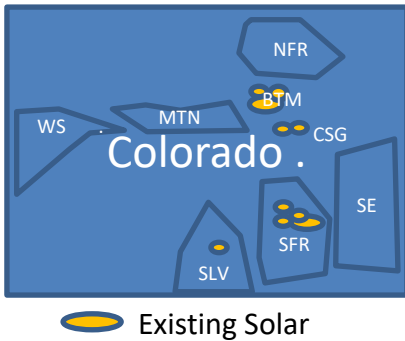


Incremental Wind



More Wind = Declining ELCC →

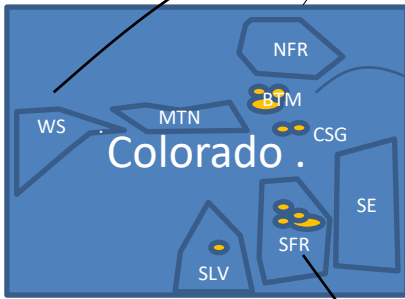
Incremental Solar



Incremental Solar

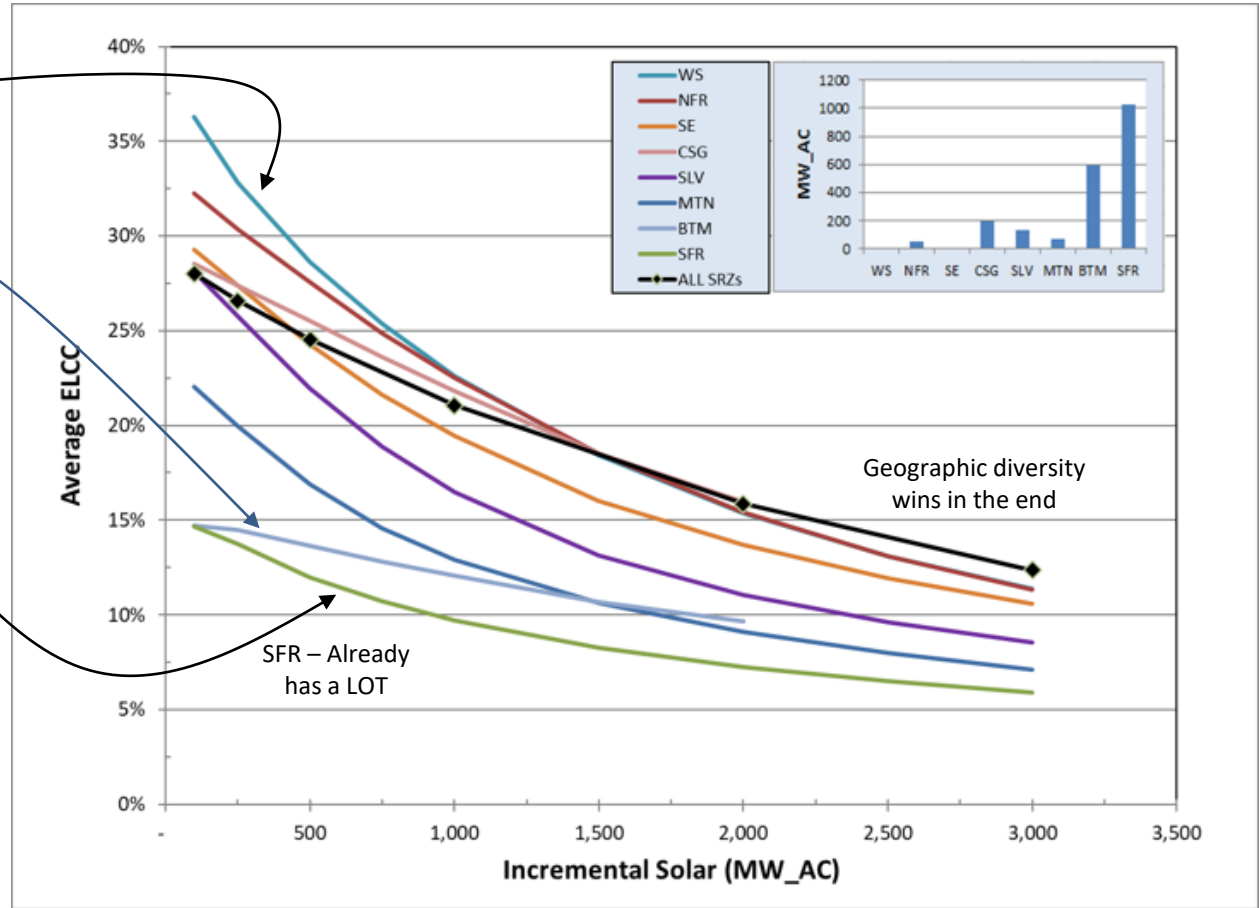
WS/NFR – Diverse! Unique!

HIGH



Existing Solar

BTM (behind the meter) – Concentrated in Denver Metro area; technology disadvantage (fixed pane)

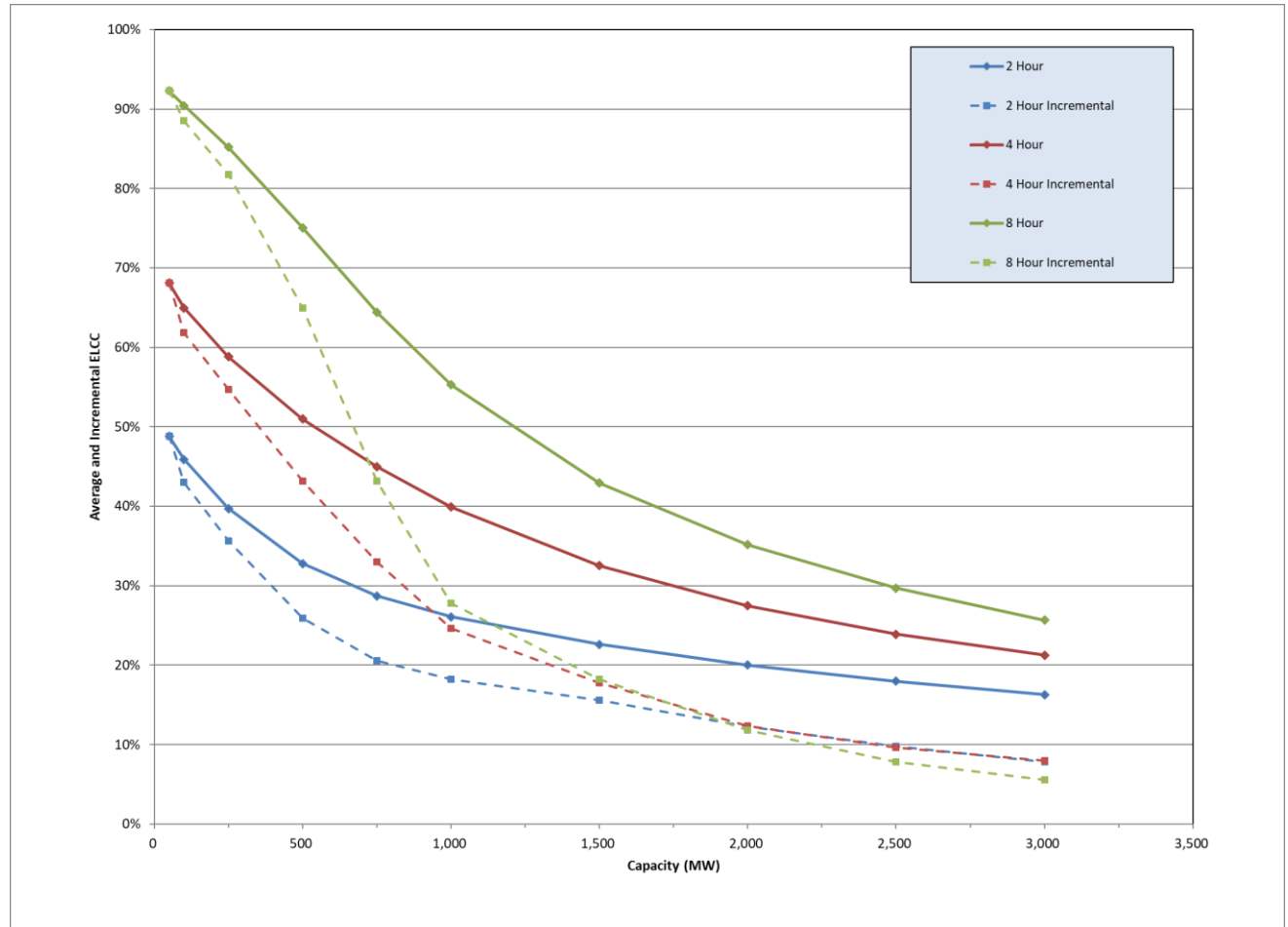


Geographic diversity wins in the end

SFR – Already has a LOT

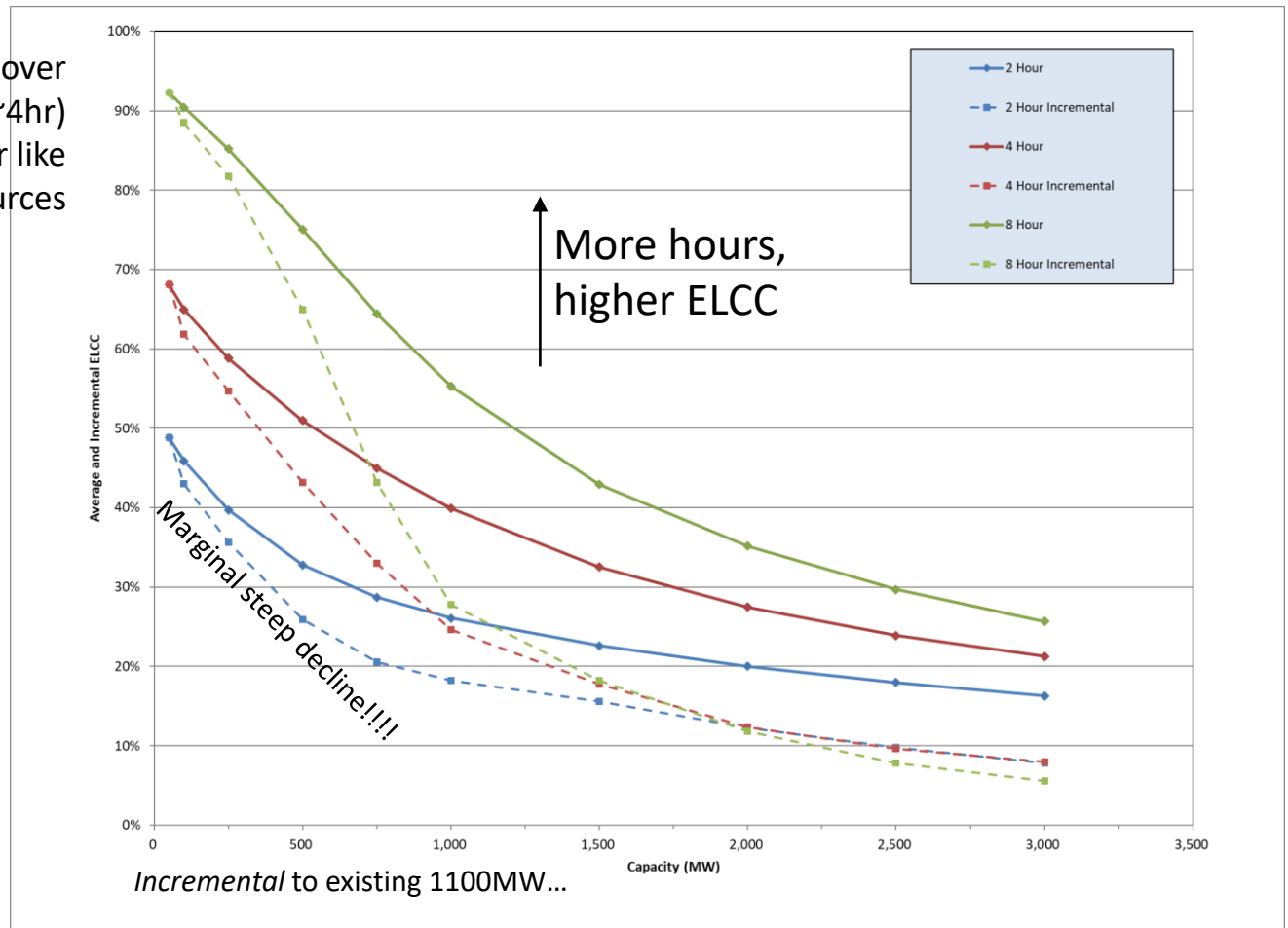
More Solar = Declining ELCC →

Incremental Storage



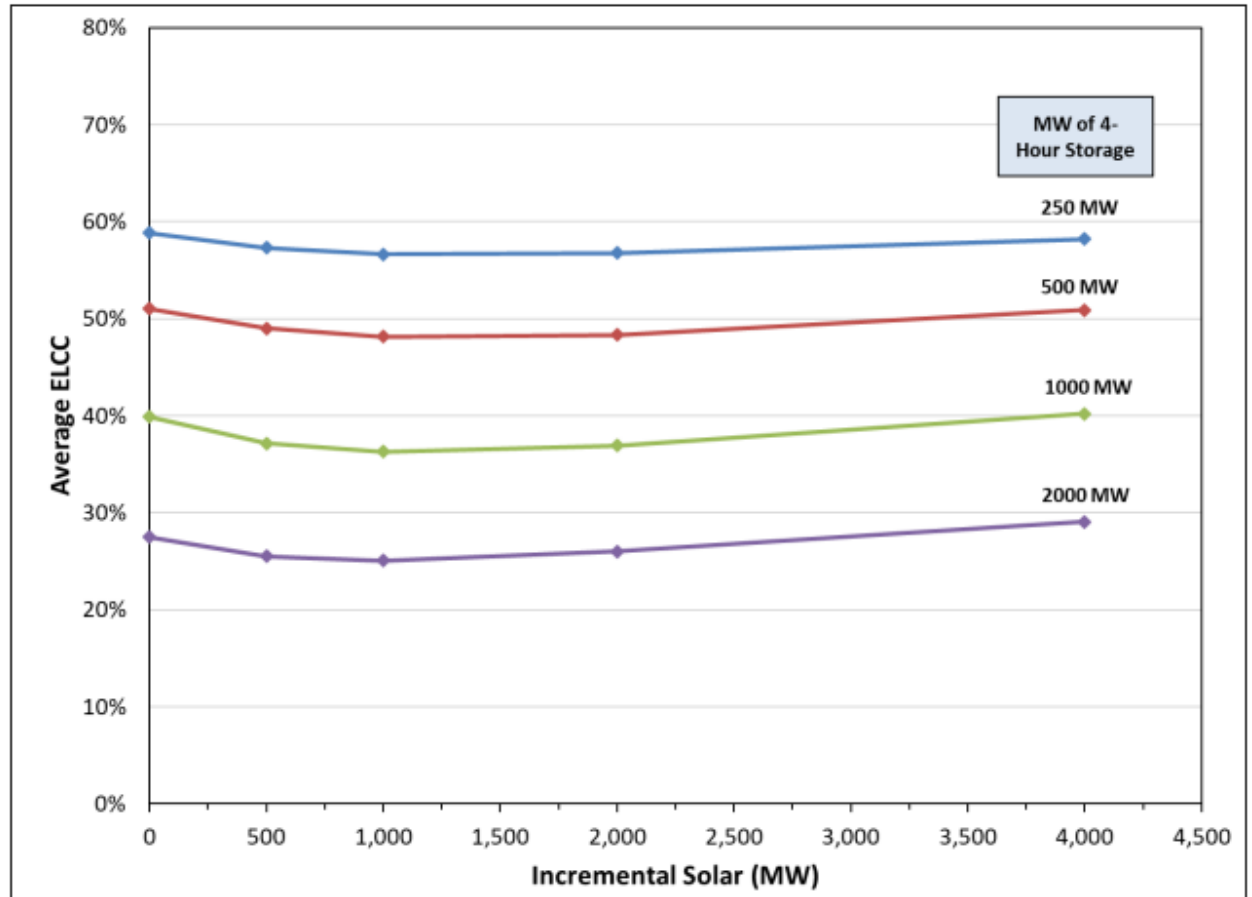
Incremental Storage

Already have over 1100MW of (~4hr) energy storage or like resources

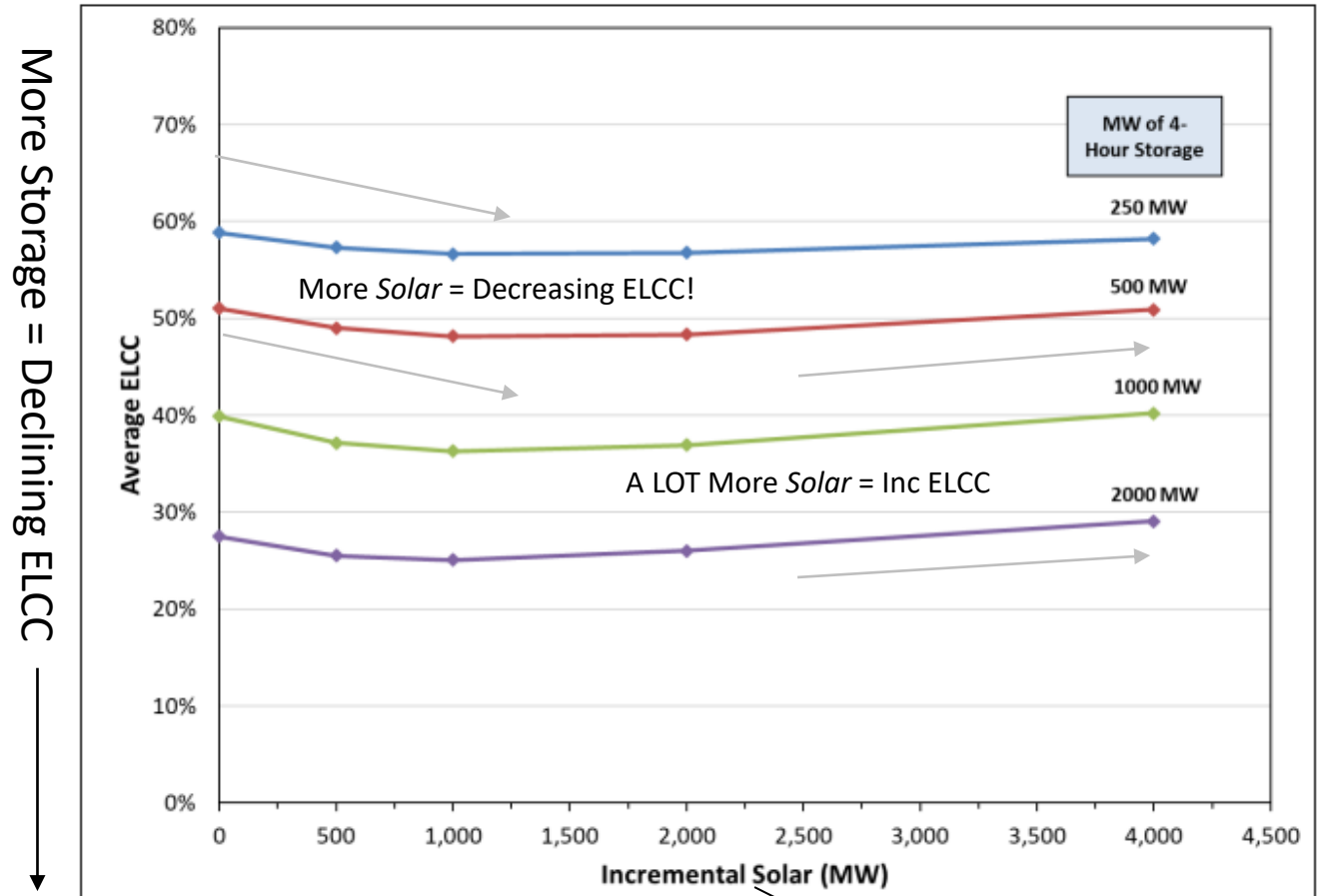


More Storage = Declining ELCC →

Storage and Solar



Storage and Solar



DIVERSIFIED