Item 18

Resource Generation Plan Update

Path to Carbon Free by 2035

November 13, 2023

Order of Presentation

EUC Generation Resource Plan Update

- Overview
- Technology Readiness Assessment
- Scenario Modeling Results
- Initial Recommendations
- Q&A

Overview

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Interim Vice President,
Energy Market Operations
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Current Challenges

Retiring Fayette Power Project

Regulatory / ERCOT Market Changes

Stronger Load Growth

Extreme Weather Events

Increased Market Volatility & Congestion Costs

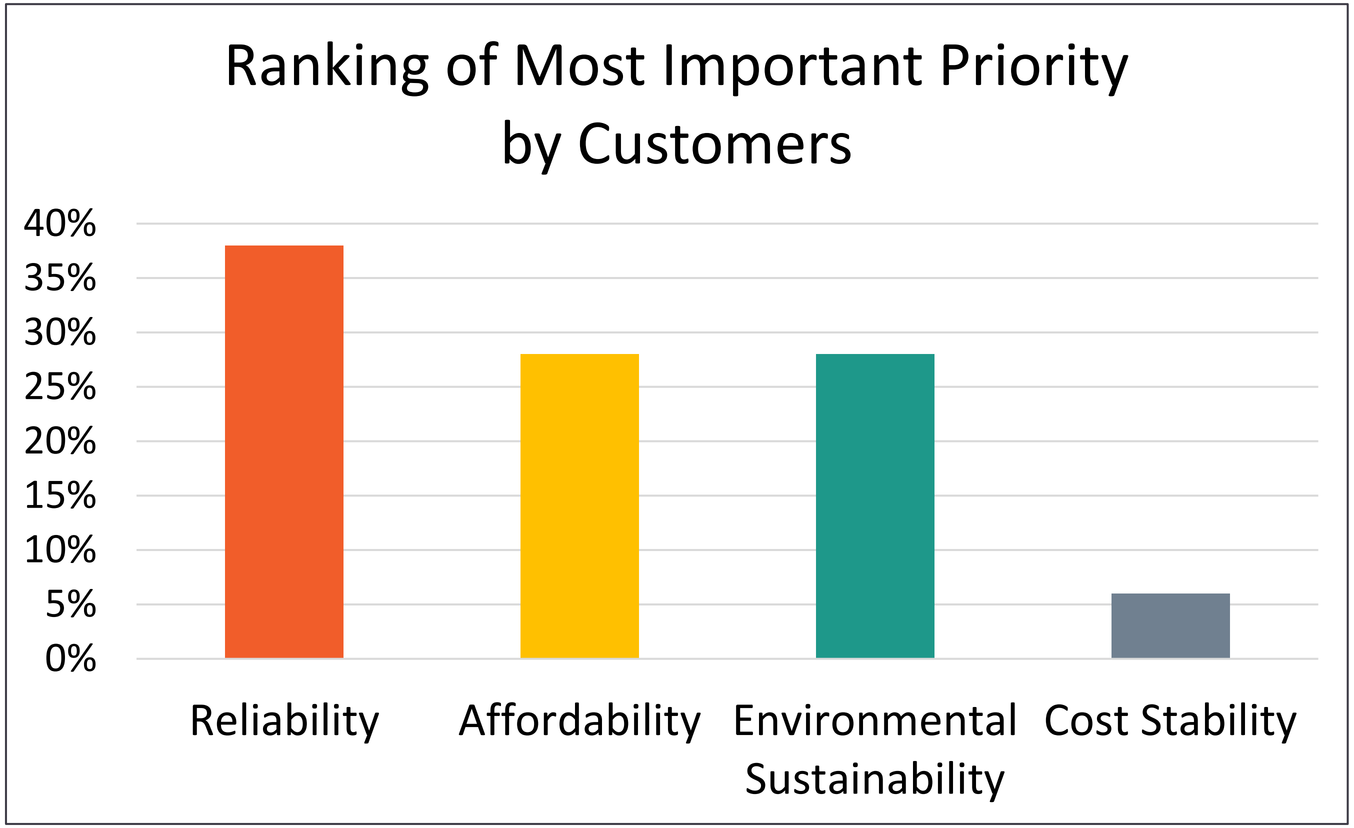
The 2030 Plan

A Quick Overview of the Balance

Environmental Sustainability ⟷ Reliability ⟷ Affordability ⟷ Cost Stability

Customer Survey Results

- 7,512 respondents
- Reliability ranked #1 priority by 38% of respondents
- Open feedback responses echoed customer importance of reliability



Path to Carbon Free by 2035

Austin Energy remains committed to the 2030 Plan's goal of carbon-free generation by 2035

Austin Energy will continue discussions with LCRA to achieve a viable exit to Austin Energy's share of Fayette Power Project

Austin Energy will implement transmission upgrades to increase import capacity

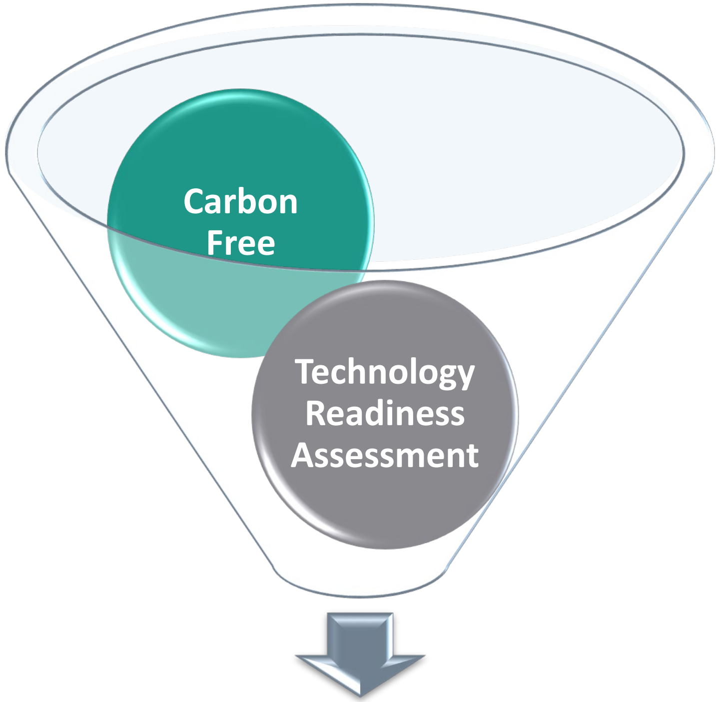
Austin Energy recommends adjusting the goals framework for demand side management to enable expansion and capture full value of programs

Initial assessment indicates a need to add local, dispatchable, hydrogen-capable generation — using natural gas as a near-term bridging solution — to address reliability and affordability risks, and to meet renewable generation goals

Framework for 2030 Plan Update

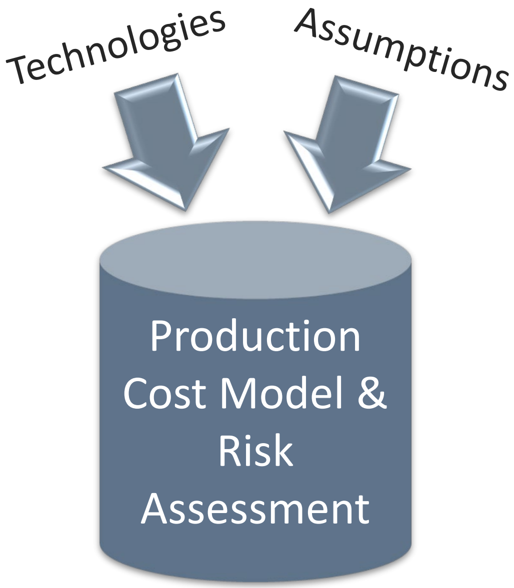
How we get to the proposed generation changes

STEP 1



Technologies to include in Production Cost Modeling & Risk Assessment

STEP 2



Costs for Comparison Purposes

Technologies to include in Resource Gen Plan

STEP 3

Locate sections of 2030 Plan needing technology or process change

Propose updated language based on quantitative and qualitative factors

Plan should maintain flexibility as technologies mature and not include specific quantities

Technology Readiness Assessment

Technology Assessments

Expertise

Assessments were based upon technology write-ups by subject matter experts within Austin Energy.

Consultation

Academics/journal articles, research firms and vendors provided outside consultation.

Criteria

Standards were based off the current Resource Generation Plan.

Scoring

Qualitative scoring for each criteria was assessed:

- Flawed
- Challenged
- Meets Criteria

Summaries

One-pagers with descriptions, breakthrough value/ innovation, market readiness, relative cost and challenges will be provided to the EUC/ Working Group.

Overview

A chart with an overview of the technology assessment scores will show comparative results.

Criteria

Readiness

Will the technology be able to serve as a resource within the 2030 Plan timeframe?

Affordability

Does using the solution at scale allow a high likelihood for meeting affordability goals?

Address Local Congestion

Can it be deployed inside Austin Energy's Load Zone?

Available 24/7

Beyond maintenance outages, can the resource reasonably be expected to meet a call to respond at any time?

Dispatchable

Can the resource respond on-demand to price and load requirements?

Flawed Challenged Meets Criteria

Technology Assessment

Technology groups covered correspond to portfolios of technologies used in scenario modeling

78°

Supply-Side Technologies

Technologies that are on the utility side of the meter and Local Solar

Demand-Side Technologies

Manageable technologies on the customer side of the meter

Other Technologies

Technologies that extend beyond the supply or demand side categories

Portfolio Technologies

Supply Side

- Advanced Nuclear
  small modular reactors
- Geothermal
  production from old oil & gas wells
- Local Distribution Battery Energy Storage Systems
  short duration <4 hrs.
- Local Distribution Battery Energy Storage Systems
  long duration >4 hrs.
- Hydrogen Capable Combined Cycle Generators
- Remote Transmission Battery Energy Storage Systems
- Local Solar

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Portfolio Technologies

Demand-Side Management

- Demand Response
- Customer-Sited Battery Energy Storage Systems
- Managed Charging of Electric Vehicles
- Distributed Energy Resource Management Systems (DERMS), including Virtual Power Plants

Portfolio Technologies

Other

- Carbon Capture & Sequestration
- Energy Efficiency
- High Efficiency Appliances
  - Induction Cooking
  - Heat Pump Systems
    - Water Heaters
    - Heating, Ventilation and Air Conditioning (HVAC)
    - Clothes Dryers
- Composite Conductor Transmission Lines

Path to Carbon Zero

Technology	Readiness	Affordability	Address Congestion	Available 24/7	Dispatchable
Supply-Side					
Advanced Nuclear	Flawed	Flawed	Challenged	Meets Criteria	Challenged
Geothermal	Challenged	Challenged	Flawed	Meets Criteria	Challenged
Local Dist. BESS- short duration	Meets Criteria	Challenged	Meets Criteria	Challenged	Meets Criteria
Local Dist. BESS- Long duration	Meets Criteria	Challenged	Meets Criteria	Challenged	Meets Criteria
Hydrogen Capable Gen.	Meets Criteria	Meets Criteria	Meets Criteria	Meets Criteria	Meets Criteria
Remote transmission-scale BESS	Meets Criteria	Challenged	Flawed	Challenged	Meets Criteria
Local Solar	Meets Criteria	Meets Criteria	Meets Criteria	Flawed	Flawed
Demand-Side Management					
Demand Response	Meets Criteria	Meets Criteria	Meets Criteria	Challenged	Meets Criteria
Customer-sited BESS	Meets Criteria	Challenged	Meets Criteria	Challenged	Meets Criteria
Managed charging	Challenged	Meets Criteria	Meets Criteria	Challenged	Meets Criteria
DERMS	Challenged	Challenged	Meets Criteria	Challenged	Meets Criteria
Other					
Carbon Sequestration	Challenged	Flawed	n/a	n/a	n/a
Energy Efficiency	Meets Criteria	Meets Criteria	Meets Criteria	n/a	n/a
High Efficiency Applicances	Meets Criteria	Challenged	Meets Criteria	n/a	n/a
Transmission-composite conductors	Meets Criteria	Challenged	Meets Criteria	n/a	n/a

■ Flawed ■ Challenged ■ Meets Criteria

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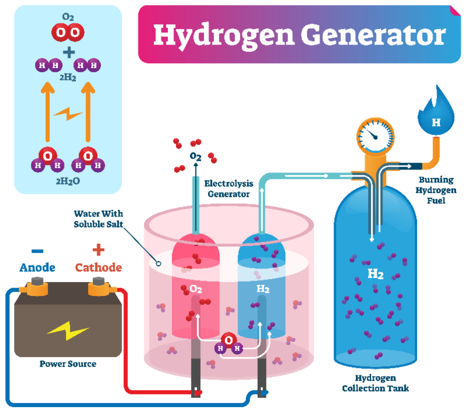
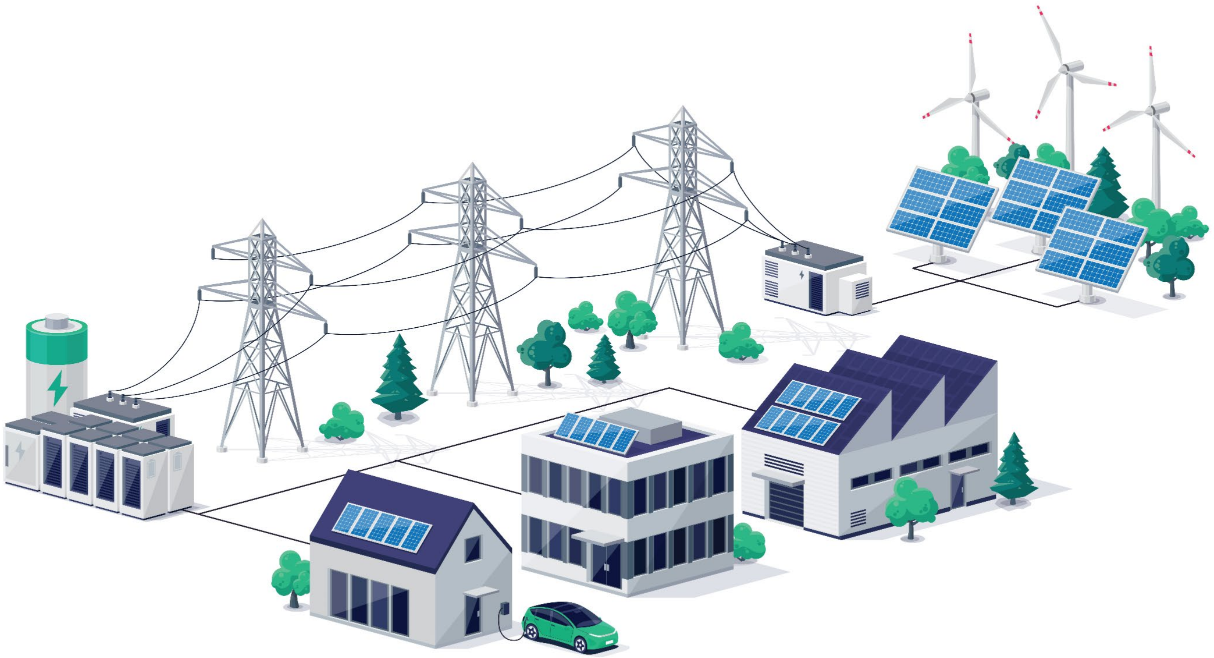
Key Takeaways



Only one technology satisfies all criteria – Hydrogen Capable Generation

No one technology can be looked at to solve all our resource needs



All technologies that meet the readiness criteria (in green) were included in the scenario modeling

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Resource Generation Plan Update

Production Cost Modeling Key Results

S. Babu Chakka

Manager, Energy Market Analysis & Resource Planning

Modeling Approach – Key Terms

Scenarios
"Environments"

- Describe various environments or future states Austin Energy will need to navigate
- Help develop a broad understanding of impacts of generation transitions and load changes inside Austin Energy and across ERCOT

Technologies
"Portfolios"

- Various types of supply and demand resources used to meet the goals and objectives of the plan
- Technologies in various combinations are called portfolios

Sensitivities
"Risk Analysis"

Help broaden understanding of risks as they relate to Austin Energy's power supply cost and system performance

OBJECTIVE: identify the least cost, carbon free, reliable, affordable, optimal path forward for Austin Energy considering risks and uncertainties that might unfold in the future

Modeling Approach – Scenario Environments

To maintain reliability and affordability while still driving toward carbon free, Austin Energy must course correct to navigate several risky environments (scenarios)

Extreme Weather

Weather events comparable to Winter Storm Uri, hot summer and extremely low wind or solar power production

Local Congestion

Conditions that cause local bottlenecks due to import limitations or changes in system conditions

Regulatory Changes

Focuses more on reliability in the face of market design changes such as Performance Credit Mechanism or load serving obligations or creating requirements on generation (cost causation)

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Modeling Approach – Technologies

Austin Energy has studied a variety of technologies in various combinations (portfolios) to assess how they perform against the scenario environments

- Local Solar **LSOL**
- Distributed Storage **DST**
- Carbon Free Generation **HCCC**
- Direct Air Capture **DAC**
- Long Duration Storage **LDST**
- Local Long Duration Storage **LLDST**
- Demand Side Management **DSM**

Technology Portfolio Options

	Portfolio*	Description	Notes
1	CF_2035	Carbon Free by 2035 and meeting renewable goals Includes REACH dispatch	Base Case / Current 2030 Plan
2	CF_2035 without REACH	Carbon Free by 2035 while meeting renewable goals Does not include REACH dispatch	For comparison to Base Case
3	CF_2035 + LSOL	Carbon Free by 2035 with Local Solar	50% behind-the-meter 50% community solar
4	CF_2035 + LDST	Carbon Free by 2035 with Long Duration Storage	8-hour Lithium-ion batteries
5	CF_2035 + HCCC	Carbon Free by 2035 with Hydrogen-Capable Combined Cycle	Green hydrogen-capable combined cycle dispatchable
6	CF_2035 + LSOL + HCCC	Carbon Free by 2035 with Local Solar and Hydrogen-Capable Combined Cycle	A combination of technologies
7	CF_2035 + LDST + HCCC	Carbon Free by 2035 with Long Duration Storage and Hydrogen-Capable Combined Cycle	A combination of technologies

**All Portfolios include Carbon Free by 2035 while meeting renewable goals*

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Technology Portfolio Options (cont.)

	Portfolio*	Description	Notes
8	CF_2035 + LSOL + LLDST + DST	Carbon Free by 2035 with Local Solar, Local Long Duration Storage and Distributed Storage	• Distributed storage is targeted specifically to peak load reduction (4CP) and price spikes • Local long duration storage is 8-hr, sited within Austin Energy's load zone
9	CF_2035 + LLDST + DST + HCCC	Carbon Free by 2035 with Local Long Duration Storage, Distributed Storage, and Hydrogen-Capable Combined Cycle	
10	CF_2035 + LSOL + LLDST + DST + DSM	Carbon Free by 2035 with Local Solar, Local Long Duration Storage, Distributed Storage and Demand Side Management	Considered heavier DSM as all runs already include demand side mgmt in the load forecast
11	CF_2035 + LSOL + LLDST + DST + HCCC	Carbon Free by 2035 with Local Solar, Local Long Duration Storage, Distributed Storage and Hydrogen-Capable Combined Cycle	A combination of technologies

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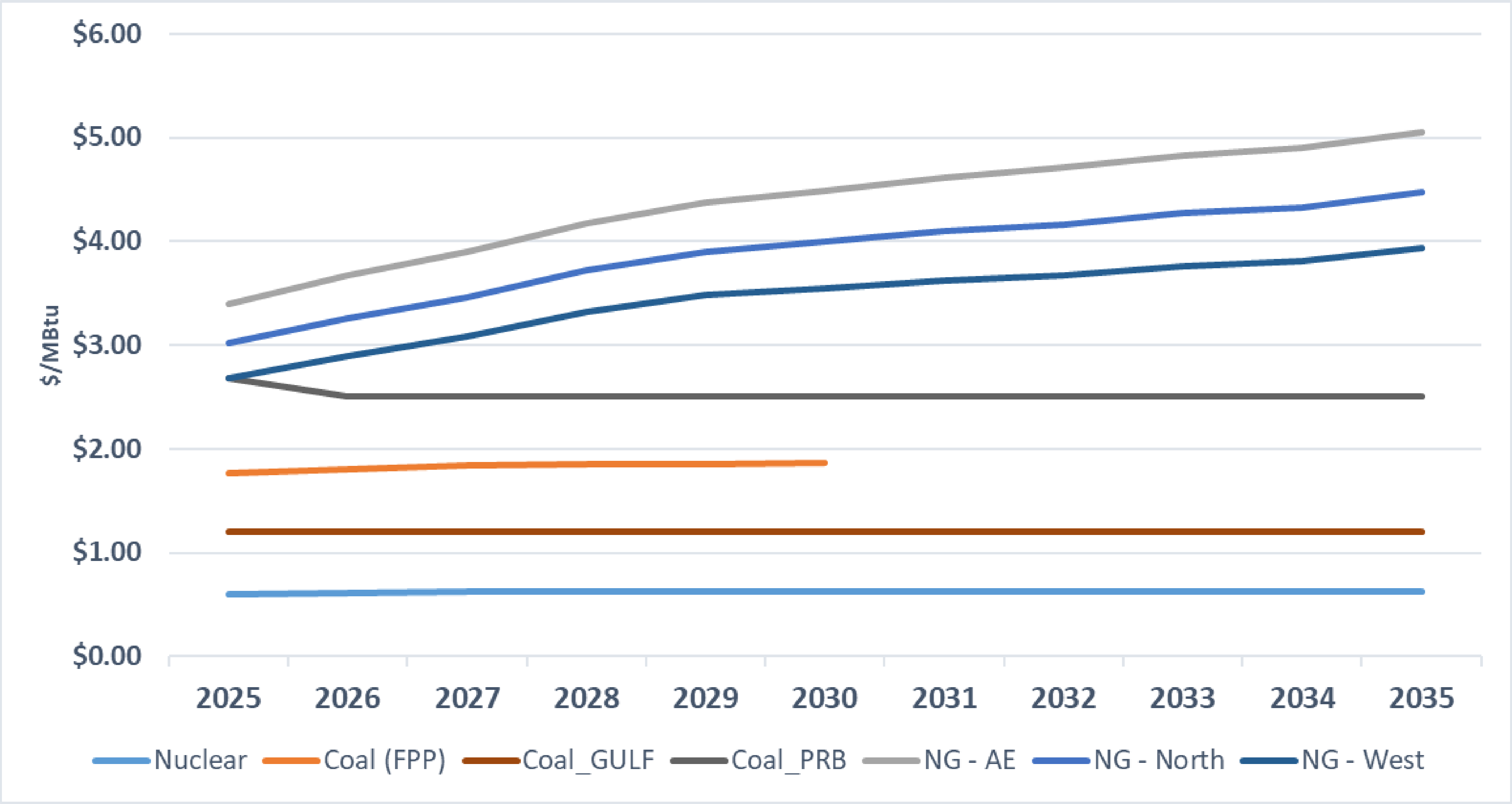
**All Portfolios include Carbon Free by 2035 while meeting renewable goals*

Key Assumptions

Key Assumptions: Technology Costs

Technology	Capital Cost ($/kW)	Variable O&M ($/MWh)	Fixed O&M ($/kW-yr)	First Year Available
Utility Solar	1,097	0	8	2025
Local Solar - Residential	0	99	0	2026
Local Solar - Community	0	92	0	2026
Hydrogen Capable Combined Cycle	1,000 - 1,100	4	11	2026
Battery Storage (2-4 hour duration)	1,099	0	15	2026
Battery Storage (8 hour duration)	2,352	0	15	2026
Demand Response	100 - 200	0	0	2026

Key Assumptions: Fuel Price Projections



**Model assumes Fayette Power Project retirement in 2030*

Key Assumptions

For comparison purposes, the total megawatts (MW) of additions and retirements are the same across all technology portfolio runs

1,000 MW added*

Model includes resource additions to

- Accommodate local generation retirements in model
- Meet future load growth
- Avoid load zone price separation

1,400 MW retired

Model includes retirement of

- 800 MW of local generation by 2035
- 600 MW Fayette Power Project by 2030

**The base case (current 2030 Plan) does not include any additional supply resources*

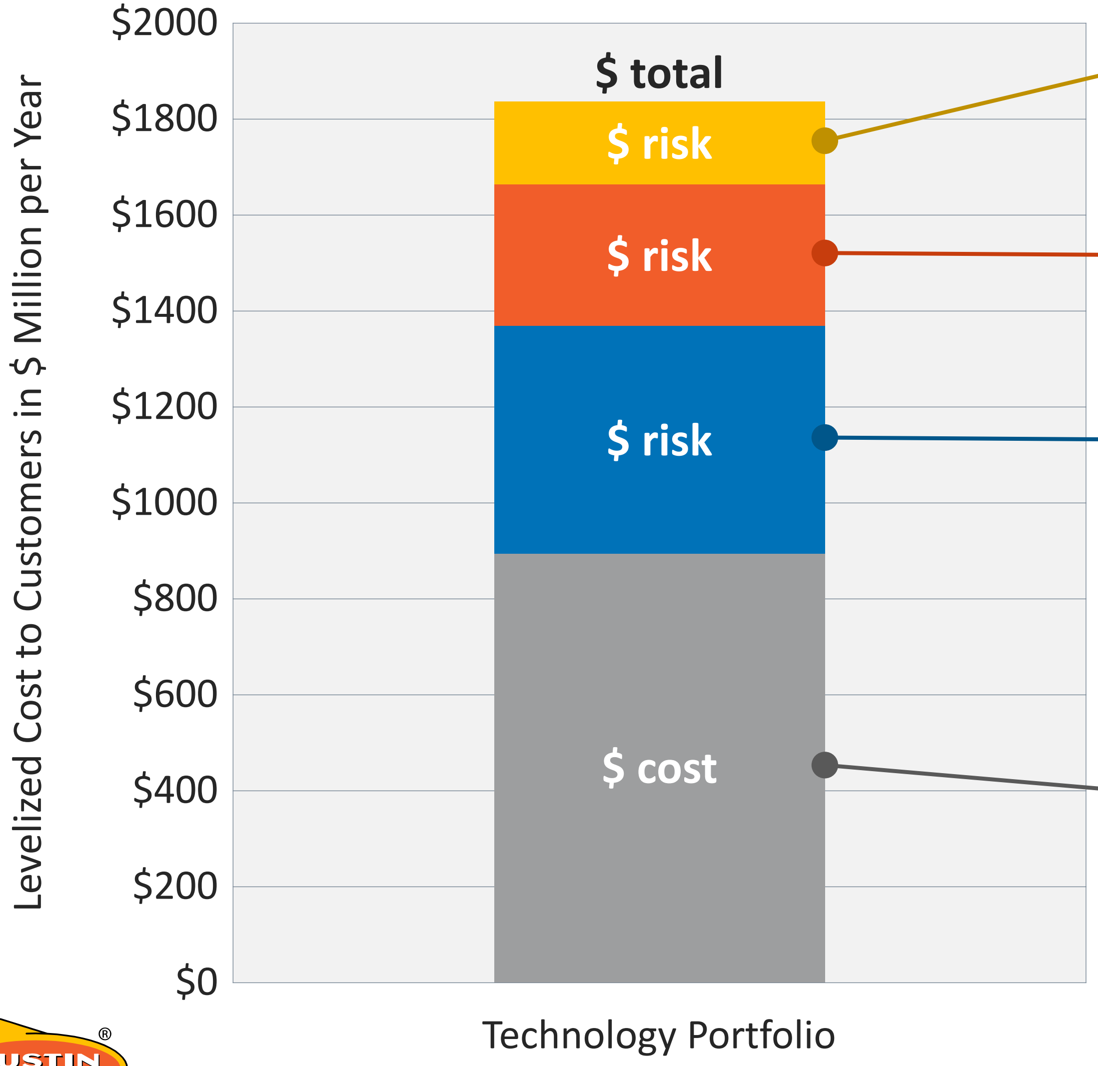
Key Assumptions: New Resource Additions/Retirements

ID	Portfolio	Total Supply Additions Modeled
1	Carbon Free by 2035 (CF_2035, base case for current 2030 Plan)	0%
2	CF_2035 without REACH	0%
3	CF_2035 + Local Solar (LSOL)	100%
4	CF_2035 + Long Duration Storage (LDST)	100%
5	CF_2035 + Hydrogen-Capable Combined Cycle (HCCC)	100%
6	CF_2035 + LSOL + HCCC	20% + 80%
7	CF_2035 + LDST + HCCC	20% + 80%
8	CF_2035 + LSOL + Local LDST (LLDST) + Distributed Storage (DST)	80% + 10% + 10%
9	CF_2035 + LLDST + DST + HCCC	10% + 10% + 80%
10	CF_2035 + LSOL + LLDST + DST + Demand Side Mgmt (DSM)	60% + 10% + 10% + 20%
11	CF_2035 + LSOL + LLDST + DST + HCCC	20% + 10% + 10% + 60%

**All portfolios, except the base cases (1 & 2), include 1000 MW of supply additions and 1400 MW of retired generation resources*

Result Summaries

Results Summary – The Framework



Quantifies the additional annual risk (cost) to customers due to **market rule changes**, based on portfolio's Effective Load Carrying Capability (ELCC)

Quantifies the additional annual risk (cost) to customers for a particular technology portfolio due to **local congestion**

Quantifies the additional annual risk (cost) to customers for a particular technology portfolio under **extreme weather conditions** in any given year

Quantifies the **annual levelized cost to customers** for a particular technology portfolio under normal conditions

This includes the capital and O&M costs of new supply resources and the removal of O&M of existing supply resources when they are retired

For comparison purposes, the current power supply cost to customers is approximately $585 million per year

Results Summary – The Current 2030 Plan (Base Case)

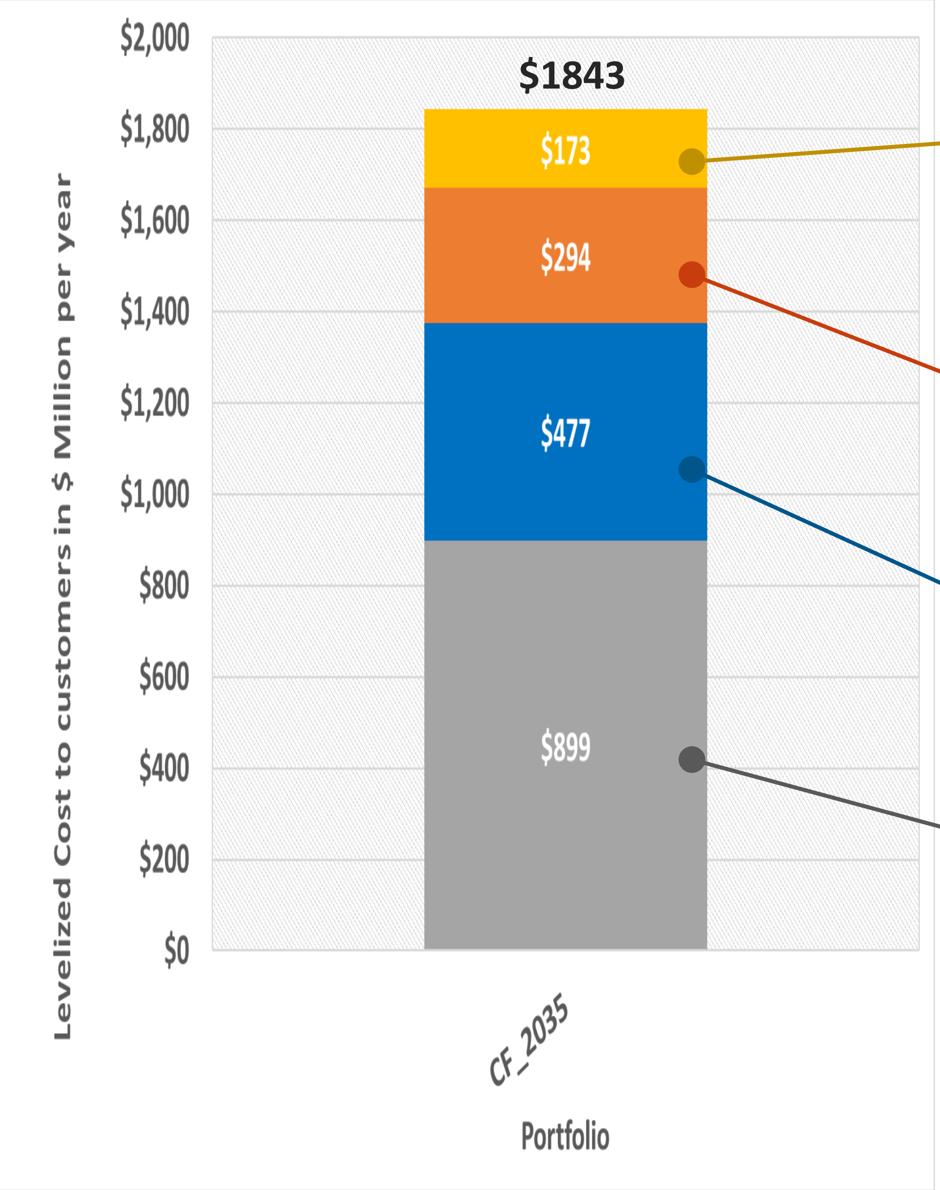
1

Key Assumptions

- No new thermal supply additions
- All 1400 MW of fossil generation retired
- Meets renewable generation goals in existing 2030 Plan
- Includes REACH dispatch

Key Takeaways

- The Current 2030 Plan has a high cost for customers
- It does not mitigate risks associated with extreme weather, local congestion or ERCOT market rule changes



This portfolio is capacity deficient in terms of its Effective Load Carrying Capacity, so it includes $173 million of additional risk per year

This portfolio is not insulated against local congestion which further adds $294 million in risk per year

Under extreme weather conditions, this portfolio has an additional risk of $477 million per year

The levelized cost of $899 million is ~$400 million higher than current costs Equates to increased rates of more than 35%

Results Summary – Current 2030 Plan without REACH

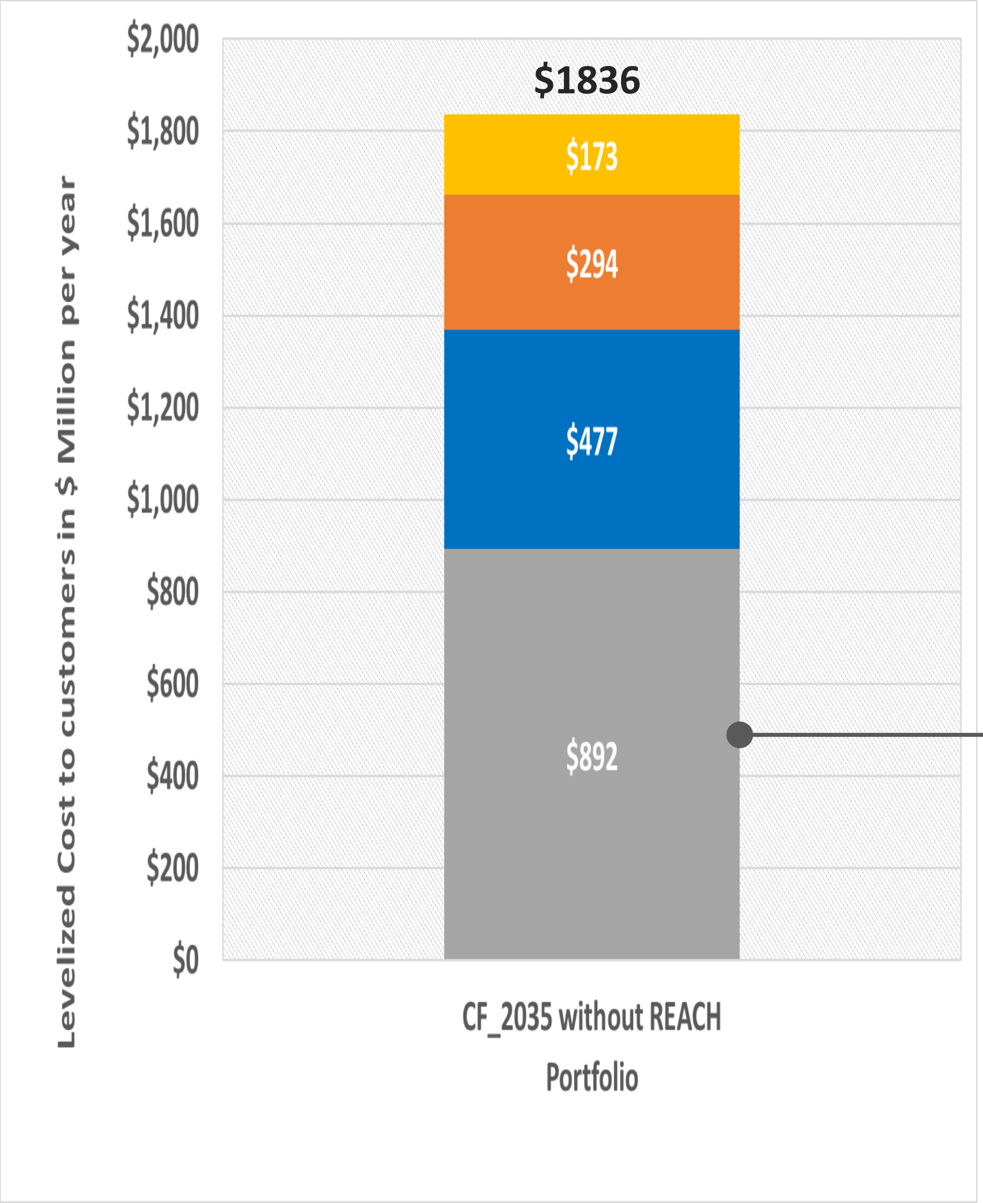
2

Key Assumptions

- Same as Current 2030 Plan (base case)
- Except this portfolio does not include REACH

Key Takeaway

The costs and risks of this portfolio are the same as the Base Case except for a decrease in the levelized cost due to not including the REACH adder



The levelized cost of $892 million is $7 million lower than the Base Case, but still ~$400 million higher than current costs

Results Summary – Carbon Free by 2035
Local Solar

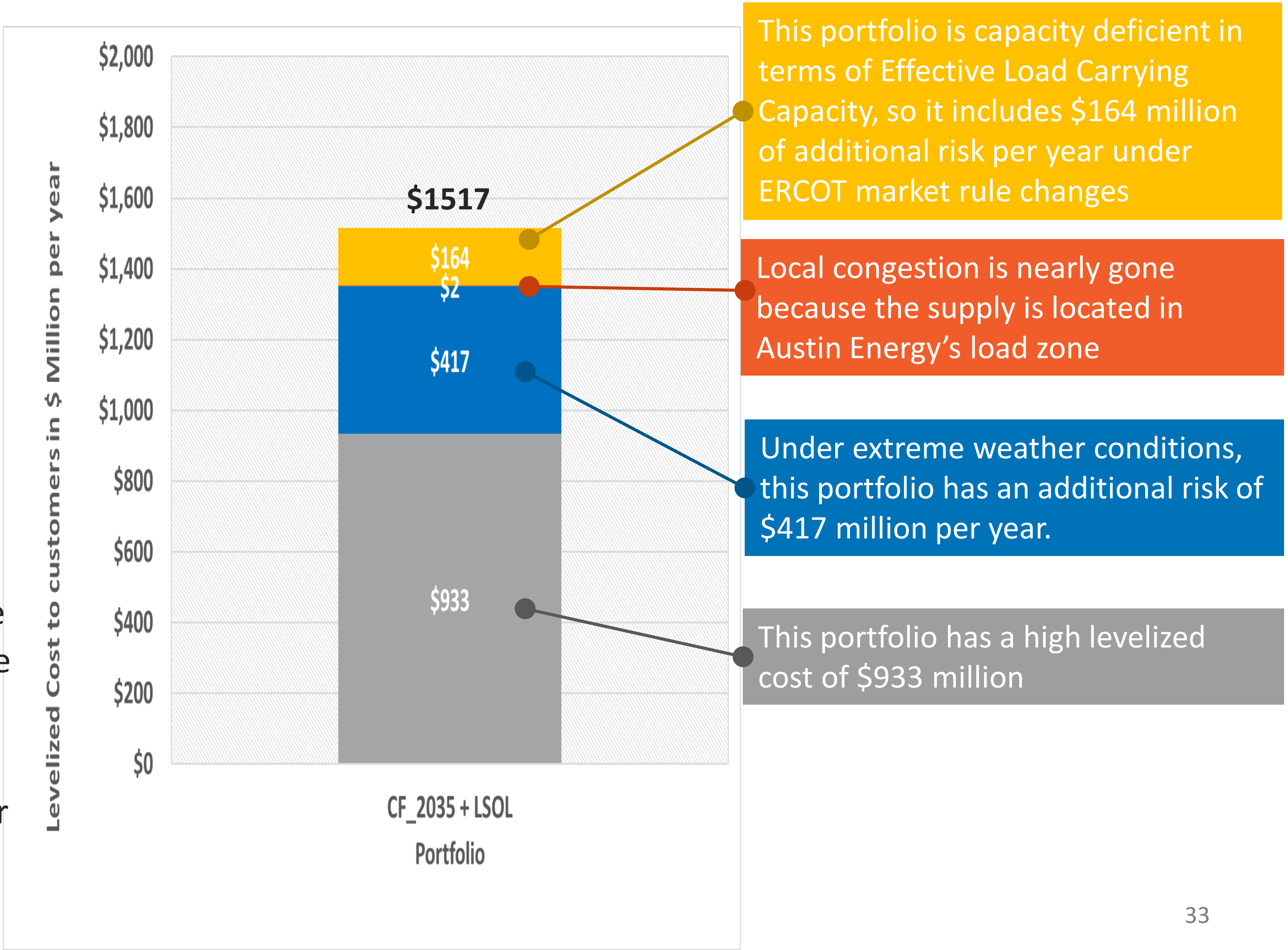
3

Key Assumptions

- Added supply is 100% local solar with
  - 50% MW behind-the-meter solar
  - 50% MW community solar
- Note: Quantities may not be feasible
- Does not include the cost of real estate

Key Takeaways

- This portfolio is costly for customers, but less costly than the base case
- It reduces congestion costs when solar performs as forecasted
- It does not mitigate risk during extreme weather even assuming the solar is able to produce
- It may not be feasible to obtain and host these large quantities of local solar



Results Summary – Carbon Free by 2035

Long Duration Storage

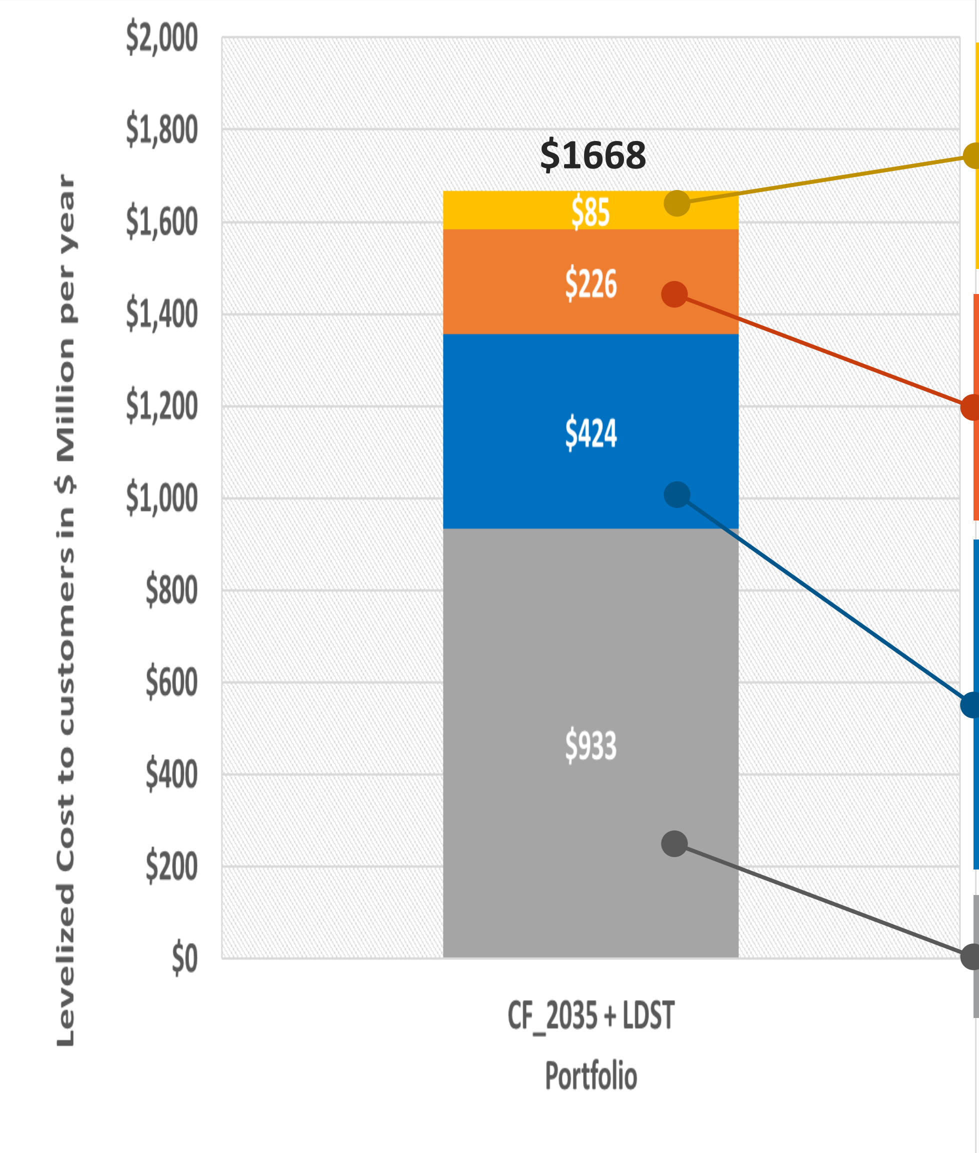
4

Key Assumptions

Added supply is 100% 8-hr Lithium-ion battery storage located outside Austin Energy's load zone

Key Takeaways

- This portfolio is costly for customers, but less costly than the base case
- There is significant local congestion risk since the storage is not local
- Given current technologies, it would not be feasible to site this much storage in Austin Energy's load zone
- Extreme weather could also pose a problem, especially if the storage fully depleted during a long event



Compared to the Base Case, this portfolio reduces risk due to ERCOT market rule changes from $173 to $85 million per year

This portfolio has $226 million of local congestion risk because the supply is located outside Austin Energy's load zone

- Under extreme weather conditions, this portfolio has an additional risk of $424 million per year.
- An event lasting longer than 8 hours could deplete the storage, and costs would be higher.

This portfolio has a high levelized cost of $933 million

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Results Summary – Carbon Free by 2035
Hydrogen-Capable Combined Cycle

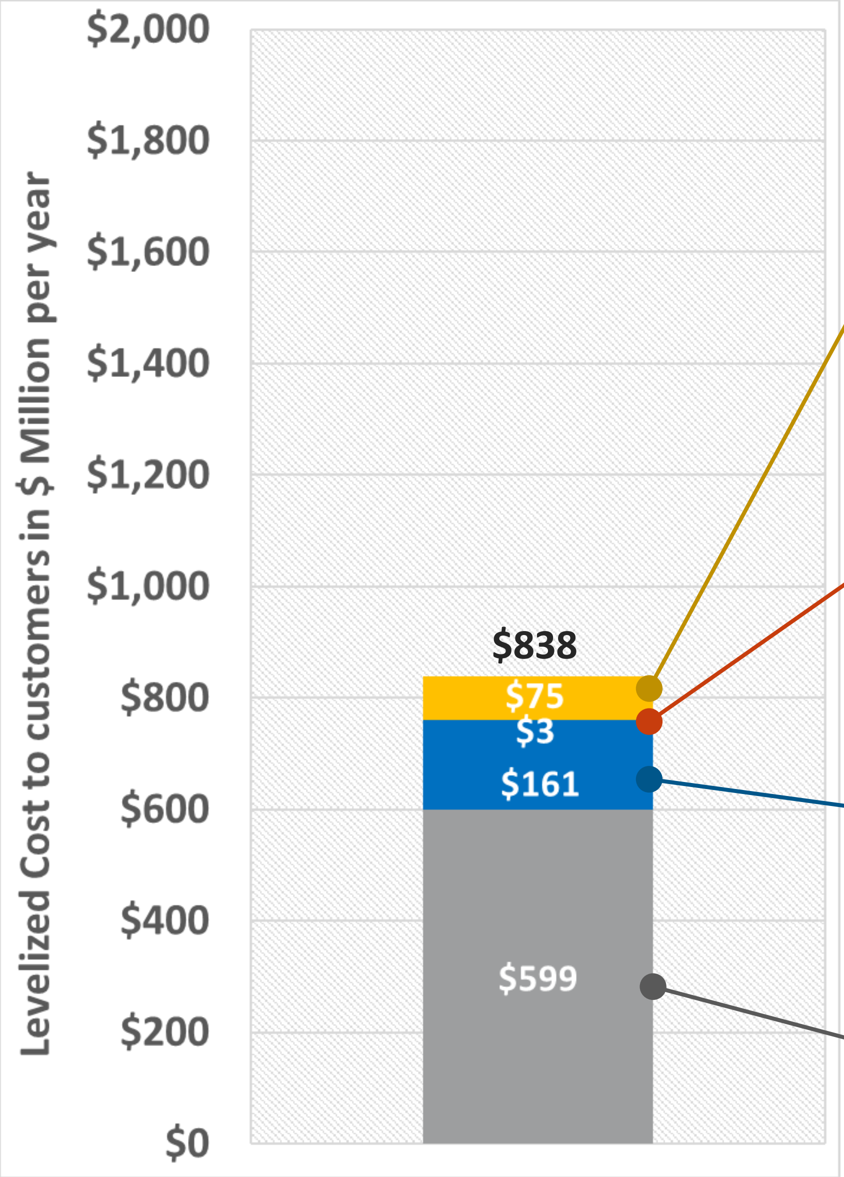
5

Key Assumptions

- Added supply is 100% hydrogen capable combined cycle generation
  - Able to burn 75% green hydrogen initially
  - Able to convert to 100% after upgrade
- Sited locally
- Fully dispatchable; can operate in peaker or combined cycle mode
- Can provide Ancillary Services
- Green hydrogen costs ≈ natural gas costs

Key Takeaways

- Portfolio reduces total costs compared to base case by $1 billion per year
- It relies on natural gas initially to provide a bridging solution to minimize risk impact on customers



This portfolio has risk due to ERCOT market rule changes of $75 million per year, which is ~$100 million lower than the Current 2030 Plan (base case)

Local congestion is nearly gone because the supply is located in Austin Energy's load zone

Under extreme weather conditions, this portfolio has an additional risk of $161 million per year, ~$300 million lower than the base case

The levelized cost of $599 million is ~$300 million lower than the Current 2030 Plan (base case)

Results Summary Portfolios 6 – 11

A Combination of Technologies

The Scenario Modeling Appendix has additional information on portfolios 6 – 11, each of which includes a combination of technologies

Summary Matrix

Flawed | Challenged | Meets Criteria

ID	Technology Portfolio	Carbon Free by 2035	Renewable Goals	Demand Side Mgmt Goals	Affordable	Total Cost/Risk (in $Million)	Levelized Cost (in $Million)	Extreme Weather Risk (in $Million)	Local Congestion Risk (in $Million)	ERCOT Market Rule Change Risk (in $Million)
1	CF_2035 (Current 2030 Plan or Base Case)	Yes	Yes	Yes	No	$1,843	$899	$477	$294	$173
2	CF_2035 without REACH	Yes	Yes	Yes	No	$1,836	$892	$477	$294	$173
3	CF_2035 + LSOL	Yes	Yes	Yes	No	$1,517	$933	$417	$2	$164
4	CF_2035 + LDST	Yes	Yes	Yes	No	$1,668	$933	$424	$226	$85
5	CF_2035 + HCCC	Yes	Yes	Yes	Yes	$838	$599	$161	$3	$75
6	CF_2035 + LSOL + HCCC	Yes	Yes	Yes	Yes	$954	$630	$231	$1	$92
7	CF_2035 + LDST + HCCC	Yes	Yes	Yes	Yes	$902	$643	$185	($3)	$77
8	CF_2035 + LSOL + LLDST + DST	Yes	Yes	Yes	No	$1,544	$944	$448	($1)	$153
9	CF_2035 + LLDST + DST + HCCC	Yes	Yes	Yes	Yes	$1,003	$651	$264	$2	$86
10	CF_2035 + LSOL + LLDST + DST + DSM	Yes	Yes	Yes	No	$1,582	$907	$523	$5	$146
11	CF_2035 + LSOL + LLDST + DST + HCCC	Yes	Yes	Yes	Yes	$1,158	$757	$304	($4)	$102
	Mapping to 2030 Plan Objectives:	ES			A CS	A CS	A CS	R A CS	R A CS	R A CS

Environmental Sustainability

Affordability
Cost Stability

Reliability
Affordability
Cost Stability

Key Takeaways

Environmental Sustainability – All portfolios meet goal by design

Reliability – Only portfolios without high percentages of solar or storage overcome extreme weather risk

Affordability – Only portfolios including hydrogen capable combined cycle meet the affordability goal – **Reliability**

Cost Stability – Only portfolios with local supply overcome local congestion risk – **Affordability**

To meet all objectives moving forward

- Austin Energy's portfolio should include local, dispatchable, hydrogen-capable generation
- This mitigates reliability and affordability risk and enables additional renewables to meet Resource Plan goals

Initial Recommendations

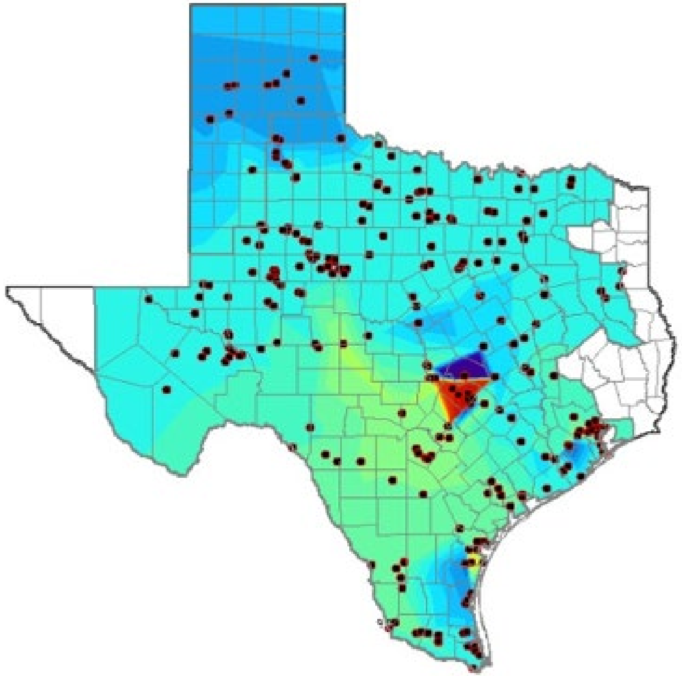
Michael Enger

Interim Vice President
Energy Market Operations & Resource Planning

Carbon Generating Assets

Stays the Same

Carbon free by 2035



Proposed Update

Local, dispatchable generation with a pathway to carbon free by 2035

- Provides voltage support in the Austin area

  R

- Mitigates load zone price separation risk

  A CS

- Provides for additional renewables to be affordably added to the supply portfolio

  ES

Carbon Reduction Goals

Stays the Same

Carbon free by 2035

Proposed Update

Clarify when carbon free generation goals are a percentage of load versus stack emissions

ES

Fayette Power Project

Stays the Same

Austin Energy's commitment to exit from the Fayette Power Project

Proposed Update

Continue discussions with LCRA to achieve a viable exit to Austin Energy's share of Fayette Power Project

R A ES CS

Demand Side Management Portfolio

Stays the Same

- Portfolio focus on environmental sustainability and peak demand reduction
- Equitable Participation in Programs
- Improving affordability for Austin Energy customers

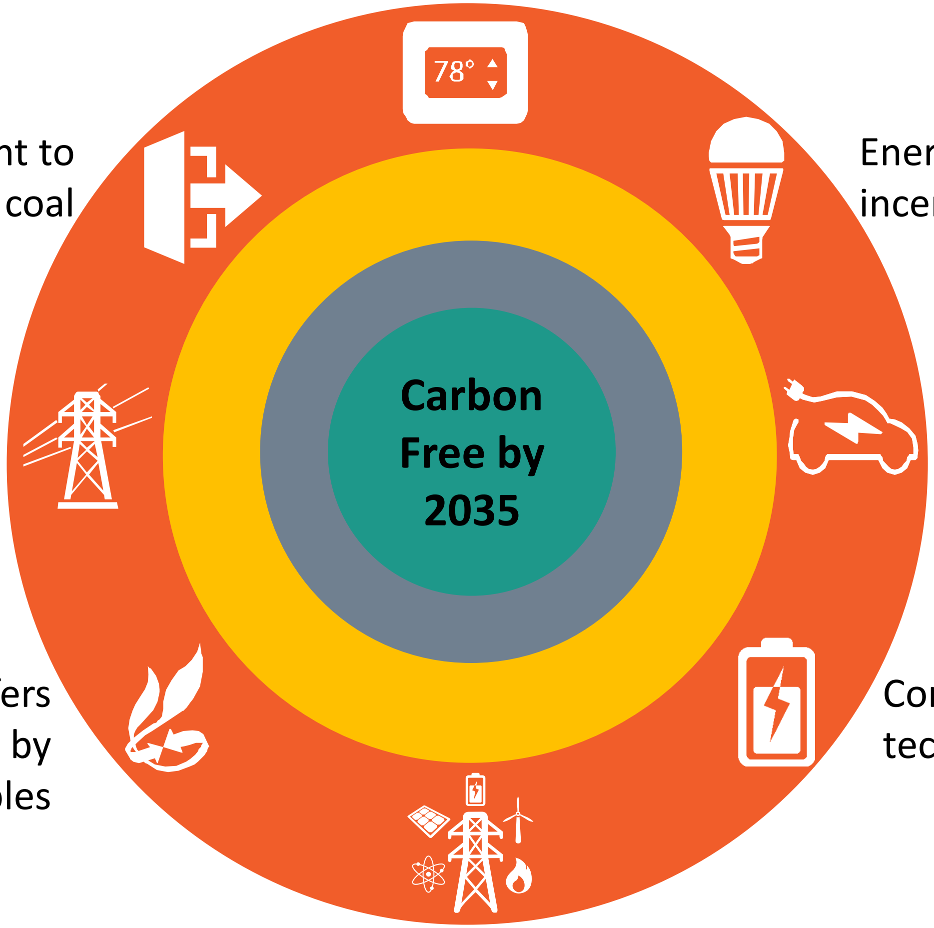
Proposed Update

- Moving away from Megawatt to Greenhouse Gas reduction to improve overall impact and effectiveness
  ES
- Enhanced definition of demand response
  R A ES CS
- Driving outcome-oriented program design
  R A ES CS

Portfolio Diversity Enables Customer Objectives

● Reliability ● Affordability ● Environmental Sustainability ● Cost Stability

Demand side management measured by carbon reduction



Renewed commitment to REACH until we can exit coal

Energy efficiency and appliance incentives to offset load growth

Transmission upgrades to increase import capacity

Distributed energy resources to leverage customer-sited technology

Local dispatchable generation that offers a bridging solution to Carbon Free by 2035 and enables more renewables

Continued assessment of new technologies to maintain flexibility

Geographically diverse renewables to meet goals

Questions?

Customer Driven.
Community Focused.℠

Technology Assessment Appendices

Format/ Icon Description

Innovation/ Breakthrough Value

Market Readiness

Relative Cost (Compared to Alternatives)

Challenges

Flawed | Challenged | Meets Criteria

Technology	Readiness	Affordability	Inside Load Zone	Available 24/7	Dispatchable

Technology Assessment Appendices

Supply-Side Technologies

Advanced Nuclear

- Smaller footprint, reduced permitting times and costs
- Widespread approval and adoption not yet expected
- $119 MWh with subsidies
- Design licensing, readiness, siting

NuScale VOYGR modular power plant (308, 462 or 924 MW) can fit on approx.32 acres of land, current target $119/MWh with federal subsidy for 1st plant.

Technology	Readiness	Affordability	Address Congestion	Available 24/7	Dispatchable
Advanced Nuclear	(red)	(red)	(yellow)	(green)	(yellow)

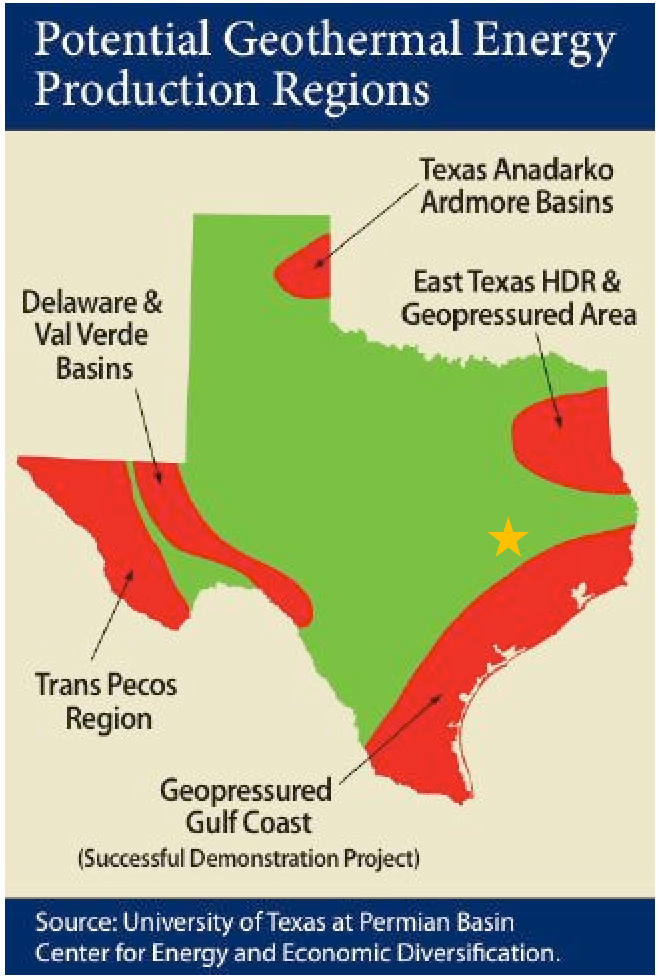
Geothermal

Natural fractures maximize heat output

Used worldwide – scaled conversion still nascent

$.07-.09 kWh

Location load constraints, small scale applications



Technology	Readiness	Affordability	Address Congestion	Available 24/7	Dispatchable
Geothermal Generation					

Local Battery Energy Storage Systems (BESS)

Both Long & Short Duration

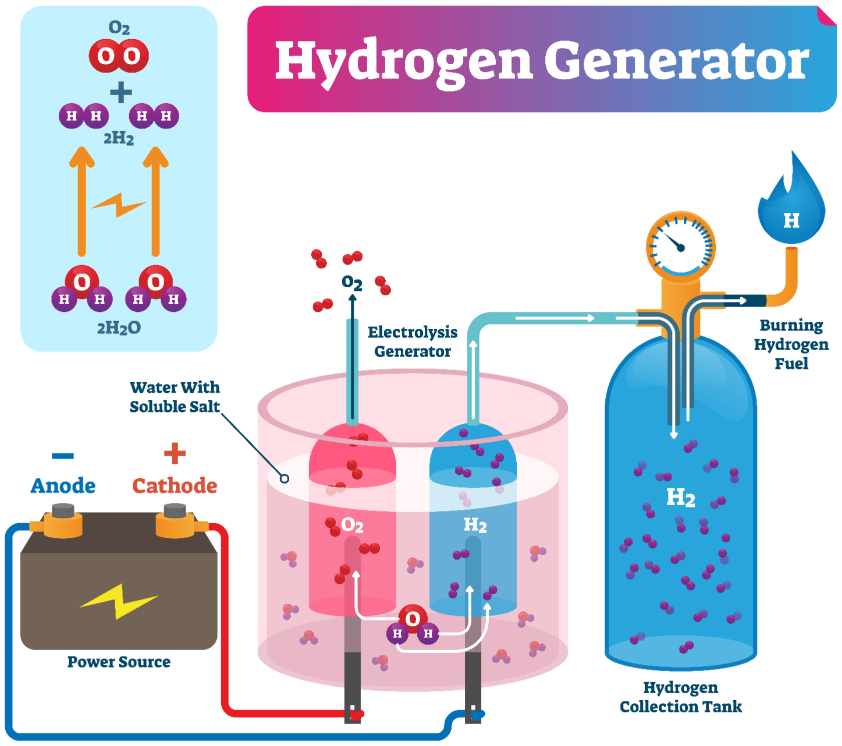
- Solid-state batteries, flow batteries
- 72 GW of additional capacity to be developed through the end of 2020s
- Cost varies depending on application
- Procurement, standards development, siting and delivering enough value to justify the cost

Battery at Austin Energy's Kingsbery Substation

Technology	Readiness	Affordability	Address Congestion	Available 24/7	Dispatchable
Local Distribution-BESS					

Hydrogen Capable Combined Cycle

- High-temperature combustion
- Inherently fuel-flexible
- Indicative pricing is competitive
- Initial cost of hydrogen, electrolyzers



Electrolyzers split water into hydrogen and oxygen

Technology	Readiness	Affordability	Address Congestion	Available 24/7	Dispatchable
Hydrogen Capable Generation					

Remote Transmission-Scale BESS

- Economies of scale and co-location
- Scaling rapidly
- Dependent on land and location
- Procurement of transformers and battery resource competition

LADWP's 20 MW energy storage project in the Mojave Desert

Technology	Readiness	Affordability	Address Congestion	Available 24/7	Dispatchable
Remote Transmission-Scale BESS					

Local Solar

Safe and highly modular

Readily available

Subsidized and a bankable asset

Non-dispatchable generation, end-of-life considerations, susceptible to hailstorms

Technology	Readiness	Affordability	Address Congestion	Available 24/7	Dispatchable
Local Solar					

Technology Assessment Appendices

Demand-Side Technologies

Demand Response

- Responsive and agile, shares both control and cost
- Devices are market-ready but not yet ready for aggregation across vendors or types of devices
- Relatively low cost, depending on technology
- Aggregation, customer experience and reliability challenges

Technology	Readiness	Affordability	Address Congestion	Available 24/7	Dispatchable
Demand Response					

Customer-Sited BESS

- Continuous battery technology improvements
- Single vendor aggregation only
- Could be utilized for demand response and provide a financial benefit
- Expensive, if unmanaged could put significant stress on the local grid

Technology	Readiness	Affordability	Address Congestion	Available 24/7	Dispatchable
Customer-Sited BESS					

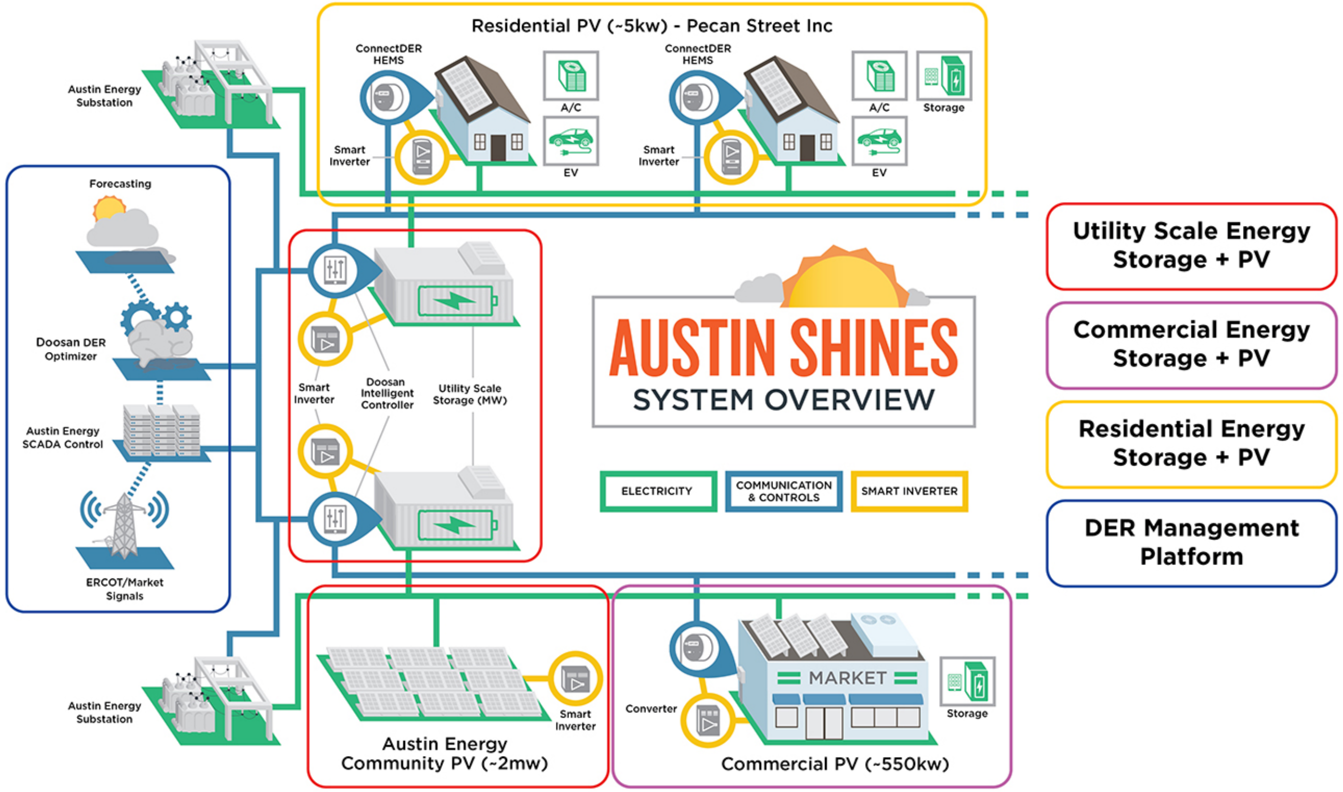
Managed Charging

- Potential for Demand Side Management
- Evolving standards and interoperability
- Significant variance in cost
- Interoperability, vendor proprietary charging/ communication network

Technology	Readiness	Affordability	Address Congestion	Available 24/7	Dispatchable
Managed Charging					

Distributed Energy Resource Management Systems (DERMS)

- Potentially connected and networked energy resources
- Lacking standards for interoperability
- Relatively expensive
- Integration



Technology	Readiness	Affordability	Address Congestion	Available 24/7	Dispatchable
DERMS					

Technology Assessment Appendices

Other Technologies

Carbon Capture & Sequestration

Electro swing absorption, zeolites, passive direct air capture

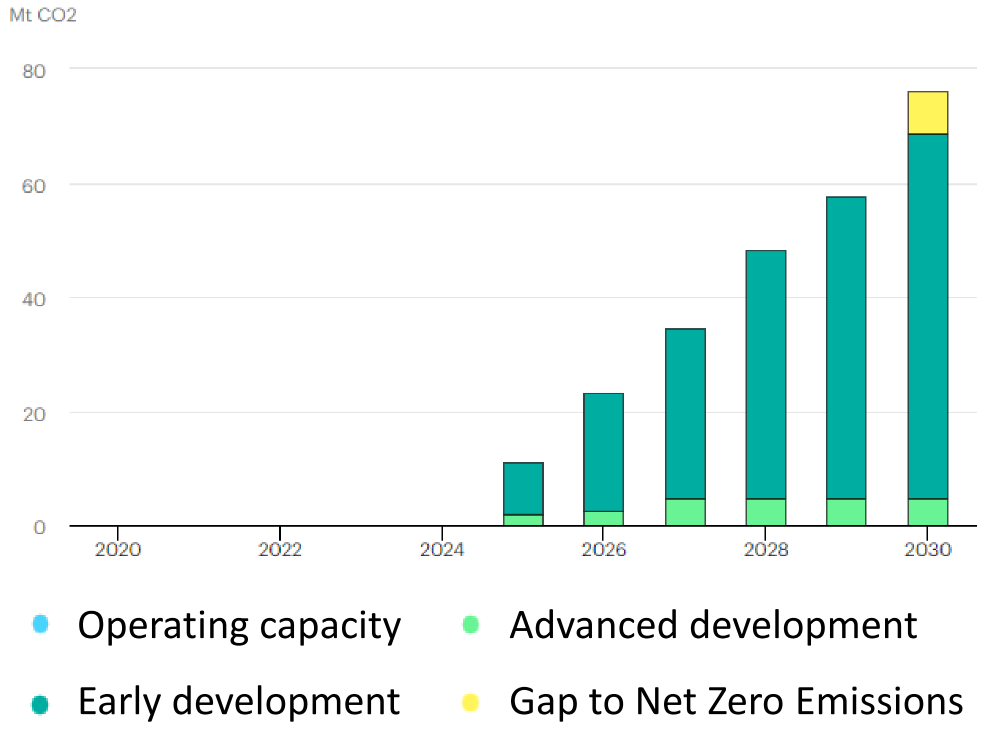
No plants currently in operation

Expensive, cost still unknown

Cost and time-to-market

CO2 Capture by Direct Air Capture

planned projects and in the
Net Zero Emissions by 2050 Scenario



Technology	Readiness	Affordability	Address Congestion	Available 24/7	Dispatchable
Direct Air Capture			n/a	n/a	n/a

Energy Efficiency

- Low-income weatherization and retrofits, Inflation Reduction Act funding
- Expanded programs targeting low-moderate income
- Affordable with subsidization
- Overcoming barriers for customers

Technology	Readiness	Affordability	Address Congestion	Available 24/7	Dispatchable
Energy Efficiency				n/a	n/a

High Efficiency Appliances

Heat pump technologies, induction cooking

Good for all but heat pump dryers

Mixed by technology, new vs. retrofit

Retrofits, cost, workforce readiness and increased electricity demand

Technology	Readiness	Affordability	Address Congestion	Available 24/7	Dispatchable
High Efficiency Appliances				n/a	n/a

Transmission – Composite Conductors

- Lighter with lower coefficient of thermal expansion than steel
- Ready, available through multiple manufacturers and currently in use
- 4-5 times the cost of comparable steel core conductors
- Limited applications due to allowable costs

Technology	Readiness	Affordability	Address Congestion	Available 24/7	Dispatchable
Transmission-Composite Cond.				n/a	n/a

Scenario Modeling Appendices

Results Summary – Carbon Free by 2035

Local Solar and Hydrogen-Capable Combined Cycle

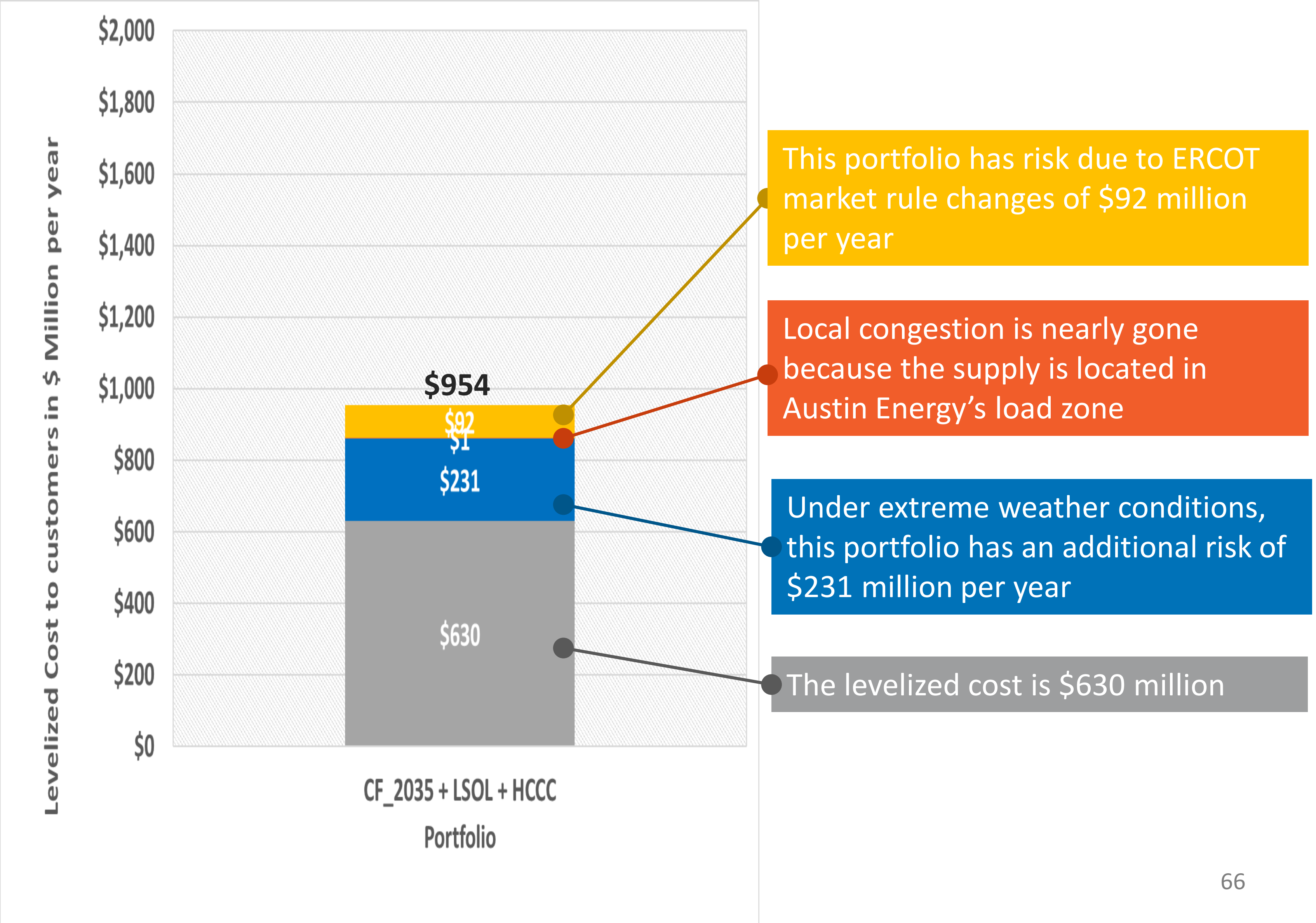
6

Key Assumptions

- 20% local solar with 50/50 split between behind the meter solar and community solar
- 80% green hydrogen capable combined cycle generation by 2035

Key Takeaways

- While this portfolio reduces total costs compared to the base case by ~$900 million per year, it remains costlier than Carbon Free by 2035 with Hydrogen-Capable Combined Cycle by ~$116 million per year
- This is mostly due to extreme weather risk



Results Summary – Carbon Free by 2035

Long Duration Storage and Hydrogen-Capable Combined Cycle

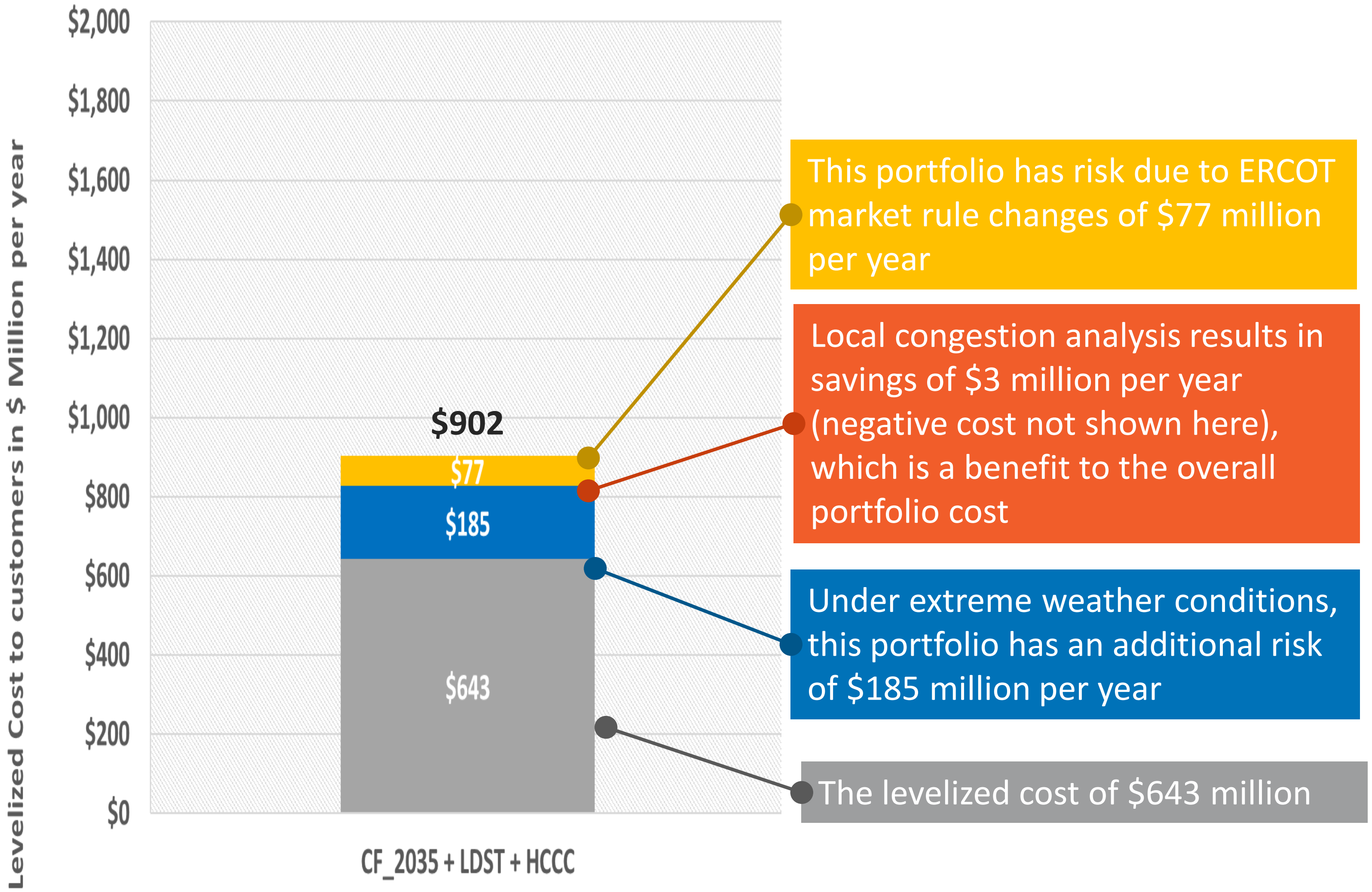
7

Key Assumptions

- 20% 8-hr Lithium-ion battery storage located outside Austin Energy's load zone
- 80% green hydrogen-capable combined cycle generation by 2035

Key Takeaways

- While this portfolio reduces total costs compared to the base case by ~$940 million per year, it is costlier than Carbon Free by 2035 with Hydrogen-Capable Combined Cycle by ~$64 million per year
- This is mostly due to the capital cost of battery storage and partly due to extreme weather risk



Results Summary – Carbon Free by 2035

Local Solar, Local Long Duration Storage and Distributed Storage

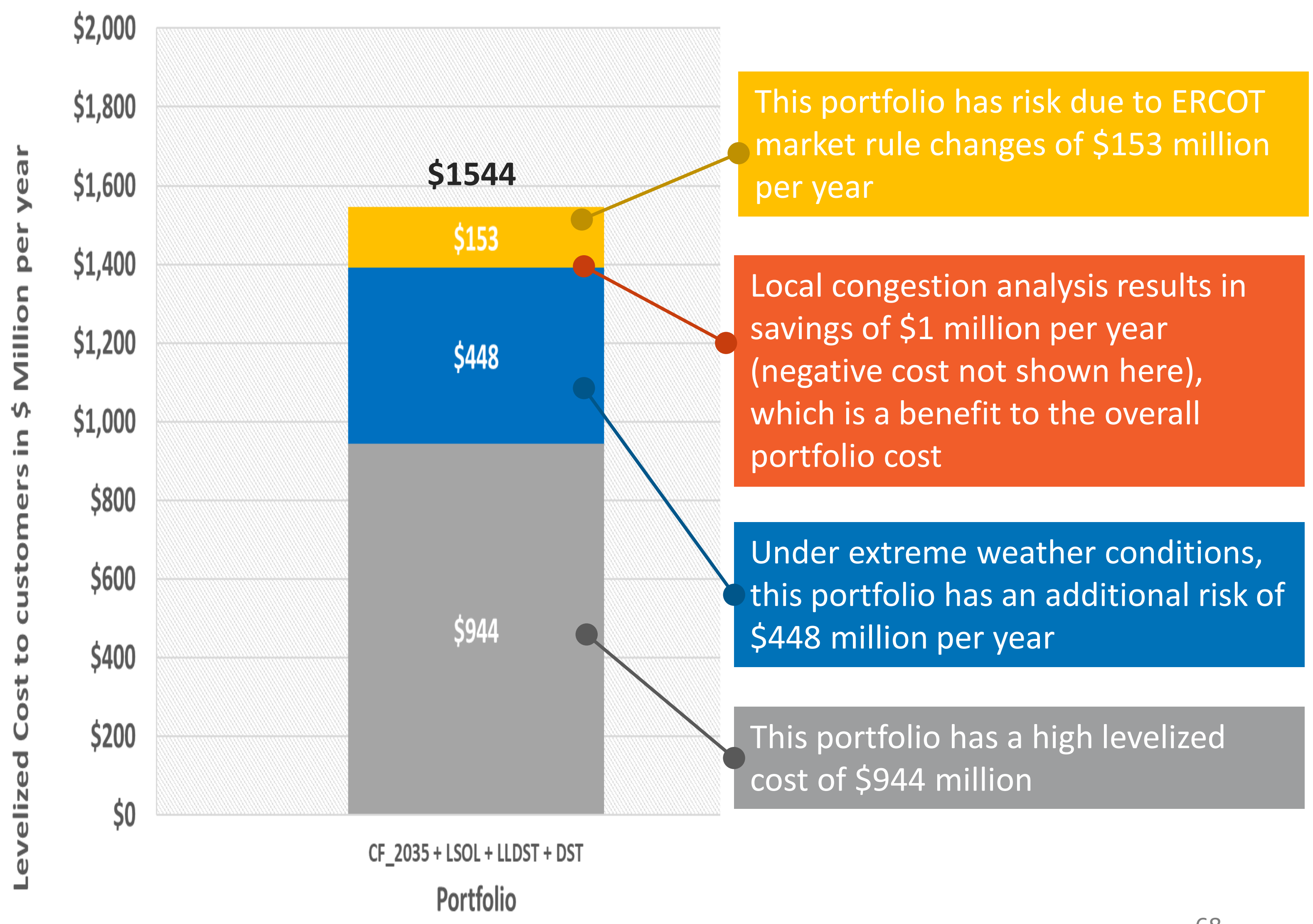
8

Key Assumptions

- 80% of local solar with 50/50 split between behind the meter solar and community solar
- Does not include the higher cost of real estate
- 10% 8-hr Lithium-ion battery storage located within Austin Energy's load zone
- 10% distributed storage within Austin Energy service territory

Key Takeaways

- This portfolio is costly and risky for customers
- It reduces congestion costs but does not mitigate risk during extreme weather even assuming the solar is able to produce
- It also does not perform well under ERCOT market rule changes
- It may not be feasible to obtain and host these large quantities of local solar



Results Summary – Carbon Free by 2035

Local Long Duration Storage, Distributed Storage and Hydrogen-Capable Combined Cycle

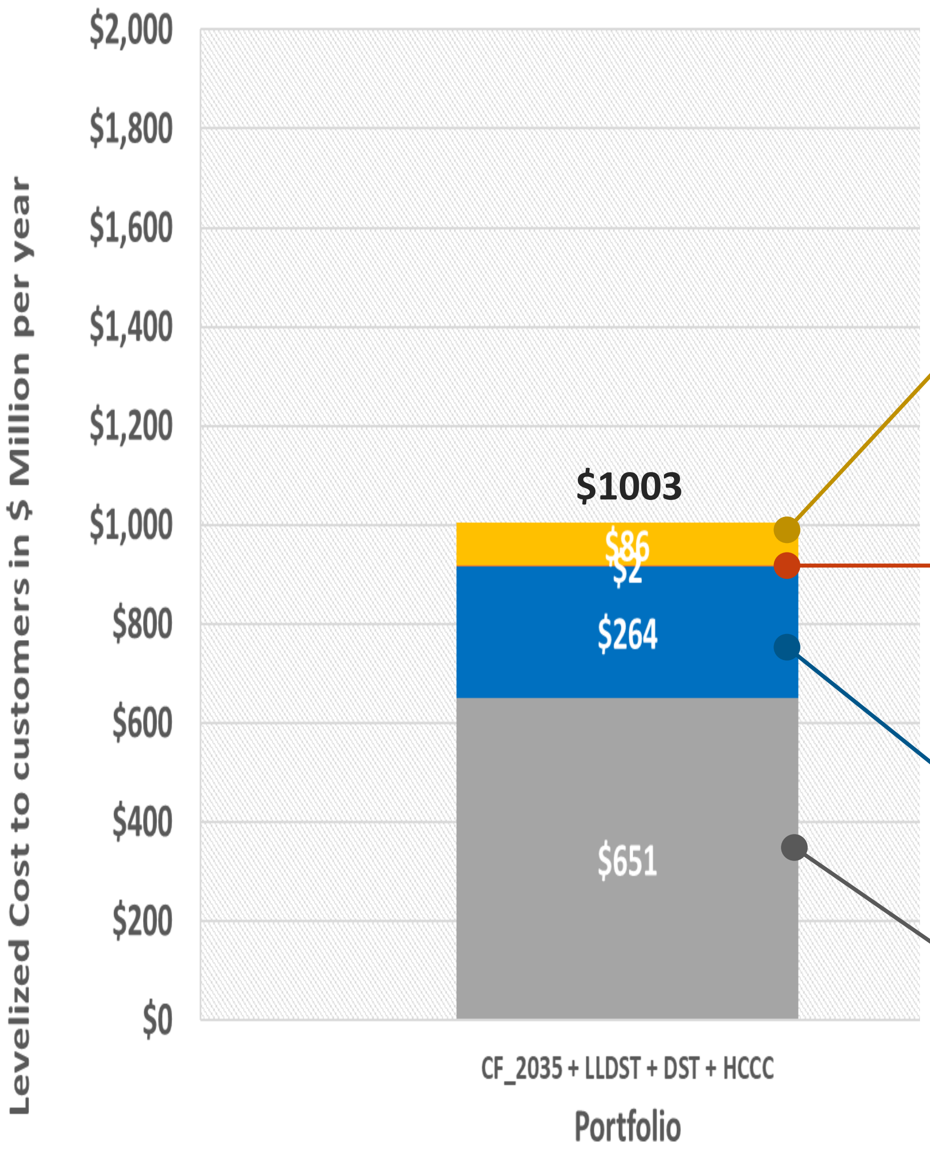
9

Key Assumptions

- 10% 8-hr Lithium-ion battery storage located and 10% distributed storage within Austin Energy's load zone
- 80% green hydrogen capable combined cycle generation by 2035

Key Takeaways

- While this portfolio reduces total costs compared to the base case by ~$840 million per year, it remains costlier than Carbon Free by 2035 with Hydrogen-Capable Combined Cycle by ~$165 million per year
- This is mostly due to extreme weather risk



This portfolio has risk due to ERCOT market rule changes of $86 million per year

Local congestion is nearly gone because the supply is located in Austin Energy's load zone

Under extreme weather conditions, this portfolio has an additional risk of $264 million per year

The levelized cost of $651 million

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Results Summary – Carbon Free by 2035

10

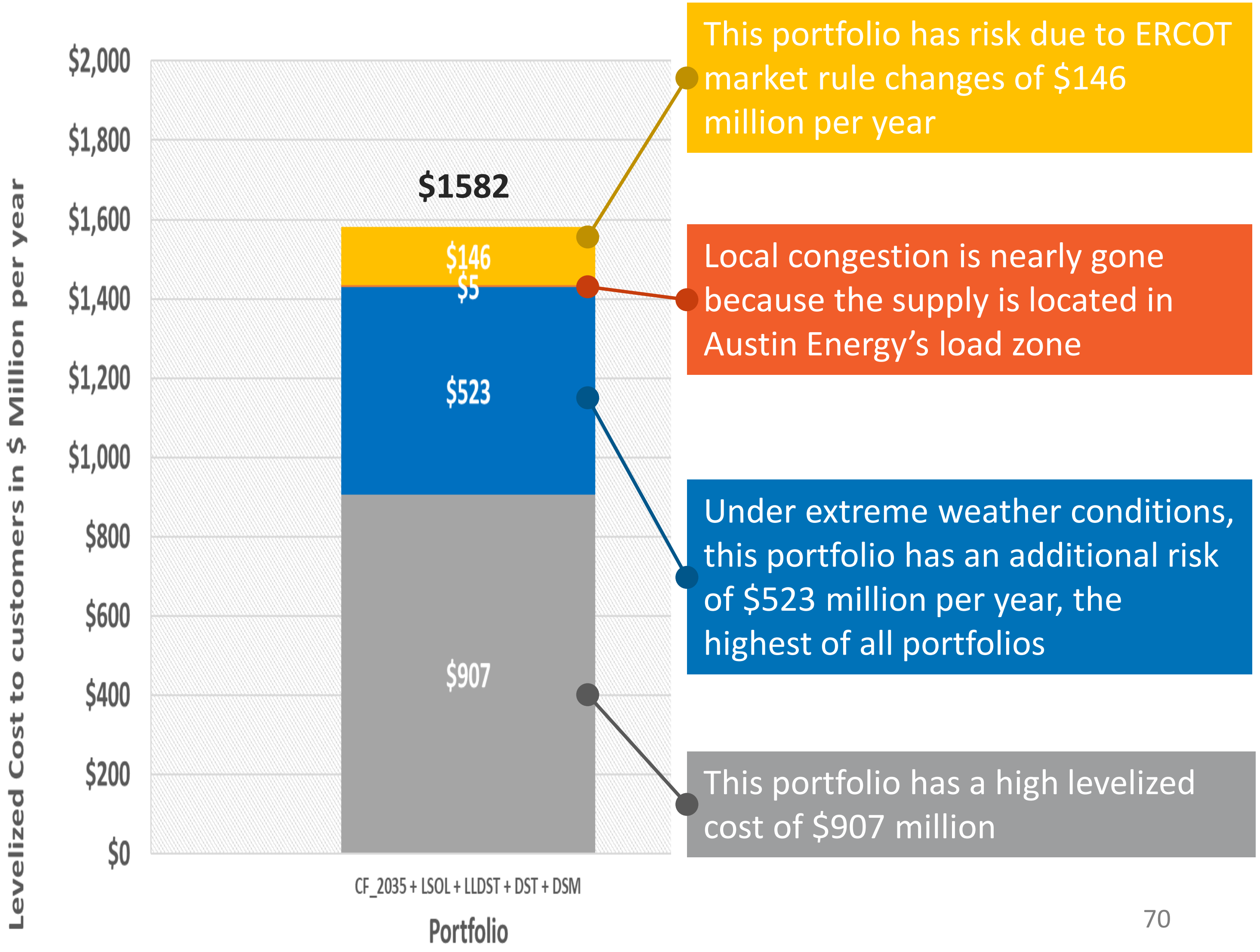
Local Solar, Local Long Duration Storage, Distributed Storage and Demand Side Management

Key Assumptions

- 60% local solar with solar with 50/50 split between behind the meter solar and community solar
- Does not include the higher cost of real estate
- 10% 8-hr Lithium-ion battery storage located & 10% distributed Storage within Austin Energy's load zone
- 20% demand side management (considered "heavier DSM" as all portfolios already include DSM in the load forecast)

Key Takeaways

- This portfolio is costly and risky for customers
- It reduces congestion costs but does not mitigate risk during extreme weather even assuming the solar is able to produce
- It also does not perform well under ERCOT market rule changes
- It may not be feasible to obtain and host these large quantities of local solar



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Results Summary – Carbon Free by 2035

Local Solar, Local Long Duration Storage, Distributed Storage and Hydrogen-Capable Combined Cycle

11

Key Assumptions

- 20% local solar with 50/50 split between behind the meter solar and community solar
- 10% 8-hr Lithium-ion battery storage located and 10% Distributed Storage within Austin Energy's load zone
- 60% green hydrogen capable combined cycle generation by 2035

Key Takeaways

- While this portfolio reduces total costs compared to the base case, it remains costlier than Carbon Free by 2035 with Hydrogen-Capable Combined Cycle by ~$320 million per year
- This is mostly due to extreme weather risk and the capital cost of battery storage