Entergy®

ELL 2019 IRP
Stakeholder Meeting 2

Entergy Louisiana, LLC

November 27, 2018

Purpose and Agenda

The purpose of this presentation is to review and to seek stakeholder feedback on the draft IRP filed in October.

Background – ELL's Planning Framework and the changing industry

1) Principles & objectives
2) Industrial load growth
3) Changing utility message

Current fleet and projected needs

1) Capacity Requirements (current fleet and the projected needs)
2) Load Forecast methodology

Assumptions

1) Supply Alternatives
    - DSM (results of the DSM evaluation)
    - Technology Assessment

Portfolio analytics

1) Futures discussion
2) Analytical Framework
3) Results

Action plan

ELL's Planning Framework and A Changing Industry

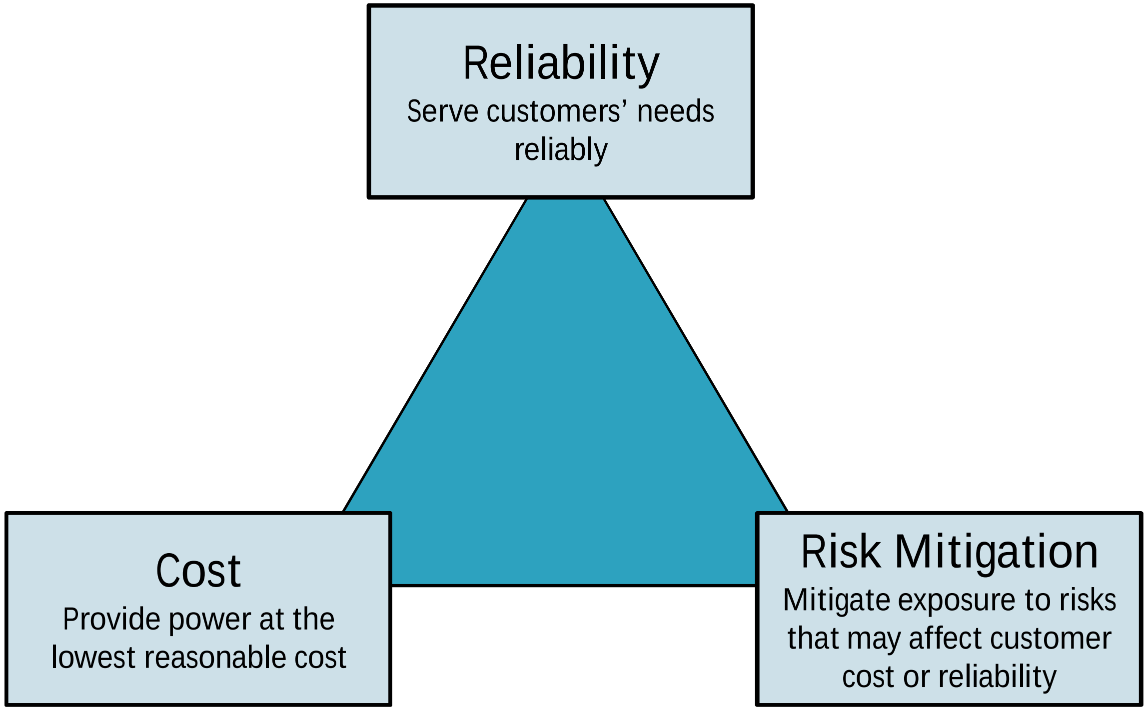
Current Fleet and Projected Needs

Supply Alternatives

Portfolio Analytics

Action Plan

Planning Process - Three Key Objectives



Above objectives will be achieved while considering utilization of natural resources and the effect on the environment

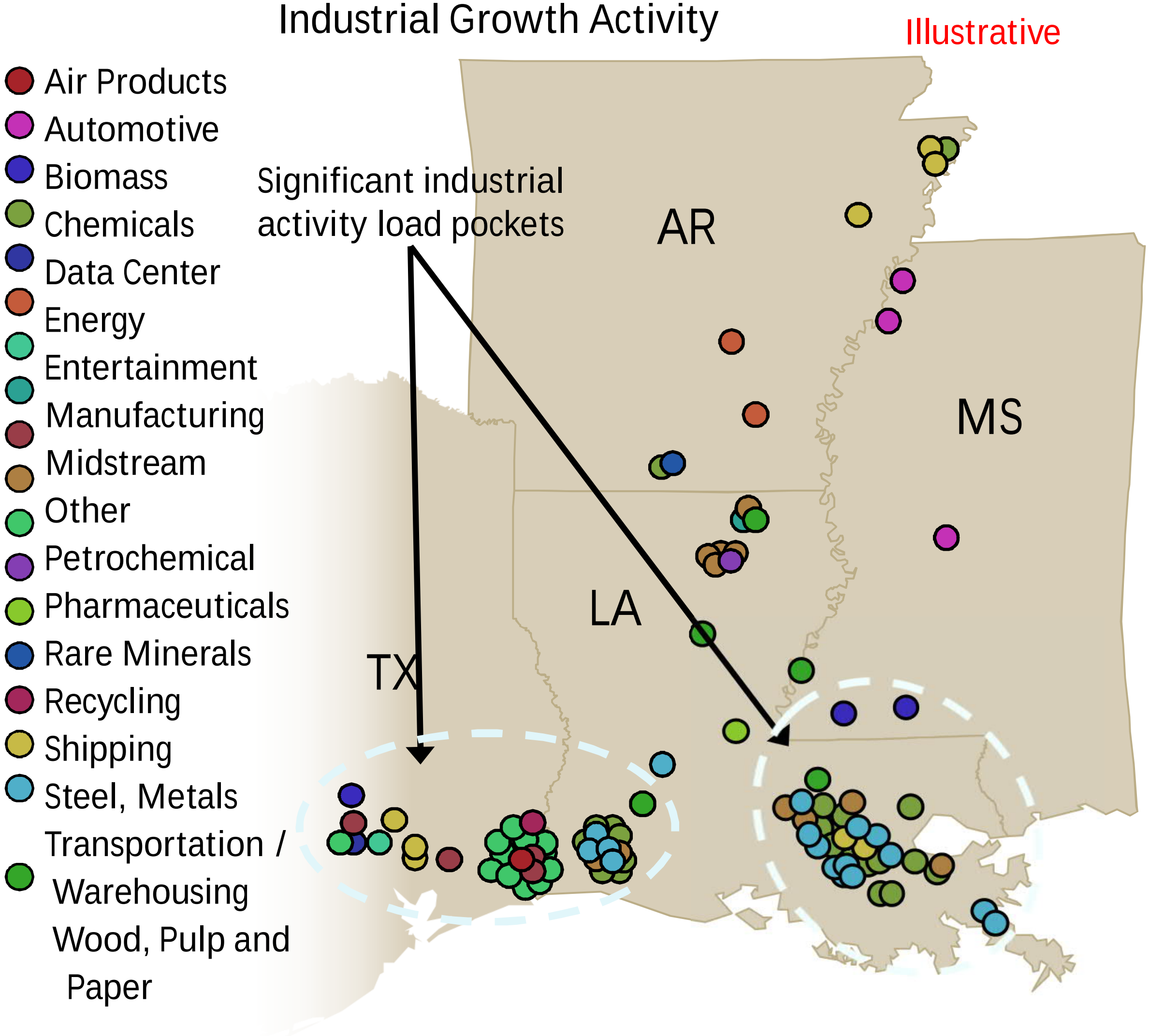
ELL's Planning Objectives

Guiding Principles	
Capacity	Provide adequate capacity to meet customer needs
Base Load Production Costs	Meet base load requirements to keep customer costs stable
Load-Following Production	Include dispatchable supply with the ability to respond to the varying needs of customers based on a number of factors.
Modern Portfolio	Avoid over reliance on aging resources
Price Stability	Mitigate exposure to price volatility
Supply Diversity	Diversify technology, location, capital commitments, and supply channels
In-region Resources	Leverage a variety of localized resources to meet customers' needs reliably and affordably

Unprecedented Growth is Taking Place

Expected projects concentrated along Gulf Coast

Industrial Growth Activity



Drivers

- Relatively low-cost domestic natural gas compared to oil or foreign natural gas
  - Feedstock / input / direct fuel source to industrial processes
  - Fuel for electricity production in Louisiana
- Relatively low cost electricity
- World-class pipeline and transportation infrastructure for industrial uses
- Business and elected leaders aggressively pursuing opportunity and removing roadblocks
- Long-term stability and energy security
- Workforce quality

Evolving Customer Preferences

- We recognize that customer preferences are changing. Our planning processes and tools are evolving and will continue to evolve in order to help identify customer needs and wants.
- Ever advancing technology (including but not limited to advances in generating technology) provides new opportunities to meet customer needs reliably and affordably.
- While traditional principles within planning will continue, the landscape within the electric utility industry is changing and ELL is putting plans in place to provide flexibility in how to respond to the evolving environment.

Changes and opportunities within the utility industry

Customer Preferences

- Increased desire for more options
- Interested in the use of cleaner more sustainable energy sources
- Changes to expected types of services and products

+

Advancing Technology

- Expanding list of viable supply alternatives, including an Integrated Grid, battery storage and commercial scale solar

+

Utility Actions

- Understand changing customer needs
- Understand and seek experience with new technologies
- Design a portfolio to meet customer needs and wants
- Continue to account for affordability and reliability

=

Increased Customer Value

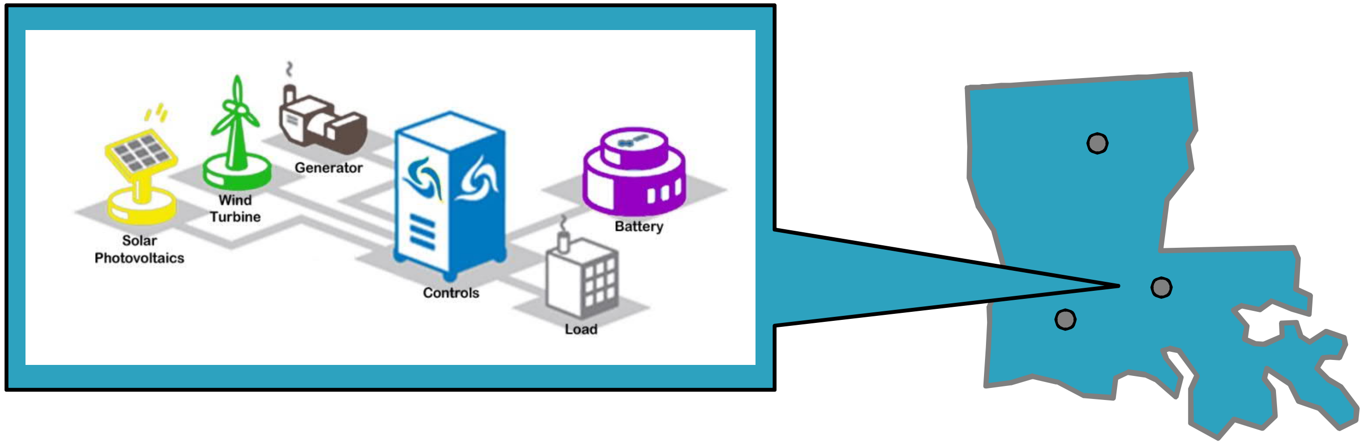
- Increased available services and products
- Diversity of supply alternatives
- Decreased risk to supply cost
- Increased reliability
- Modernization of the supply portfolio

Evolving Customer Preferences

- The evolution of customer-centric technology and services has created a shift in customer preferences and expectations—both in terms of how the power they use is generated, and the services and offerings they value from utility companies.
- Today's energy customers are using energy more efficiently than ever before – both due to increasing emphasis on social responsibility and sustainability, and appliance efficiency standards.
- ELL would like to approach energy efficiency with the goal of enhancing the generation, delivery and use of energy, recognizing that a well-designed electric system, with the proper mix of generating resources is important.
- Customers are becoming more interested in getting their power from cleaner, more sustainable sources of energy, including natural gas, nuclear, and renewables like solar.
- Understanding changing customer preferences will allow ELL to adopt a more thoughtful approach to the IRP process, and will allow ELL to:
  - Develop a comprehensive outlook on the future utility environment so we can more effectively anticipate and plan for the future energy needs of our customers and region.
  - Incorporate new, smart technologies and advanced analytics to better assess where expanding resource alternatives can be leveraged, and plan for improvements and enhancements to the electrical grid.
  - Continue integrating and offering the innovative products and services our customers want and expect.

Technology Advancements

- Technological advancements provide the energy industry increased opportunities and alternative pathways to plan for and efficiently meet customer energy needs.
- When properly integrated into the electric system as part of ELL's overall planning processes and grid design, new technology like storage, conservation, and advanced metering can improve reliability, efficiency of energy production, and delivery of energy to customers.
- New technologies support the continued development and expansion of sustainability efforts while addressing ELL's long-term planning objectives.
  - Example: The deployment of advanced meters and development of smart energy grids is enabling the entire utility industry to better understand ways customers are using energy.
  - Technology will allow ELL to make more informed decisions and provide tailored customer solutions through enhancements to the electric infrastructure, and the adoption of new products and services.



Utility Actions

- As utility providers, it is incumbent upon ELL to adapt to the evolving needs of customers.
- ELL is evaluating and incorporating new, customer-centric technology, and designing an energy portfolio that leverages a more diverse mix of energy resources including cost-effective renewable and clean energy sources.
- ELL, as compared to individual customers, is better positioned to efficiently integrate these new technologies and solutions into the electric grid.
- All the while, ELL is keeping affordability, reliability, and risk to its customers at the forefront of its planning.

ELL's Planning Framework and A Changing Industry

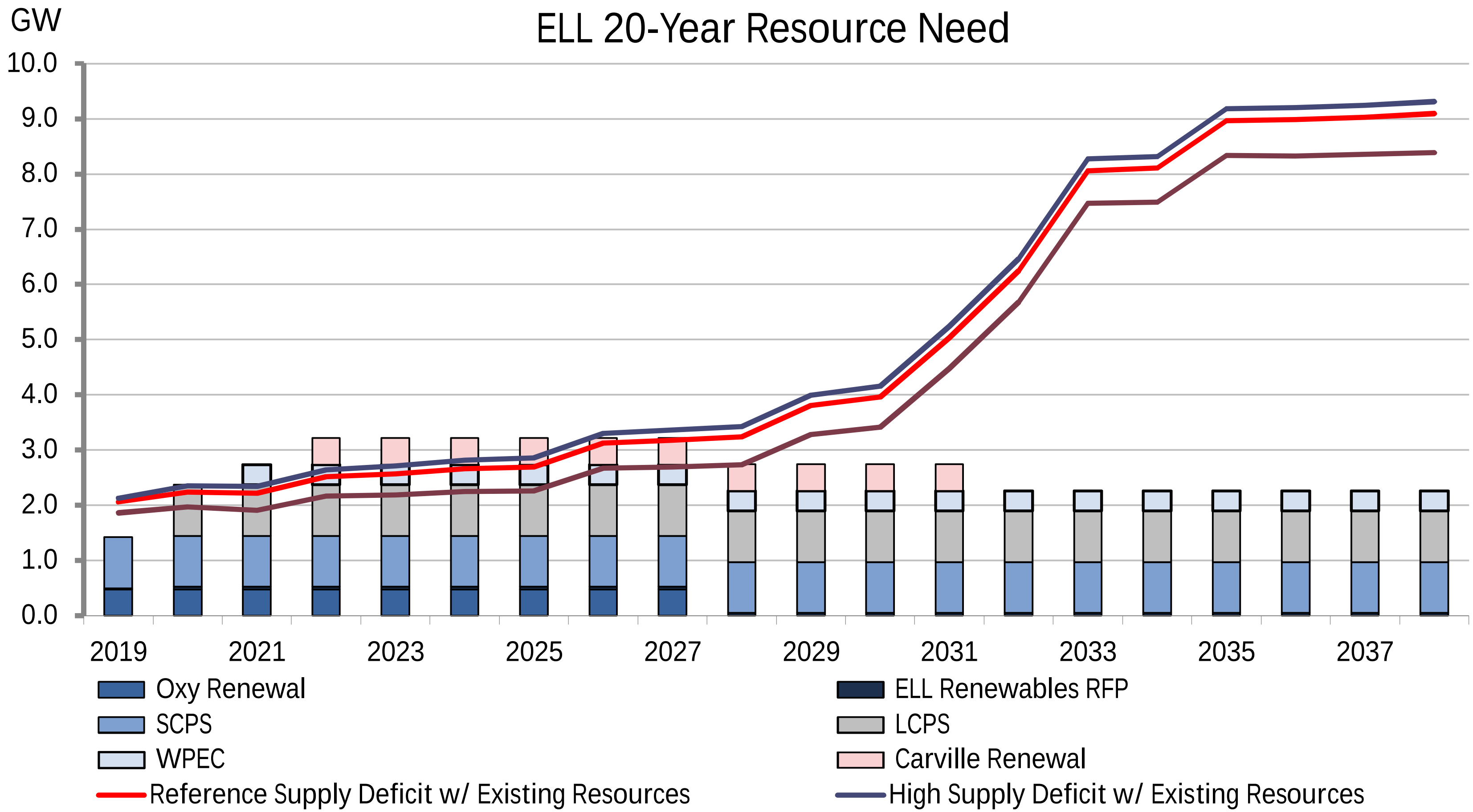
Current Fleet and Projected Needs

Supply Alternatives

Portfolio Analytics

Action Plan

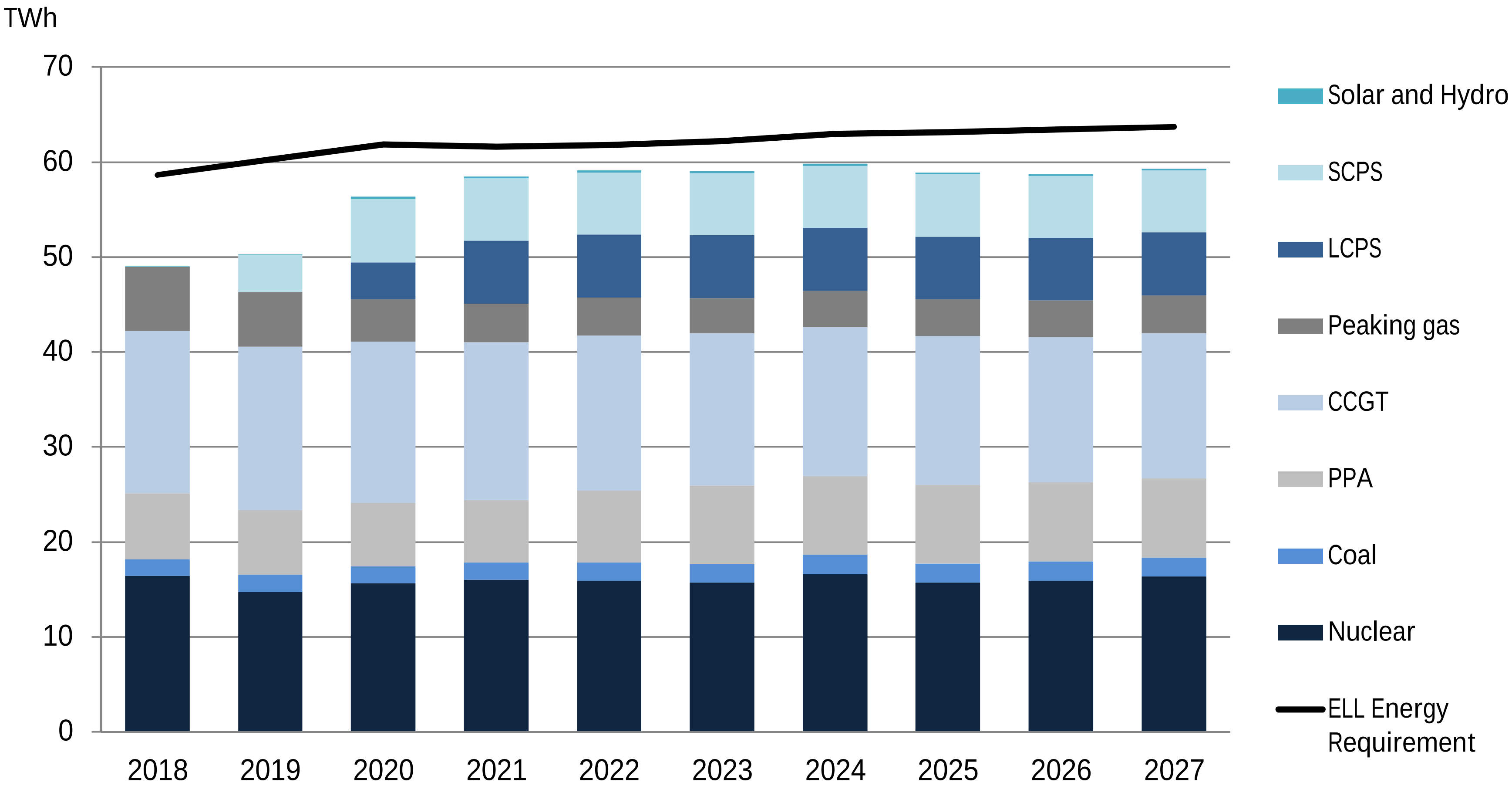
ELL's Long-term Supply Needs



Notes:

1. Long-term planning requirement is based on BP18U ELL non-coincident peak load forecast and incorporates a 12% ICAP reserve margin.
2. Supply deficit is calculated based on the difference in existing ICAP (taking into account assumed deactivations) and long-term planning requirement.
3. ELL's existing supply includes ~330 MW of LMRs

ELL Projected Energy Position

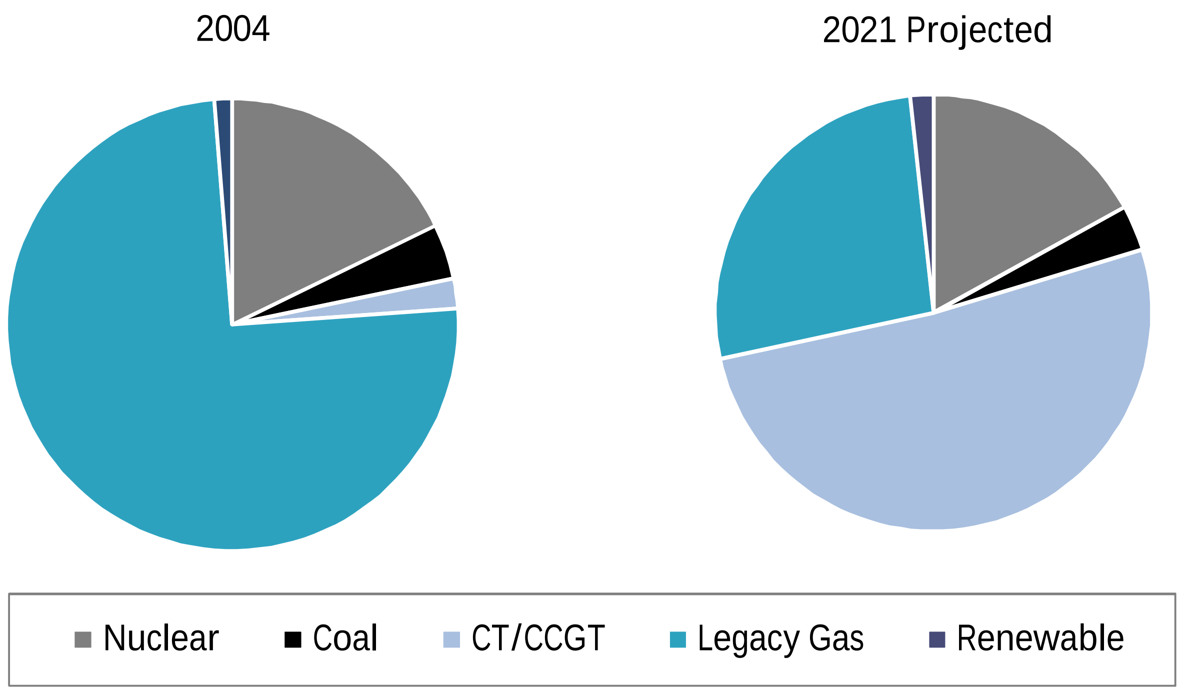


Notes:
1. AURORA Nodal Case
2. Peaking gas includes legacy gas, existing CTs, and WPEC

WE POWER LIFE℠

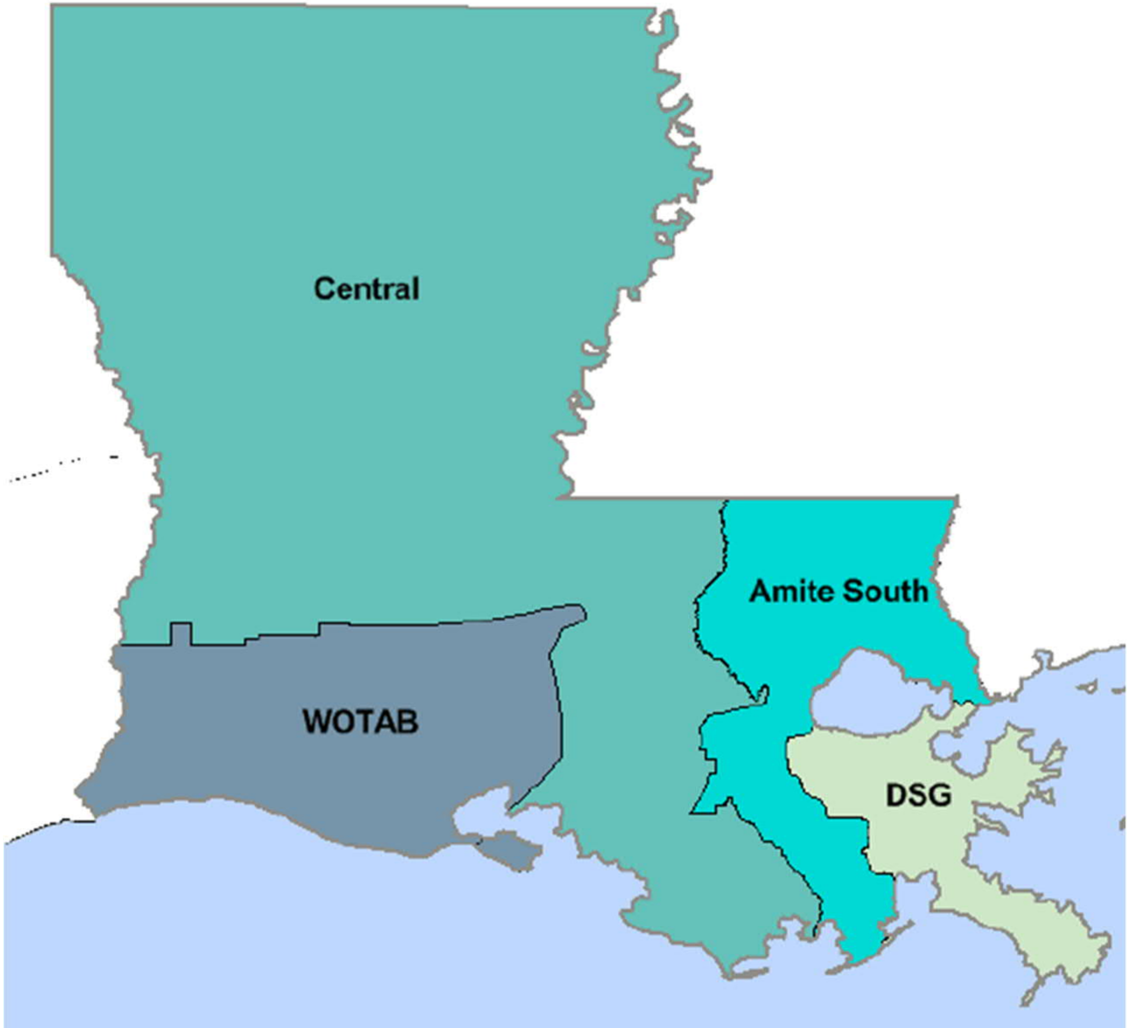
Fuel Diversity

- ELL has been successful at transforming its portfolio with reliable, efficient CT and CCGT capacity to meet its supply needs.



- It is expected that gas-fired generation will continue to be a part of the supply strategy.
- Going forward, portfolio enhancements may include a focus on increasing fuel diversity with procurement of more renewables and DSM.
- The Integrated Resource Plan helps explore the benefits of fuel diversity and the economics of non-traditional generation.

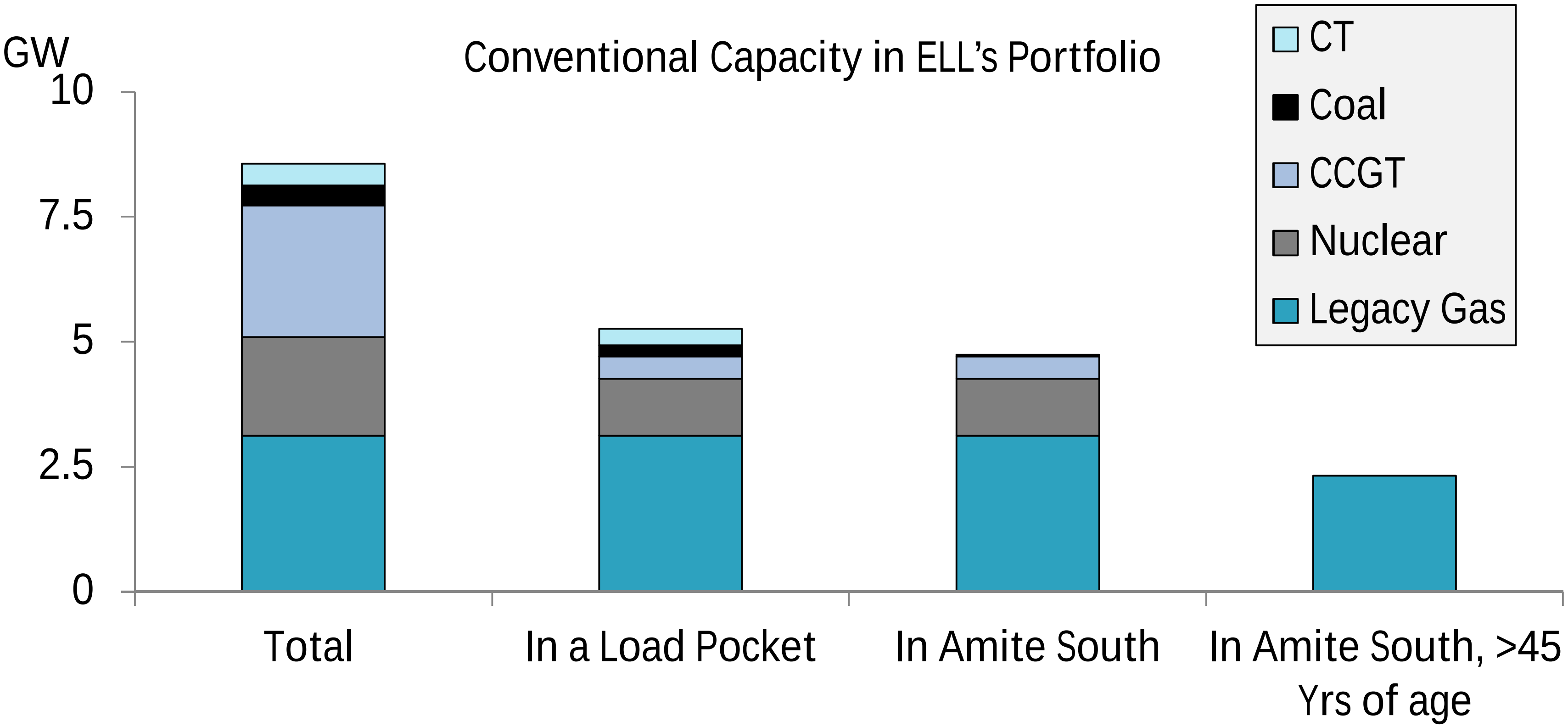
Area Planning



- One aspect of the planning process is to identify supply needs within load pockets, and to evaluate supply options to meet those needs.
- As described in the next slides, load pocket requirements are largely influenced by potential unit deactivations and increased industrial load.

Legacy Gas Risk

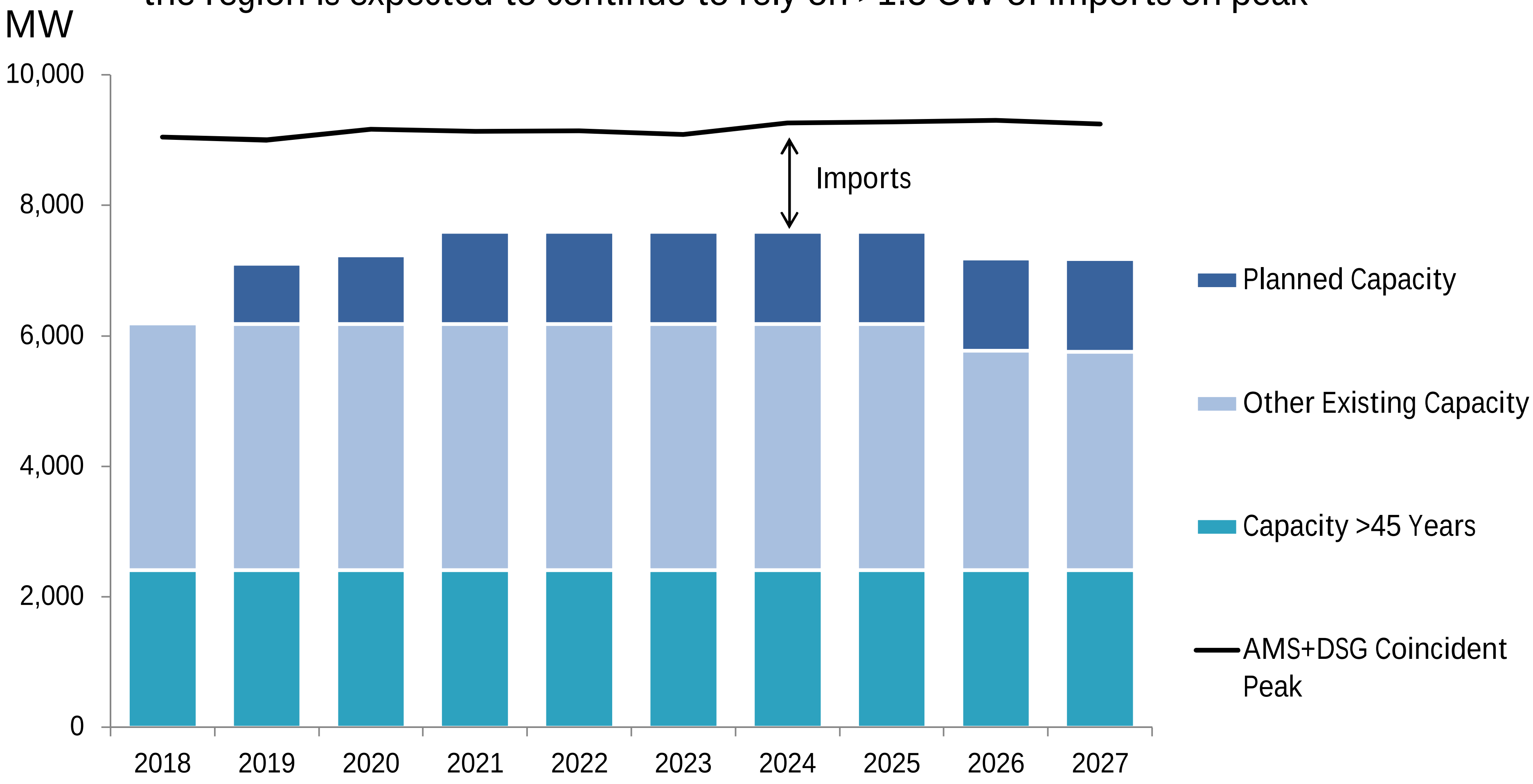
Of ~9GW of ELL's total capacity, nearly ¼ is Legacy Gas located within the Amite South (AMS) planning area and nearing the useful life cycle assumption of 60 years



WE POWER LIFE℠

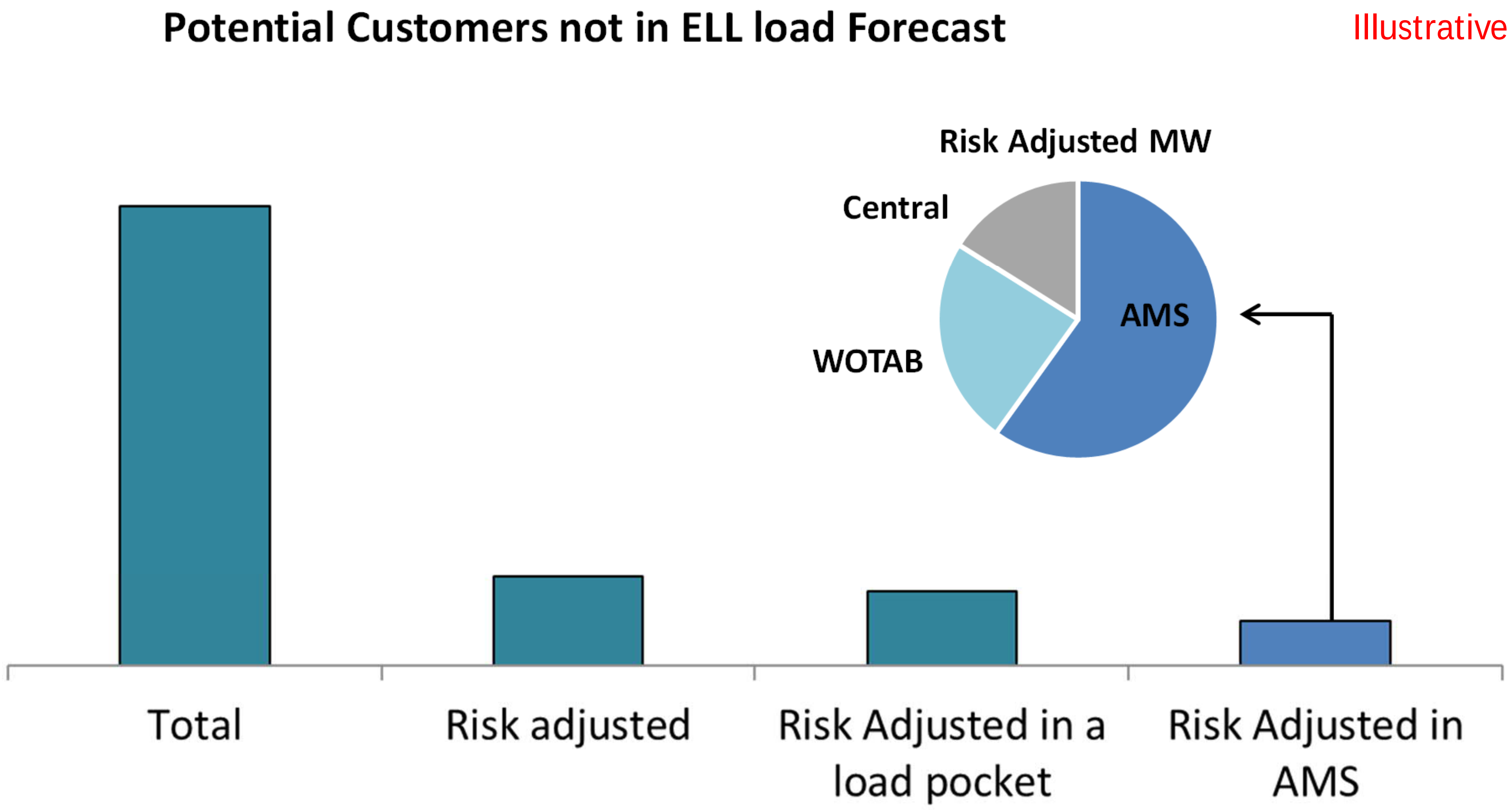
Load and Capability – AMS + DSG

Including Planned Additions, ~1/3 of the capacity in AMS is >45 years of age, and the region is expected to continue to rely on >1.5 GW of imports on peak



Block Load Additions Within Planning Areas

Not incorporated within the load forecast is several hundred MWs of industrial demand on a risk adjusted basis, over half of which is in AMS



ELL's Planning Framework and A Changing Industry

Current Fleet and Projected Needs

Supply Alternatives

Portfolio Analytics

Action Plan

Demand Side Management (DSM) Potential Study

ICF was retained by ELL to perform a DSM potential study.

The study considered scenarios to create savings forecasts for DSM programs:

- EE study:
  1. Current programs (based on ELL's Quick Start PY2 designs with expanded budgets)
  2. Expanded programs (current programs plus new best practice programs)
- DR study:
  1. Reference case
  2. High case

Hourly loadshapes and program costs associated with these savings forecasts served as inputs to IRP production cost modeling in Aurora.

DSM programs that appear to be cost-effective from the Potential Study were considered in ELL's portfolio evaluations to meet supply needs.

DSM Alternatives

- DSM program were evaluated based on the characteristics and attributes provided.
  - Demand response programs described by an average annual load reduction and annual program costs were evaluated through spreadsheet models outside of the Aurora model based on capacity value net of fixed program costs.
  - Energy efficiency programs described by an hourly load reduction profile and annual program costs.
- Programs determined to be economic (i.e. positive net benefits) were selected in the first year.
  - ELL's capacity position (surplus/deficit) was adjusted to reflect the capacity contribution of selected demand response programs.

Technology Assessment

Within the Technology Assessment, the status and potential portfolio fit of viable resource alternatives are considered, including traditional centralized generating technologies, renewable technologies, and emerging technologies such as battery storage

Emerging trends and implications:

- Renewable energy resources, especially solar, have emerged as viable economic alternatives and continue to improve.
- Trend towards smaller, more modular resources provides opportunity to reduce risk.
- New, smaller scale supply alternatives will better address locational, site specific reliability requirements while continuing to support overall grid reliability.
- Increased deployment of intermittent generation has increased the value and necessity of flexible, diverse supply alternatives.
- In recent years opportunities for portfolio diversity have been limited. Emerging technologies including renewable energy resources increase this opportunity.
- With the growth of renewable energy and distributed generation comes a greater need for investment into the development of a more complex energy system that can help manage the requirements of the electrical system.

Gas-fired technology considerations

	Frame CCGT (~1,000MW)	Frame CTs (~300MW)	Internal Combustion Engines (~10-20MW)	Aeroderivative CTs (~100MW)
Capital Cost ($/kW)	◕	●	◔	◔
Non-Fuel O&M	◕	◕	◔	◑
Heat Rate	●	◔	◕	◑
Flexibility	◑	◑	●	●
Contingency Risk	◔	◑	●	◕
Gas Supply	◑	◑	●	◑

Relatively More — Benefits — Relatively Less

● ← ◑ → ◔

Note: Technologies are ranked relative to one another and available gas-fired peaking alternatives.

Renewable technology considerations

	Solar PV Tracking	Onshore Wind
Capital Cost ($/kW)	●	◐
Capacity Factor	◔	◐
On-Peak Production	◐	◔
In-region Potential	◕	◔

Relatively More ● ← Benefits ◐ → ◔ Relatively Less

Note: Technologies are ranked relative to one another

Additional Benefits of Renewables

Diversity - Renewables add fuel diversity and provide a hedge within gas-centric resource portfolios as ELL's ability to rely on coal for fuel diversity becomes uncertain.

Infrastructure - Reduced infrastructure requirements (e.g., gas pipelines, water supply) increases siting flexibility.

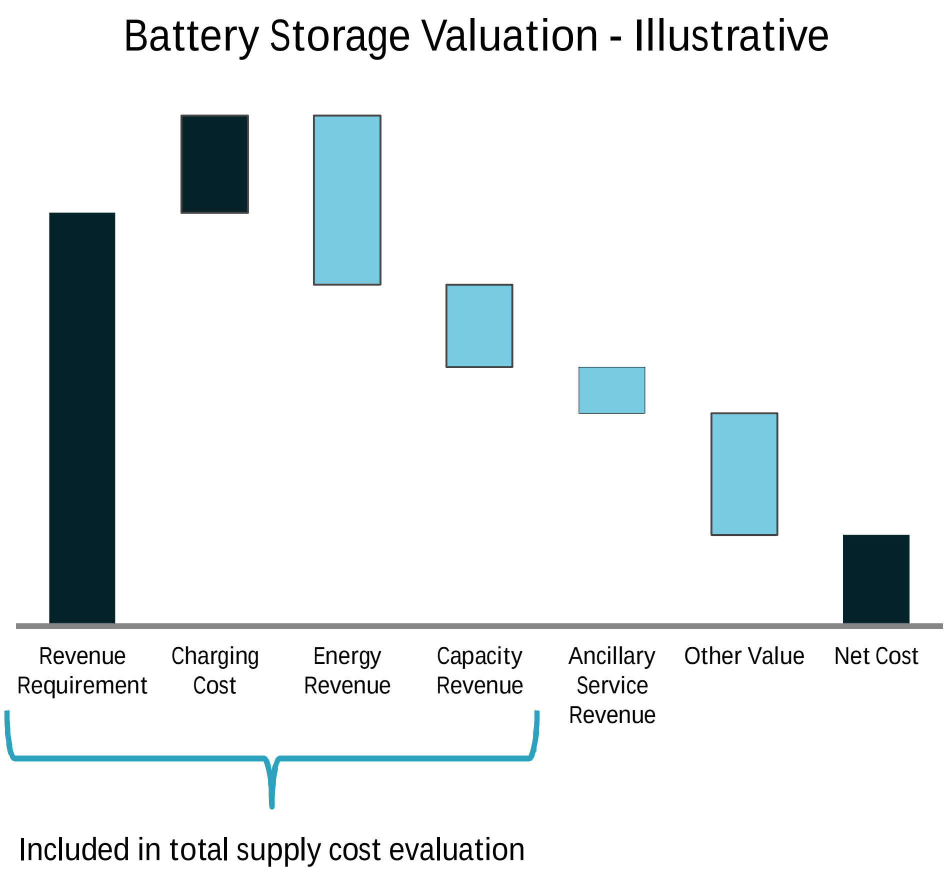
Scalability - Deployment potentially can be scaled up or down to meet capacity needs more easily relative to conventional alternatives, although economics remain a factor.

Carbon - Renewables offer customers protection against uncertainty related to potential CO_2 costs.

Customer Engagement – ELL's experience with renewables will help ELL better meet customer expectations with respect to renewable energy pricing tariffs, deployment of distributed energy resources (DERs), and the integration of advanced metering infrastructure (AMI).

Battery Storage Alternatives

As installation costs decrease, battery storage has the potential to provide economic and reliability benefits and reduce risk to customers in the future.



Several factors may increase the value of battery storage and merit additional analysis:

- Forecasted capital cost declines
- Rapid construction
- Modular deployment and portability
- Increased renewable penetration
- Application of ITC to energy storage devices if coupled with solar
- Potential to defer transmission or distribution investments

ELL’s Planning Framework and A Changing Industry

Current Fleet and Projected Needs

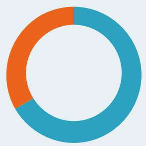
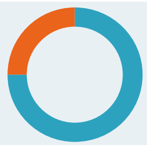
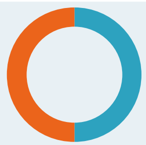
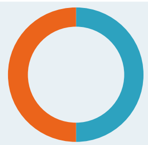
Supply Alternatives

Portfolio Analytics

Action Plan

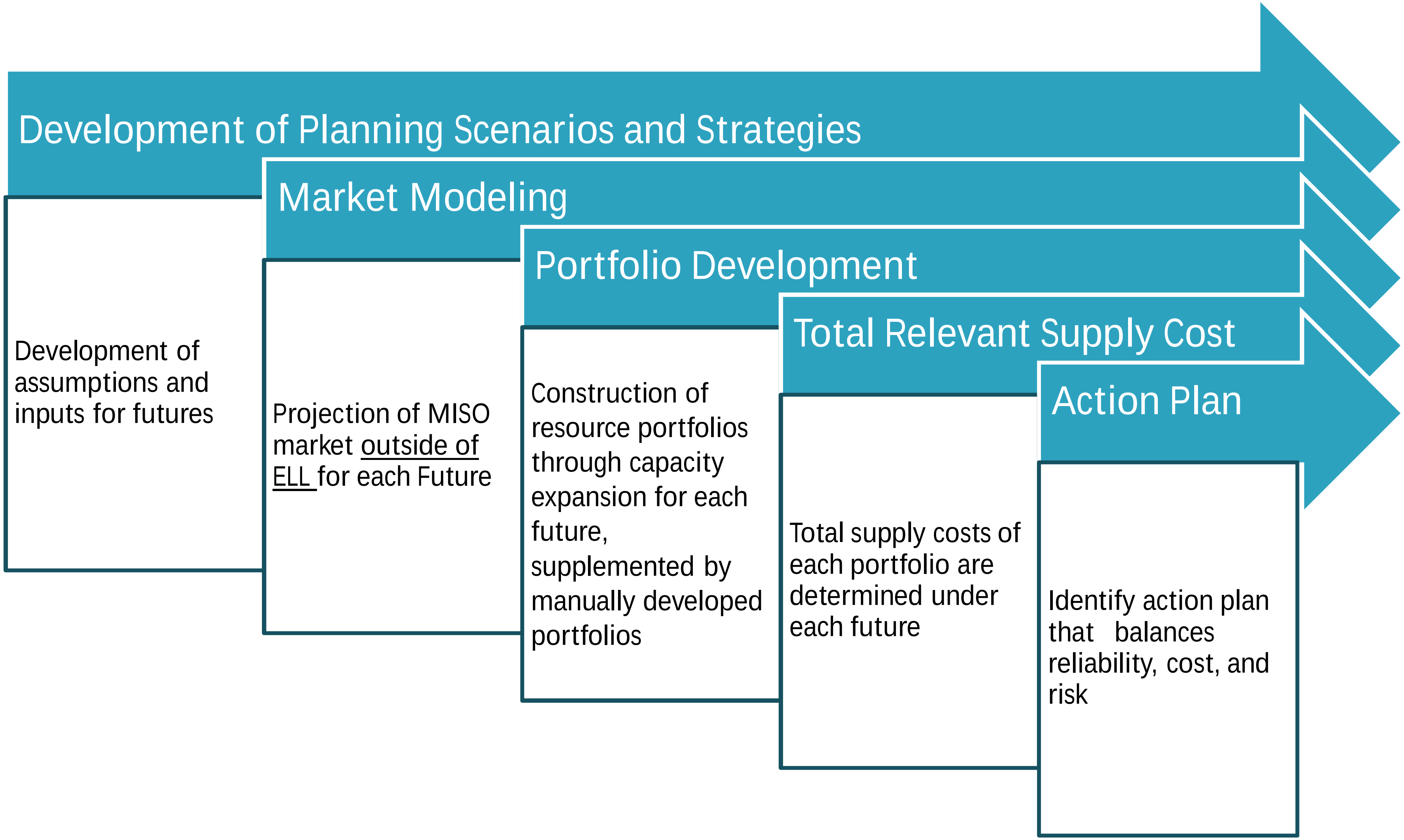
IRP Analysis Scenarios

- The IRP analysis relied on 4 scenarios ("futures") to assess supply portfolios across a range of market outcomes.
- The scenario approach, along with sensitivities, allows ELL to assess portfolio performance as it is related to expected total supply cost and risk.

	Progression Towards Resource Mix	Policy Reversion (Gas Centric)	Decentralized Focus (DSM & Renewables)	Economic Growth w/ Emphasis on Renewables
Peak Load & Energy Growth	Reference	High	Low	High
20-Year Levelized Natural Gas Prices (2019$)	Reference ($4.81)	Low ($3.27)	Low ($3.27)	High ($6.70)
Market Coal & Legacy Gas Deactivations [1]	Reference (60 years)	55 years	50 years	55 years
Magnitude of Market Coal & Legacy Gas Deactivations	12% by 2028 54% by 2038	31% by 2028 88% by 2038	54% by 2028 91% by 2038	31% by 2028 88% by 2038
Incremental Market Renewables / Gas Mix				
CO_2 Price Forecast	Reference	None	High	Reference

Notes:
1. Deactivation assumptions are consistent with current planning assumptions for ELL owned or contracted generation

Analytic Process to Create and Value Portfolios

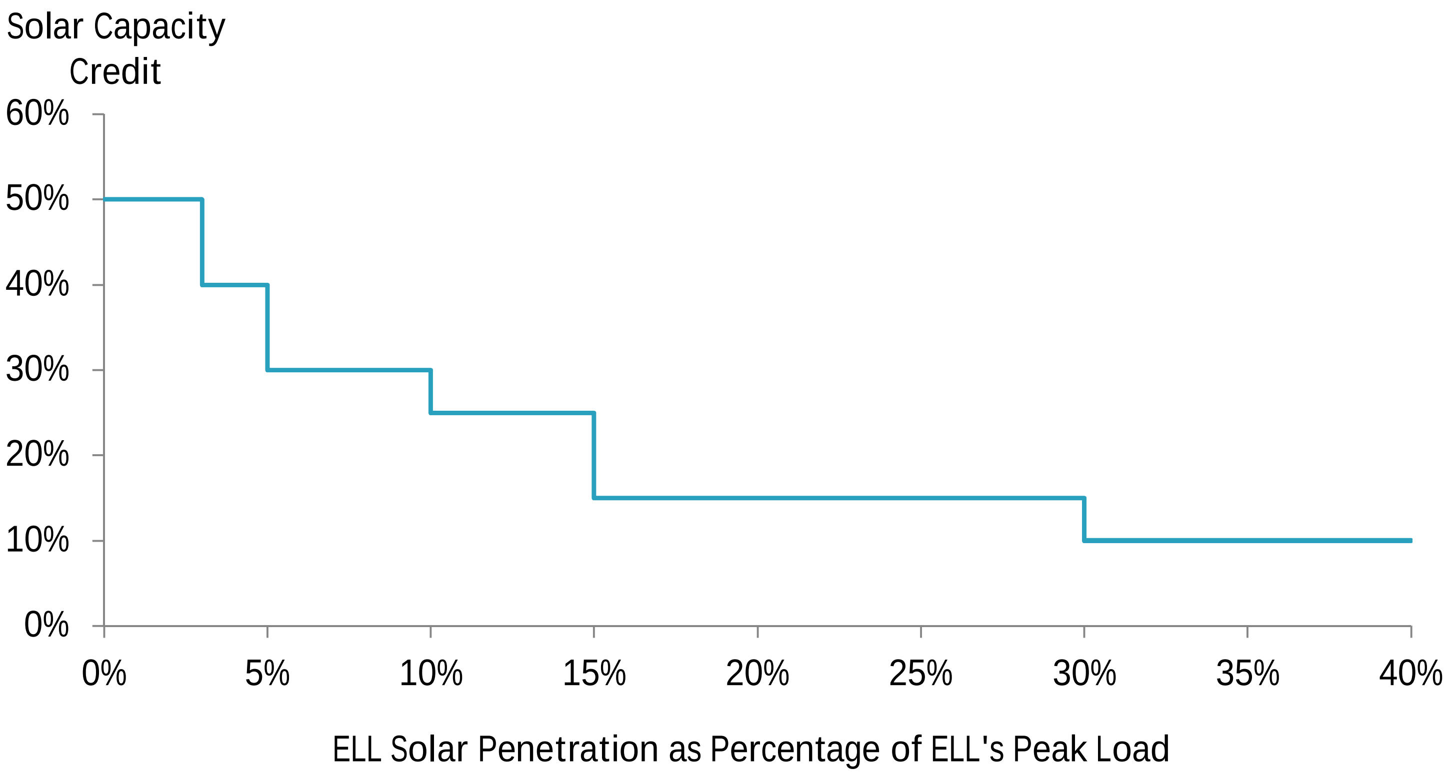


Aurora Process and Framework

1. Market Model Set-Up
   - Develop MISO market build scenario for each future based on assumptions for that future
     - 16% reserve margin target based on MISO summer peak load
     - 2 Pool model: MISO, ELL
     - Build out MISO Pool to achieve target fuel mix, not in excess of need
2. Initial Production Cost Simulation
   - Simulate market in each future to generate market price curve (i.e. LMPs) for MISO excluding ELL
3. Capacity Expansion Model
   - Optimize selection of supply-side alternatives to create ELL portfolio matched to each future
     - 12% reserve margin target
     - An assumed transfer capability between MISO pool and ELL
     - Portfolio addition decisions based on maximizing value of supply additions
4. Final Production Cost Simulations
   - Compute Variable Supply Costs for each capacity expansion portfolio in each of the 4 futures using Zonal Model

Solar Capacity Credit Modeling

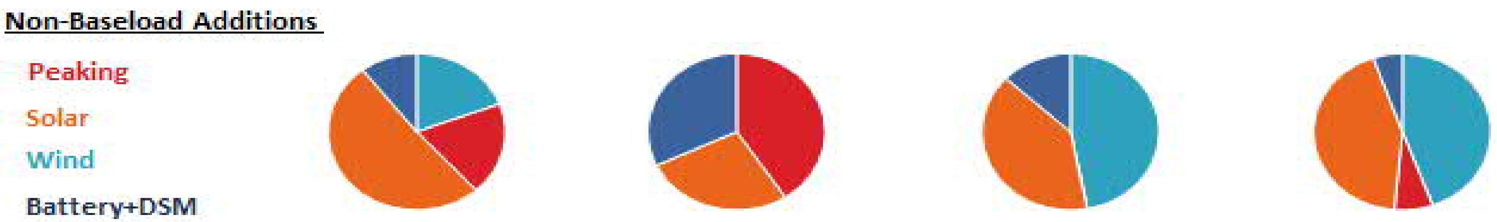
Within the capacity expansion model, a declining capacity value was applied to solar to account for decreased reliability contribution



WE POWER LIFE SM

Capacity Expansion Results

	Builds			
Resource Type	P1	P2	P3	P4
CCGTs	4080	4080	4590	4590
J - CTs	1200	1500	0	600
Solar	3200	1000	1700	3700
Wind	1200	0	2000	3800
Batteries	100	600	0	400
DSM	554	580	554	53
Total	10,143	7,546	8,653	13,148
Effective	6,685	6,926	5,800	7,076



Capacity Expansion generally favored CCGT and Solar additions across futures

Notes:
1. Long-term planning requirement is based on ELL non-coincident peak load forecast and includes a 12% ICAP reserve margin.
2. Supply deficit is calculated based on the difference in existing ICAP (including assumed deactivations) and long-term planning requirement

Energy Efficiency Additions

Results indicate that some of ELL's future capacity and energy needs could be economically met by Energy Efficiency Programs

Energy Efficiency		Portfolio 1	Portfolio 2	Portfolio 3	Portfolio 4
EE Industrial Sector	Industrial Process	x	x	x	
	Industrial Prescriptive & Custom	x	x	x	x
	Industrial Strategic Energy Management				
EE Residential Sector	Appliances Recycling	x	x	x	
	ENERGY STAR New Homes	x	x	x	
	Home Audit and Retrofit	x	x	x	
	Residential Prescriptive Non-Lighting	x	x	x	
	Residential AC Tune up	x	x	x	
	Residential HVAC Duct Sealing	x	x	x	
	Residential Lighting	x	x	x	x
	Low Income Weatherization	x	x	x	x
	Residential Unitary AC and HP	x	x	x	
	Home Energy Use Benchmarking	x	x	x	
EE Commercial Sector	Commercial Prescriptive & Custom HVAC	x	x	x	
	Commercial Prescriptive & Custom Other				
	Small Business Solutions	x	x	x	
	RetroCommissioning				
	Commercial New Construction				
	Current Commercial Prescriptive & Custom Lighting	x	x	x	
	Reduced Commercial Prescriptive & Custom Lighting				
	Midstream Commercial Lighting				
	Max Potential EE MWs*	404	404	404	10

*MWs not grossed up for 12% Reserve margin

Notes:
1. Highlighted programs are currently offered by ELL. Program funding and specifics may differ from DSM study inputs.

Demand Response Additions

Results indicate that some of ELL's future capacity needs could be economically met by Demand Response Programs

Demand Response		Portfolio 1	Portfolio 2	Portfolio 3	Portfolio 4
Reference Case	Residential DLC (thermostat + water heater)				
	Residential ToU				
	Commercial DLC (thermostat)				
	Commercial ToU				x
	Industrial ToU				
High Case	Residential DLC (thermostat + water heater)	x	x	x	
	Residential ToU				
	Commercial DLC (thermostat)	x	x	x	x
	Commercial ToU		x		
	Industrial ToU				
	Max Potential DR MWs*	90	114	90	23
Combined DR & EE	Total Max Potential DSM MWs**	495	518	495	47

*MWs not grossed up for 12% Reserve margin

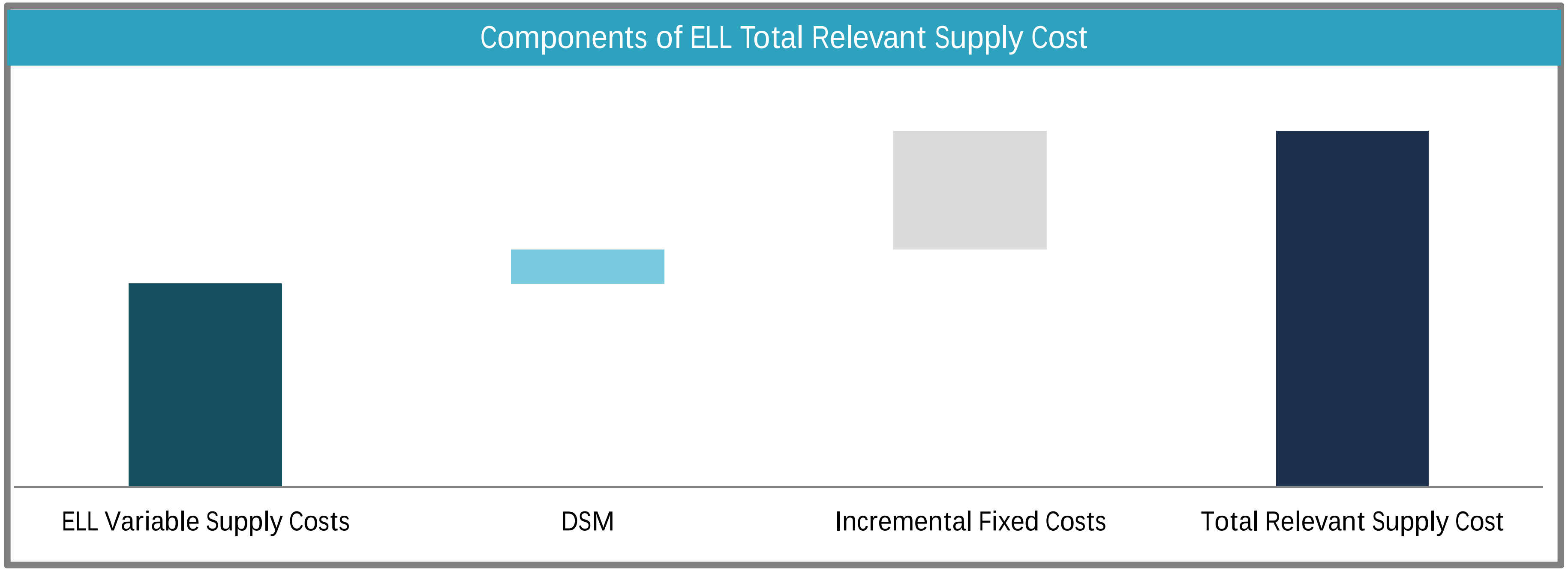
**Max Potential MW represents total MW DSM capacity in the year which DSM contributes the most capacity during the planning period. DSM capacity contribution will vary by year

ELL Total Relevant Supply Cost Components

- ELL Total Relevant Supply Cost results consist of 3 major components:

  ELL Variable Supply Costs
  + Demand Side Management (DSM) Costs[1]
  + Incremental Fixed Costs[2]
  Total Relevant Supply Cost ("TRSC")

Illustrative



[1] DSM costs are not a distinguishing component between portfolios
[2] Incremental Fixed Costs include an adjustment for applicable tax credits and capacity purchases/sales

Final Total Relevant Supply Cost Results

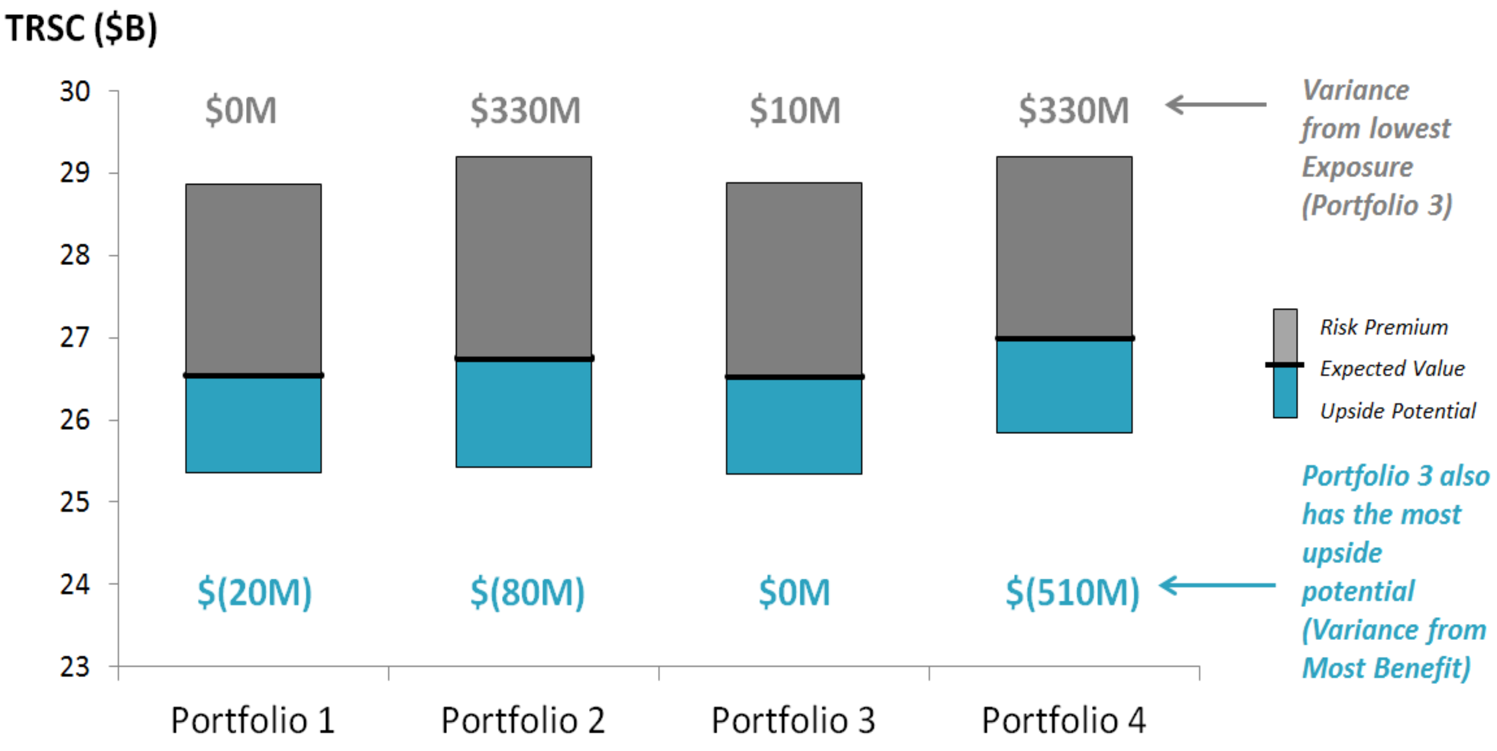
PV of Total Relevant Supply Cost (MM, 2019$, 2019-2038)				
	Future 1	Future 2	Future 3	Future 4
Portfolio 1	$26,294	$21,816	$22,224	$35,803
Portfolio 2	$26,534	$21,460	$22,492	$36,489
Portfolio 3	$26,557	$21,787	$21,876	$35,872
Portfolio 4	$27,099	$22,647	$22,431	$35,767

Portfolio Rankings				
	Future 1	Future 2	Future 3	Future 4
Portfolio 1	1	3	2	2
Portfolio 2	2	1	4	4
Portfolio 3	3	2	1	3
Portfolio 4	4	4	3	1

PV of Total Relevant Supply Cost Variance to Least Cost Portfolio (MM, 2019$, 2019-2038)				
	Future 1	Future 2	Future 3	Future 4
Portfolio 1	$0	$355	$348	$36
Portfolio 2	$240	$0	$616	$722
Portfolio 3	$263	$327	$0	$105
Portfolio 4	$804	$1,186	$555	$0

Tradeoff Between Cost and Risk

- Portfolios that provide additional fuel diversity through solar additions lower supply cost risk compared to gas-centric portfolios
- Portfolios that focuses on solar generation complemented with peaking gas-fired generation performed the best when taking into account risk



Notes:
1. Expected value computed as the average of a portfolio's total relevant supply cost across all futures

WE POWER LIFE℠

Conclusions

Planning Guideline	Cost	Risk	Reliability	Aligned with Planning Guidelines
2019 IRP Metric	Expected Value	Risk Premium	12% PRM	
Portfolio 1	✓	✓	✓	✓
Portfolio 2			✓	
Portfolio 3	✓	✓	✓	✓
Portfolio 4			✓	

- The best performing portfolios incorporate a balance of CCGT, Renewables, and DSM
- Energy Storage was selected in small amounts in Portfolio 1 (100MW) and with policy changes, market conditions, cost declines, and performance improvements, storage may become increasingly viable for ELL's customers
- ELL continues to see that CCGTs provide value to customers
- Renewable generation, such as solar, provides an opportunity for ELL to diversity its portfolio with assets not dependent on fuel prices or CO_2 prices and align with customer preferences for sustainable generation
- There is value in pursuing energy efficiency and demand response as a supply alternative

ELL’s Planning Framework and A Changing Industry

Current Fleet and Projected Needs

Supply Alternatives

Portfolio Analytics

Action Plan

Action Plan

- Legacy generation economic study - ELL will conduct a comprehensive evaluation to assess the continued operations and role of its legacy fleet.
- Integration of more modular supply – ELL will continue to evaluate the potential to bring more economic solar generation online in the coming years to support ELL's planning objectives.
- Renewable energy pricing tariff - In conjunction with its first utility-scale solar resource, ELL is seeking Commission authorization of an Experimental Renewable Option Rate Schedule, which provides pricing that is tied directly to renewable generation.
- Battery storage – With potential of providing an array of benefits, ELL will continue to explore opportunities for battery storage.
- Demand side management ("DSM") and interruptible rate schedules - ELL intends to conduct more detailed analysis of Demand Response ("DR") and Energy Efficiency ("EE") programs, some of which will be facilitated by the deployment of AMI. Additionally, ELL will develop and offer new interruptible tariffs with options for participation in the MISO energy and capacity markets.
- Growth and reliability study – ELL may find it necessary to undertake a study to evaluate load growth and unit deactivations not accounted for in the Commission's current long-term planning processes in order to measure potential impact on ELL customers and system reliability, which may affect ELL's resource needs.

Legacy Generation Economic Study

- ELL continually monitors the condition of its units, market conditions, and economics to evaluate whether legacy units are candidates for deactivation or retirement
- Consistent with the LPSC directive from the February 21, 2018 open session, ELL will conduct a comprehensive evaluation to assess the continued operations and role of its legacy fleet
- The study will:
  - Consider the reliability implications of future unit deactivation and retirements
  - Provide additional insight in the transmission and generation support needed within the Amite South region

Integration of Modular Supply

- Customers are increasingly interested in sustainable energy generation
- Solar generation possesses a variety of beneficial attributes which could provide benefits to ELL customers:
  - Costs continue to decline, zero emissions, federal investment tax credits (ITCs), predictable energy curve
  - Added fuel diversity and a hedge within gas-centric resource portfolio like ELL's
  - Deployment is scalable
  - Offers customers protection against uncertainty related to potential CO_2 and other emissions regulations and costs
- Solar generation also has some challenges:
  - Intermittent operations
  - Relatively lower capacity value compared to traditional generation
  - Land-intensive
  - Responsive, quickstart generation is necessary to integrate large amounts of solar PV
- Currently seeking certification for a 50MW solar PPA (stemming from 2016 Renewables RFP)
- ELL intends to plan for increased investments in, and development of, its renewable energy resources and generation

Renewable Energy Pricing Tariff

- New rate schedule offering for customers interested in power from a renewable source
- ELL signed a PPA for 50 MW from a solar facility ("LA3 PPA") to be located near Port Allen, LA
  - ELL filed for approval of the LA3 PPA in LPSC Docket U-34836
- Experimental Renewable Option Rate Schedule ("Schedule ERO") being made available to qualifying commercial and industrial customers
  - An individual customer may subscribe up to 10,000 kW in 500 kW increments
  - Energy is priced between $0-15/MWh above existing rate based on the MISO value of the LA3 PPA
- Schedule ERO is under review in LPSC Docket U-35019
  - Service under Schedule ERO is contingent on approval of the LA3 PPA, which is expected to be online as early as late 2019

Battery Storage

- Potential to provide an array of benefits:
  - Ability to store energy for later use
  - Ability to discharge rapidly and ramp quickly
  - Rapid construction
  - Modular deployment and portability (potential to be redeployed in different areas)
  - Relatively small footprint allows for more flexible siting
  - Ability to offer "stacked" values (though rules are still being developed in MISO)

- Also has some challenges:
  - Typical on-peak / off-peak spread remains low in MISO South (may limit arbitrage potential)
  - MISO's ancillary services market is limited today and fully met with existing resources
  - Fixed costs of energy storage today remain relatively higher than a new build CT

- Expectations are that costs will continue to decline
- ELL intends to continue to explore opportunities to expand upon and develop this technology

Interruptible Rate Schedules

- ELL will develop new interruptible rate schedules in response to stakeholder feedback and in response to recent activity of Aggregators of Retail Customers ("ARCs") in Louisiana
  - Careful consideration must be given to pricing to protect against cost shift to non-participating customers

- Rates under consideration
  - General interruptible rate based on the value of physical generating capacity
  - MISO market value-based rate schedules, which would allow for customer access to MISO demand response products while giving ELL visibility of the amount of interruptible load participating in these programs

- Staff's proposed rule in the ARC rulemaking (R-34948) proposes a new rulemaking to study the potential development of demand response products and tariffs for Louisiana retail customers

- ELL expects to file these new rate schedules in 2019; timing may depend on any demand response rulemaking initiated by the LPSC

Demand Side Management (DSM)

- ELL engaged ICF to produce a potential study that includes EE and DR offerings
  - EE included programs administered by ELL's Quick Start Phase I Program Year 2, an expansion of those programs and new offerings
  - DR included offerings related to price response and load response
- IRP analytics indicated the value DSM may bring ELL's customers
- ELL intends to conduct more detailed analysis on the programs that proved to be economic in its modeled portfolio results
- The deployment of AMI will position ELL to offer dynamic pricing alternatives
- ELL engaged with LPSC Staff on ARC rulemaking

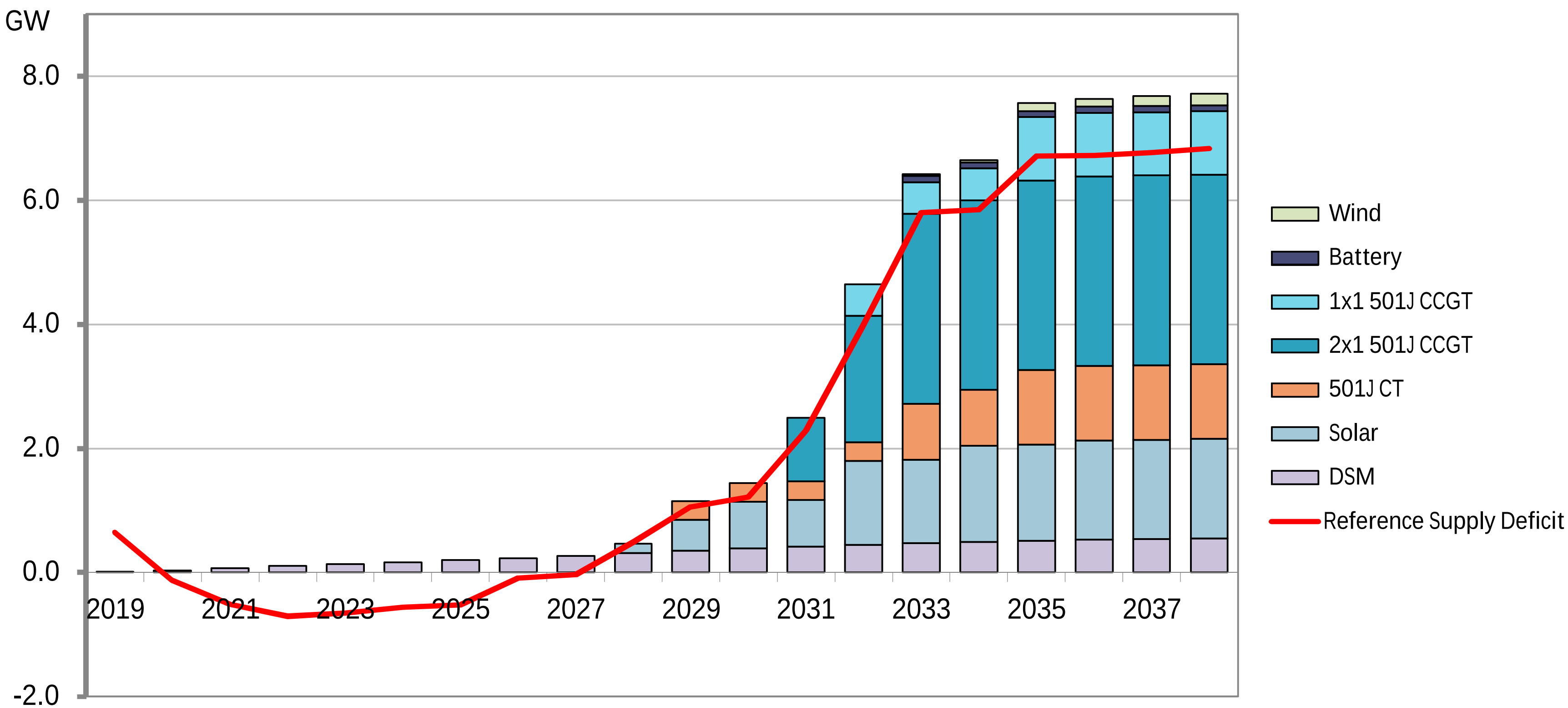
Growth and Reliability Study

- ELL is responsible for planning and maintaining a resource portfolio to meet its customers' power needs
- Thus far, distribution electric cooperatives have been exempted from the IRP order on the basis that they have a full requirement contract
- It appears that some cooperatives are attempting to enter into new wholesale supply agreements in connection with block load additions without LPSC engagement in that resource planning procurement effort
- Should distribution electric cooperatives, or other entities, rely on the short-term MISO capacity market to serve load, such reliance could have unintended consequences on reliability and electricity prices
- ELL is concerned with this activity and may find it necessary to undertake a study to evaluate load growth and unit deactivations not accounted for in current long-term planning processes in order to measure potential impact on ELL customers and system reliability, which may affect ELL's resource needs

Appendix

Future 1 (Progression Towards Resource Mix)

Future 1 produces a diverse portfolio of resources which includes baseload energy producing resources, grid balancing gas, renewables, energy storage, and DSM



Notes:

1. Long-term planning requirement is based on ELL non-coincident peak load forecast and includes a 12% ICAP reserve margin.
2. Supply deficit is calculated based on the difference in existing ICAP (including assumed deactivations) and long-term planning requirement.

Future 1 (Progression Towards Resource Mix)

Future 1 produces a diverse portfolio of resources which includes baseload energy producing resources, grid balancing gas, renewables, energy storage, and DSM

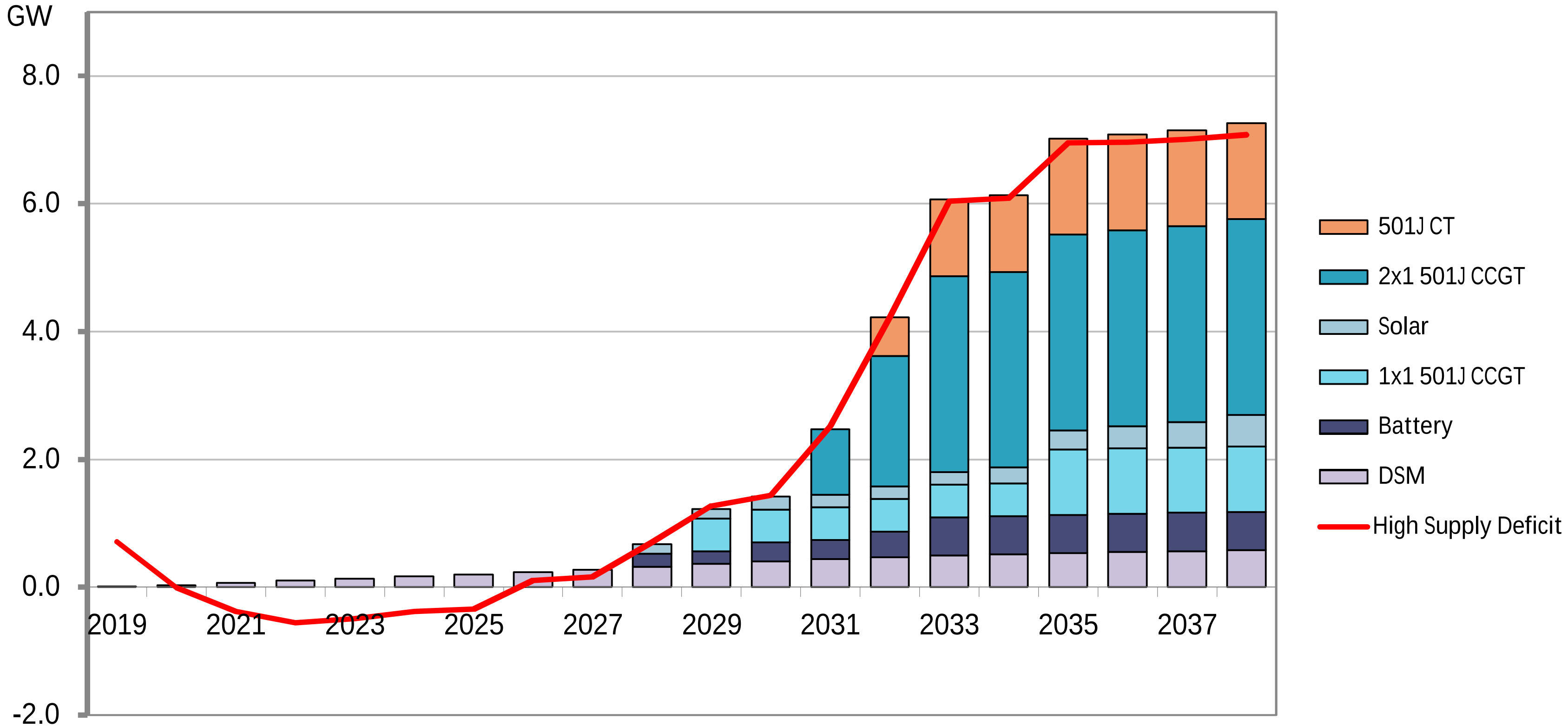
[GW]	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
DSM [1]	0.013	0.034	0.067	0.106	0.138	0.169	0.199	0.233	0.271	0.312	0.351	0.388	0.420	0.449	0.472	0.492	0.510	0.527	0.541	0.554
CT	---	---	---	---	---	---	---	---	---	---	0.300	0.300	0.300	0.300	0.900	0.900	1.200	1.200	1.200	1.200
CCGT	---	---	---	---	---	---	---	---	---	---	---	---	1.02	2.55	3.57	3.57	4.08	4.08	4.08	4.08
Solar [2]	---	---	---	---	---	---	---	---	---	0.15	0.50	0.75	0.75	1.35	1.35	1.55	1.55	1.60	1.60	1.60
Wind [3]	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.03	0.03	0.12	0.12	0.16	0.19
Battery Storage [4]	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.10	0.10	0.10	0.10	0.10	0.10
Fixed Cost [5]	$13	$20	$29	$36	$37	$38	$40	$43	$45	$84	$196	$260	$403	$775	$1,035	$1,103	$1,369	$1,409	$1,481	$1,555

Notes:
1. DSM includes demand response and energy efficiency programs
2. Solar additions represented as 50% of nameplate capacity
3. Wind additions represented as 15.6% of nameplate capacity
4. All battery storage modeled at a 4:1 energy capacity to power ratio (MWH:MW)
5. Total cost represents levelized real 2019$MM 2019-2038 fixed cost revenue requirements for DSM and supply-side resource additions

WE POWER LIFE℠

Future 2 (Gas Centric)

High load, coupled with low gas prices may provide opportunities for storage and peaking, dispatchable gas



Notes:

1. Long-term planning requirement is based on ELL non-coincident peak load forecast and includes a 12% ICAP reserve margin.
2. Supply deficit is calculated based on the difference in existing ICAP (including assumed deactivations) and long-term planning requirement.

WE POWER LIFE℠

Future 2 (Gas Centric)

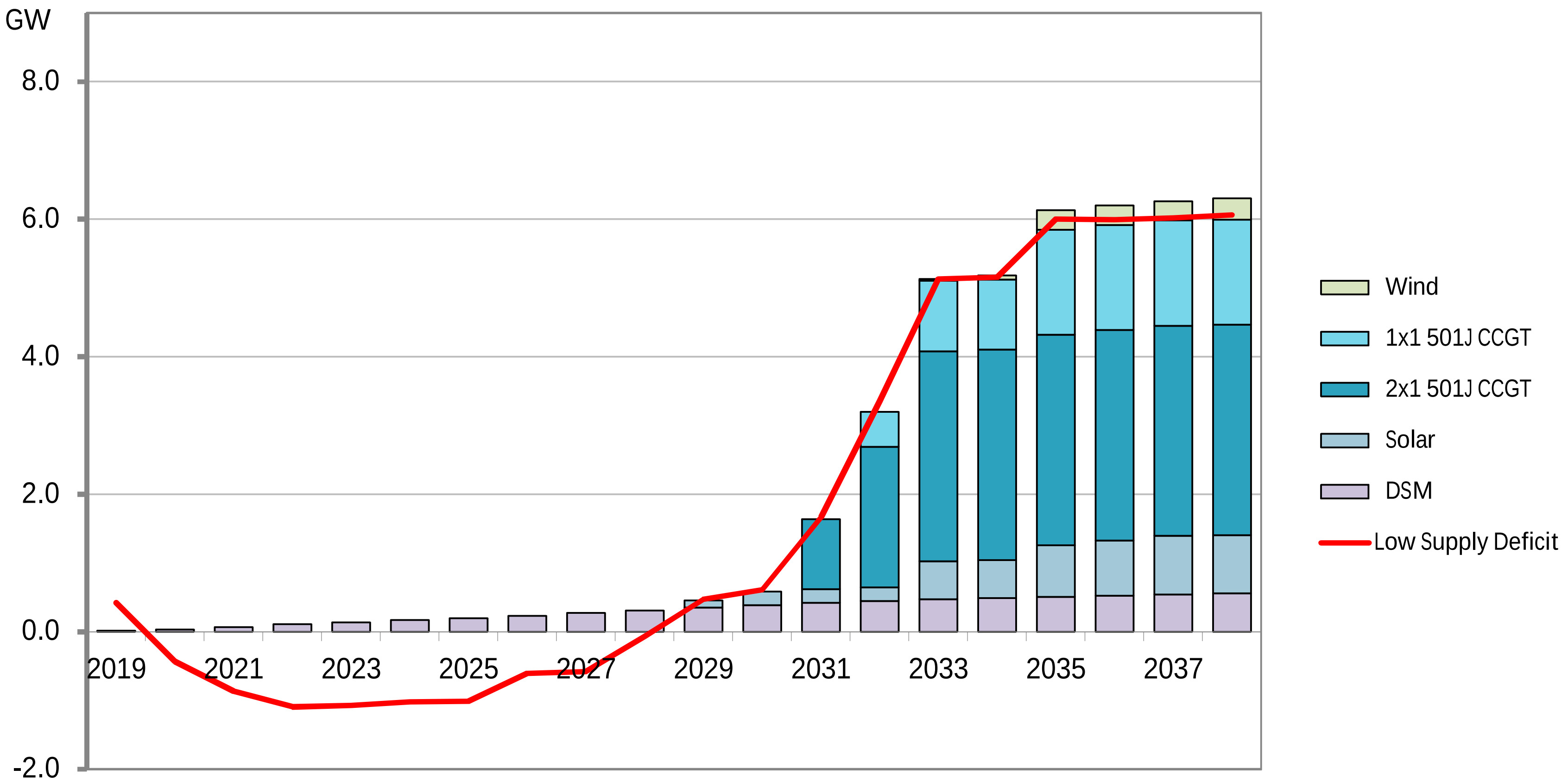
High load, coupled with low gas prices may provide opportunities for storage and peaking, dispatchable gas

[GW]	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
DSM [1]	0.01	0.03	0.07	0.11	0.14	0.17	0.20	0.24	0.28	0.32	0.37	0.41	0.44	0.47	0.50	0.52	0.54	0.55	0.57	0.58
CT	---	---	---	---	---	---	---	---	---	---	---	---	---	0.600	1.200	1.200	1.500	1.500	1.500	1.500
CCGT	---	---	---	---	---	---	---	---	---	---	0.51	0.51	1.53	2.55	3.57	3.57	4.08	4.08	4.08	4.08
Solar [2]	---	---	---	---	---	---	---	---	---	0.15	0.15	0.20	0.20	0.20	0.20	0.25	0.30	0.35	0.40	0.50
Wind [3]	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Battery Storage [4]	---	---	---	---	---	---	---	---	---	0.20	0.20	0.30	0.30	0.40	0.60	0.60	0.60	0.60	0.60	0.60
Fixed Cost [5]	$13	$20	$29	$36	$37	$38	$40	$43	$46	$90	$171	$191	$332	$539	$757	$783	$929	$960	$991	$1,028

Notes:
1. DSM includes demand response and energy efficiency programs
2. Solar additions represented as 50% of nameplate capacity
3. Wind additions represented as 15.6% of nameplate capacity
4. All battery storage modeled at a 4:1 energy capacity to power ratio (MWH:MW)
5. Total cost represents levelized real 2019$MM 2019-2038 fixed cost revenue requirements for DSM and supply-side resource additions

Future 3 (DSM & Renewables)

Lowered electric demand and CO_2 prices discourage CT deployments seen in futures 1 and 2



Notes:

1. Long-term planning requirement is based on ELL non-coincident peak load forecast and includes a 12% ICAP reserve margin.
2. Supply deficit is calculated based on the difference in existing ICAP (including assumed deactivations) and long-term planning requirement.

Future 3 (DSM & Renewables)

Lowered electric demand and CO_2 prices discourage CT deployments seen in futures 1 and 2

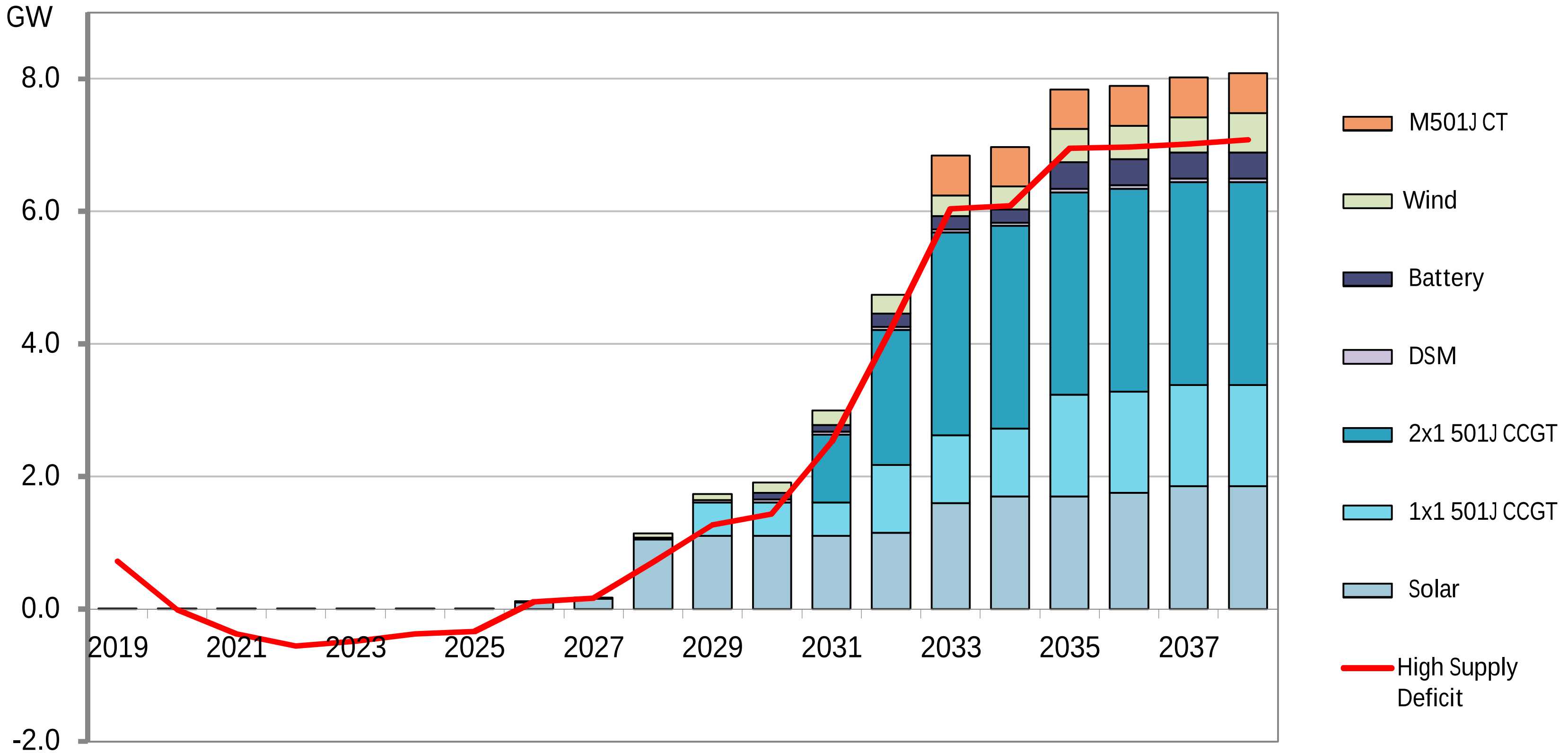
[GW]	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
DSM [1]	0.01	0.03	0.07	0.11	0.14	0.17	0.20	0.23	0.27	0.31	0.35	0.39	0.42	0.45	0.47	0.49	0.51	0.53	0.54	0.55
CT	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
CCGT	---	---	---	---	---	---	---	---	---	---	---	---	1.020	2.550	4.080	4.080	4.590	4.590	4.590	4.590
Solar [2]	---	---	---	---	---	---	---	---	---	---	0.10	0.20	0.20	0.20	0.55	0.55	0.75	0.80	0.85	0.85
Wind [3]	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.031	0.062	0.281	0.281	0.281	0.312
Battery Storage [4]	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Fixed Cost [5]	$13	$20	$29	$36	$37	$38	$40	$43	$45	$49	$75	$101	$241	$468	$827	$884	$1,332	$1,371	$1,411	$1,484

Notes:

1. DSM includes demand response and energy efficiency programs
2. Solar additions represented as 50% of nameplate capacity
3. Wind additions represented as 15.6% of nameplate capacity
4. All battery storage modeled at a 4:1 energy capacity to power ratio (MWH:MW)
5. Total cost represents levelized real 2019$MM 2019-2038 fixed cost revenue requirements for DSM and supply-side resource additions

Future 4 (Economic Growth with Renewables)

High energy demand coupled with high gas prices and reference CO_2 yields high renewable and battery deployment relative to other futures



Notes:
1. Long-term planning requirement is based on ELL non-coincident peak load forecast and includes a 12% ICAP reserve margin.
2. Supply deficit is calculated based on the difference in existing ICAP (including assumed deactivations) and long-term planning requirement.

Future 4 (Economic Growth with Renewables)

High energy demand coupled with high gas prices and reference CO_2 yields high renewable and battery deployment relative to other futures

[GW]	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
DSM [1]	---	---	---	---	0.01	0.01	0.01	0.01	0.02	0.03	0.03	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
CT	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.60	0.60	0.60	0.60	0.60	0.60
CCGT	---	---	---	---	---	---	---	---	---	---	0.51	0.51	1.53	3.06	4.08	4.08	4.59	4.59	4.59	4.59
Solar [2]	---	---	---	---	---	---	---	0.10	0.15	1.05	1.10	1.10	1.10	1.15	1.60	1.70	1.70	1.75	1.85	1.85
Wind [3]	---	---	---	---	---	---	---	---	---	0.06	0.09	0.16	0.22	0.28	0.31	0.34	0.50	0.50	0.53	0.59
Battery Storage [4]	---	---	---	---	---	---	---	---	---	---	---	0.10	0.10	0.20	0.20	0.20	0.40	0.40	0.40	0.40
Fixed Cost [5]	$3	$3	$3	$3	$3	$3	$3	$26	$39	$324	$458	$547	$774	$1,106	$1,477	$1,572	$1,907	$1,958	$2,065	$2,196

Notes:
1. DSM includes demand response and energy efficiency programs
2. Solar additions represented as 50% of nameplate capacity
3. Wind additions represented as 15.6% of nameplate capacity
4. All battery storage modeled at a 4:1 energy capacity to power ratio (MWH:MW)
5. Total cost represents levelized real 2019$MM 2019-2038 fixed cost revenue requirements for DSM and supply-side resource additions