Summary of the Electrification Study to Support the Los Alamos County

Climate Action Plan

Decarbonization of Los Alamos County

Achieving carbon neutrality will require significant efforts by the County.

All solutions needed to do so are commercially available **today.**
This is a deployment & policy challenge, not a technology challenge.

Climate Action Plan - **County Government Targets**

-30%
By 2030
Primarily driven by federal and state policies

-80%
By 2040
Significant EV adoption, home electrification, and green building standards across the county

-100%
By 2050
Final ~12% very challenging to achieve and may depend on new public policies

ELECTRIC CIRCUITS OF THE FUTURE

The electric distribution system is increasingly exposed to a wide variety of uncertain future grid scenarios and pressures including:

- Evolving customer behavior and **expansion of electrification**
- Increasing incidence of **inclement weather**
- Proliferation of **distributed energy resources**
- Heightened **customer sensitivity** to service interruptions
- Aging infrastructure and **outmoded technology**

Major Assets of DPU

- The Los Alamos County Department of Public Utilities currently owns a substation in White Rock and takes delivery of power in Los Alamos from a LANL substation with a 20 MVA contract limit.
- The transformers in White Rock are in need of repair or replacement and not of sufficient capacity for load growth forecasted with the electrification initiative.
- The contractual agreement with LANL has delayed the investment in a substation for many years but is the primary driver of upgrade cost in the City of Los Alamos.

Electrification Scenarios

Comply with the Climate Action Plan

100% EV Adoption by 2055

100% Home & Commercial Electrification By 2055
20% Building Efficiency

50% Homes with Solar
20% Homes with Batteries

Climate Action Plan Scenario

1

Comply with Current Policies

Historical EV Trend in LAC

50% Home & Commercial Electrification By 2055
10% Building Efficiency

25% Homes with Solar
10% Homes with Batteries

Current Policy Scenario

2

Assume Government Regs. Play No Role

Historical EV Trend Statewide

25% Home & Commercial Electrification By 2055
0% Building Efficiency

10% Homes with Solar
5% Homes with Batteries

Natural Behavior Scenario

3

Three Load Growth Scenarios were Studied

2040 Electrification Forecast		
	Adoption % by 2040	MW Growth by 2040
EV Adoption		
Scenario 3 (Low)	15%	3.5
Scenario 2 (Med)	31%	7.1
Scenario 1 (High)	50%	11.5
Building Electrification		
Scenario 3 (Low)	22%	2.2
Scenario 2 (Med)	25%	4.1
Scenario 1 (High)	55%	16.0
Total Additional Electrification Peak Load		
Scenario 3 (Low)	NA	4.4
Scenario 2 (Med)	NA	8.5
Scenario 1 (High)	NA	20.9

2055 Electrification Forecast		
	Adoption % by 2055	MW Growth by 2055
EV Adoption		
Scenario 3 (Low)	30%	8.1
Scenario 2 (Med)	79%	18.2
Scenario 1 (High)	97%	22.4
Building Electrification		
Scenario 3 (Low)	38%	9.9
Scenario 2 (Med)	59%	18.7
Scenario 1 (High)	100%	33.3
Total Additional Electrification Peak Load		
Scenario 3 (Low)	NA	13.5
Scenario 2 (Med)	NA	28.0
Scenario 1 (High)	NA	44.4

Current Peak Load is Approximately 17 MW

Consumer Electric Service Upgrades

Customer electrification may require service upgrades

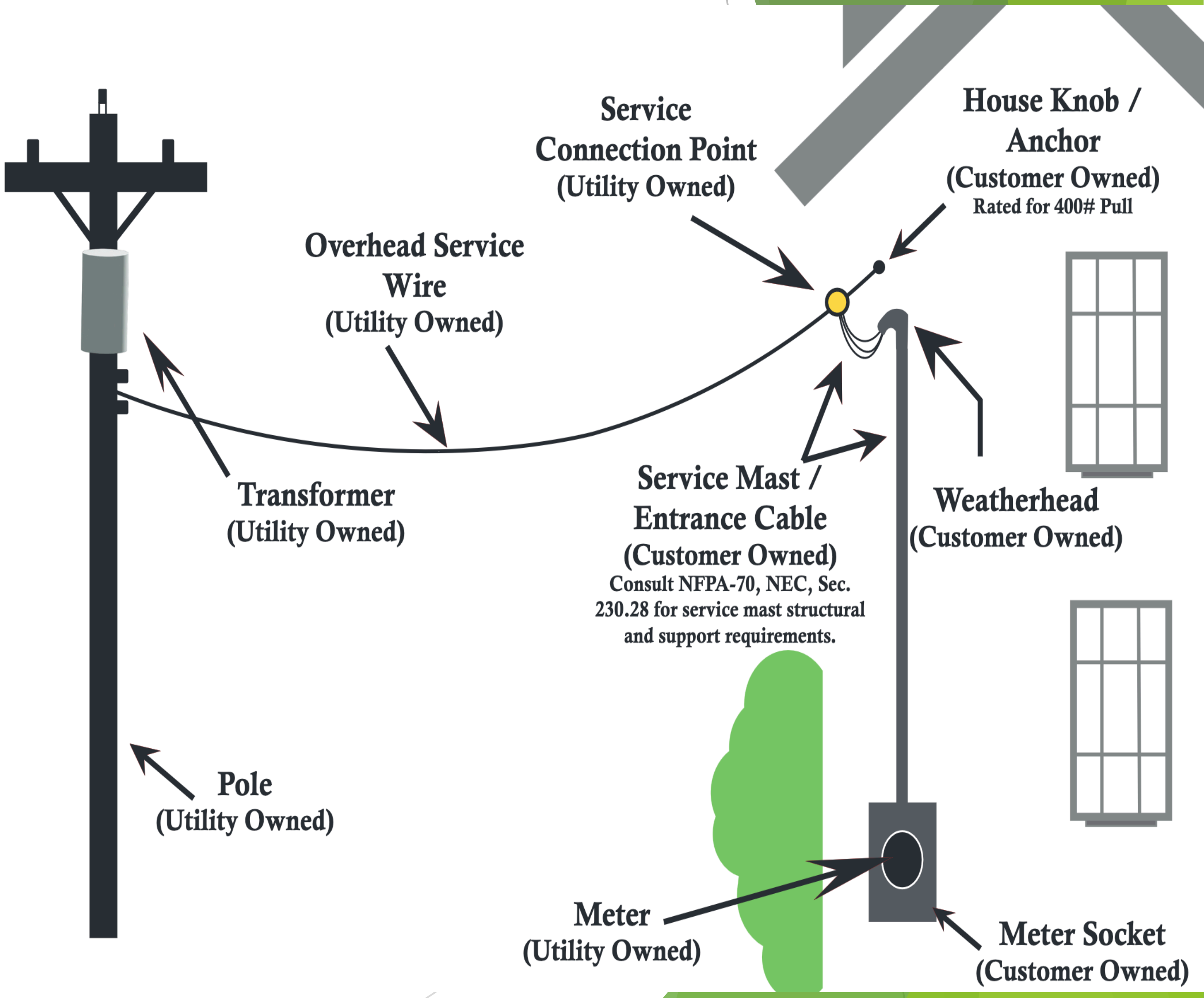
- Panel upgrades, new conduit/trenching, circuit rewiring, make ready improvements, etc.
- Equipment and installation costs to the customer - $3,000 - $20,000+
- Utility upgrades include new service transformer, new service conductor, primary system upgrades, etc. **These costs impact utility operating budgets.**

Residential Panel Capacity Examples*

60 Amp	100 Amp	200 Amp	300 Amp+
Lighting	Lighting	Lighting	Lighting
Wall Outlets	Wall Outlets	Wall Outlets	Wall Outlets
Dishwasher	Dishwasher	Dishwasher	Dishwasher
	Clothes Dryer	Clothes Dryer	Clothes Dryer
	Oven/Range	Oven/Range	Oven/Range
	Mini Split/Wall Mount AC Unit	Water Heater	On Demand Water Heater
	Low Power EV Charging	Heat Pump/Air Conditioning	Heat Pump (s) and Strip Heating
		Medium Power EV Charging	High Power EV Charging
			Hot Tub/Pool Pump
			Shop/Outbuildings

Typical Service Size in the County

- Los Alamos has a large number of vintage 30, 60, and 100 Ampere Services.
- The typical new home installs a 200 Ampere electric service.
- Electrification would require an upgrade to the service that includes an upgrade to the service transformer owned and provided by the utility.
- Electrification would require an upgrade to the service wire.
- Electrification would require an upgrade to the homeowner's service panel.



Investment Categories

- System Improvements – upgrades performed to serve forecasted **electrification load growth**. These upgrades were necessary to maintain both normal load service and provide capacity for contingency scenarios.

- • Asset Replacement – replacement of existing system assets **due to age and deterioration – not driven by growth**. Estimates of necessary replacements are provided for each electrification scenario based on the data provided by LACDPU. The County may not be required to replace the magnitude of assets presented in this study if actual asset life exceeds the anticipated asset life recommendations from the LACDPU.

Asset Replacement Estimate 2055

Conductor/ Equipment	% of Assets Replaced	Quantity
Overhead Conductor Replacements (miles)	100%	25
Underground Cable Replacements (miles)	95%	46
Mainline Switches	100%	137
Three-Phase Service Transformers	80%	147
Single-Phase Service Transformers	90%	842
Secondary Services	90%	5,724

Asset Replacement Quantities

Los Alamos

Conductor/ Equipment	Quantity
500 MCM CU Cable (miles)	7.9
4/0 CU Cable (miles)	0
477 ACSR Conductor (miles)	7.8
4/0 ACSR Conductor (miles)	1.9
UG Switch (PME)	11
OH Switch	2
Capacitor Bank	5
Voltage Regulator	2

White Rock

Conductor/ Equipment	Quantity
500 MCM CU Cable (miles)	4.4
4/0 CU Cable (miles)	0
477 ACSR Conductor (miles)	3.7
4/0 ACSR Conductor (miles)	0.1
UG Switch (PME)	3
OH Switch	2
Capacitor Bank	1
Voltage Regulator	0

Example of the age of DPU Lines

Electrical Asset Costs

Equipment/Project	Unit Cost
1 Mile of Installed 500 MCM Cable	$2,300,000
1 Mile of Installed 4/0 Cable	$1,800,000
1 Mile of Installed 477 ACSR Conductor	$525,000
1 Mile of Installed 4/0 ACSR Conductor	$500,000
PME Switch (Various Types)	$75,000
Overhead Switch	$25,000
1,800 kVAR Capacitor Bank	$115,000
500 kVA Voltage Regulator Bank	$90,000
Residential Single-Phase Service Transformer (Various Sizes)	$10,000
Commercial Three-Phase Service Transformer (Various Sizes)	$90,000
Typical Secondary Service Line Upgrade (~500 ft.)	$6,000

What is being Done to Mitigate Costs?

- Vintage underground electric lines were direct buried in the earth. Replacement requires digging new cable into the ground – sometimes under streets or sidewalks. Repairs of failed cable require digging and splicing a section of cable.
- New underground electric lines are being installed in electrical conduit so that cable replacement can be more easily accomplished without the cost of digging.

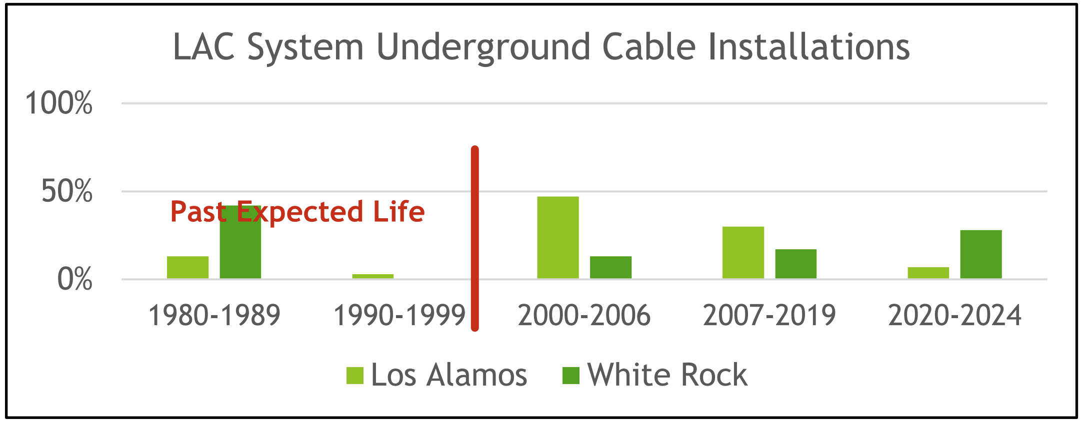
Financial Impact for Growth vs. Aged Assets

Scenario	2040 Model Year			2055 Model Year - Incremental Costs			Total Scenario Cost
	System Improvement Costs	Asset Replacement Costs	Total Financial Impact	System Improvement Costs	Asset Replacement Costs	Total Financial Impact	
Scenario 1	$53.7M	$119.8M	$173.4M	$14.1M	$94.6M	$108.7M	$282.1M
Scenario 2	$38.1M	$125.3M	$163.4M	$15.1M	$86.1M	$101.3M	$264.6M
Scenario 3	$27.6M	$125.3M	$152.9M	$8.3M	$82.9M	$91.2M	$244.1M

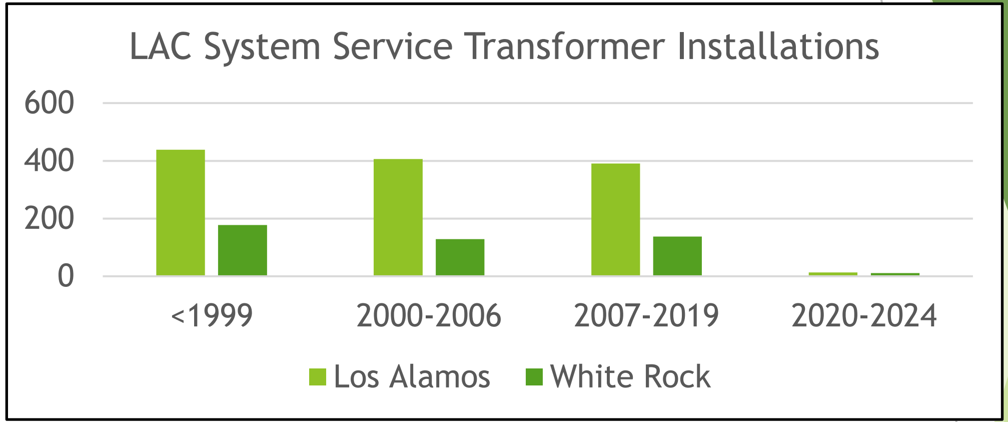
Asset Replacement Costs are Anticipated to be more significant than the System Improvement Costs due to Electrification

System Improvements have a similar Financial Impact as Major Substation Upgrades were Necessary for All Scenarios

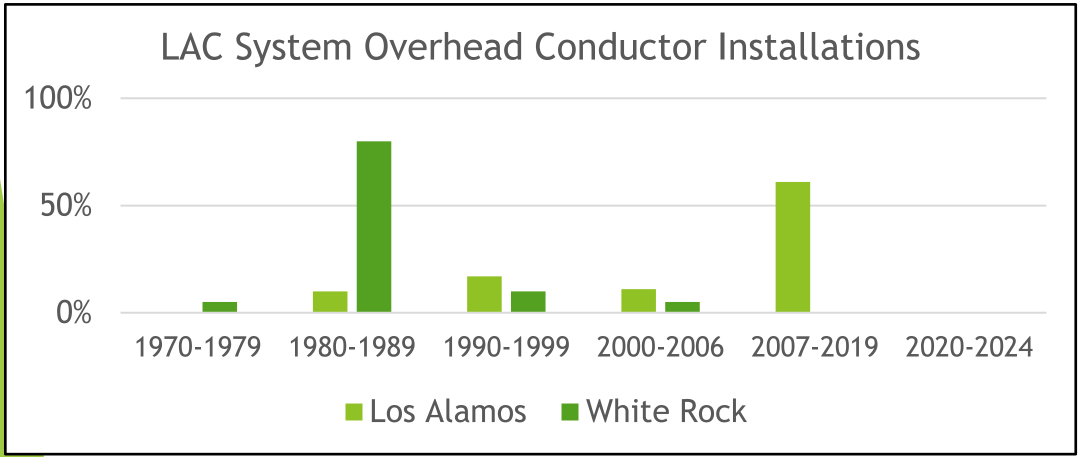
WHAT ARE THE DRIVERS OF THE COSTS FOR ASSET REPLACEMENT?



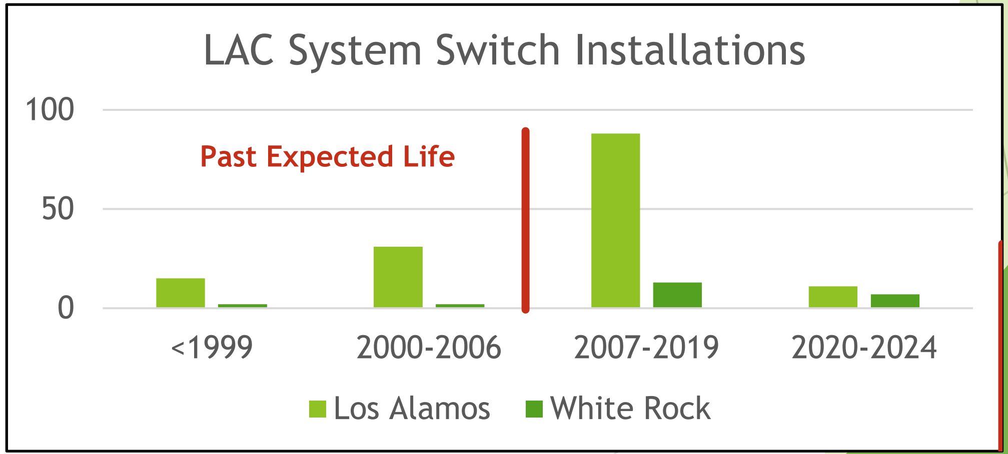
Expected life of URD cable – 30 Years



Typical Life of Service Transformer - 25 to 40 Years

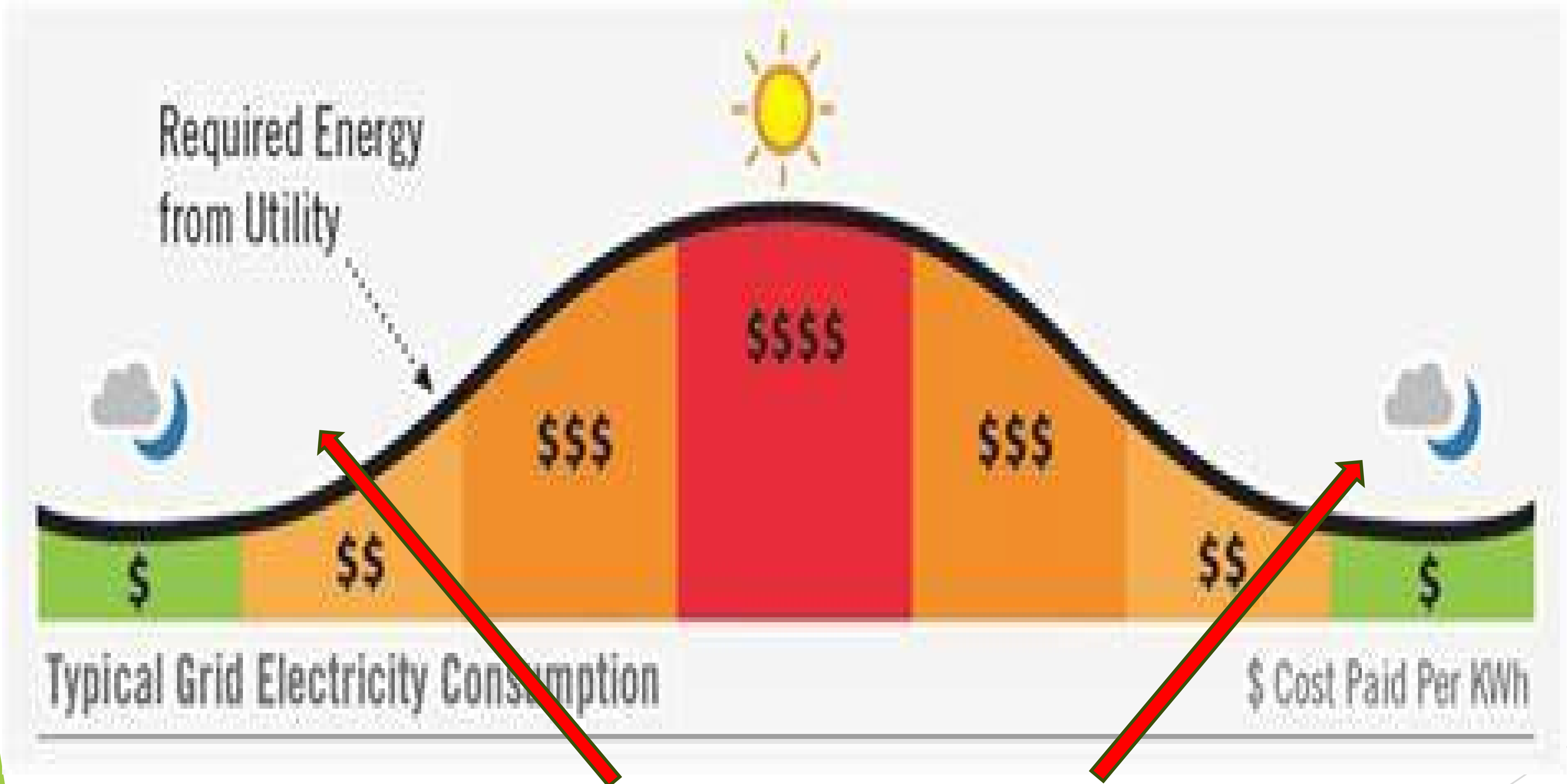


Expected Life of Overhead Line – 40 Years



Expected Life of Switch - 20 Years

When can we efficiently add Electric Load



Off Peak Hours

Efficient Load Growth

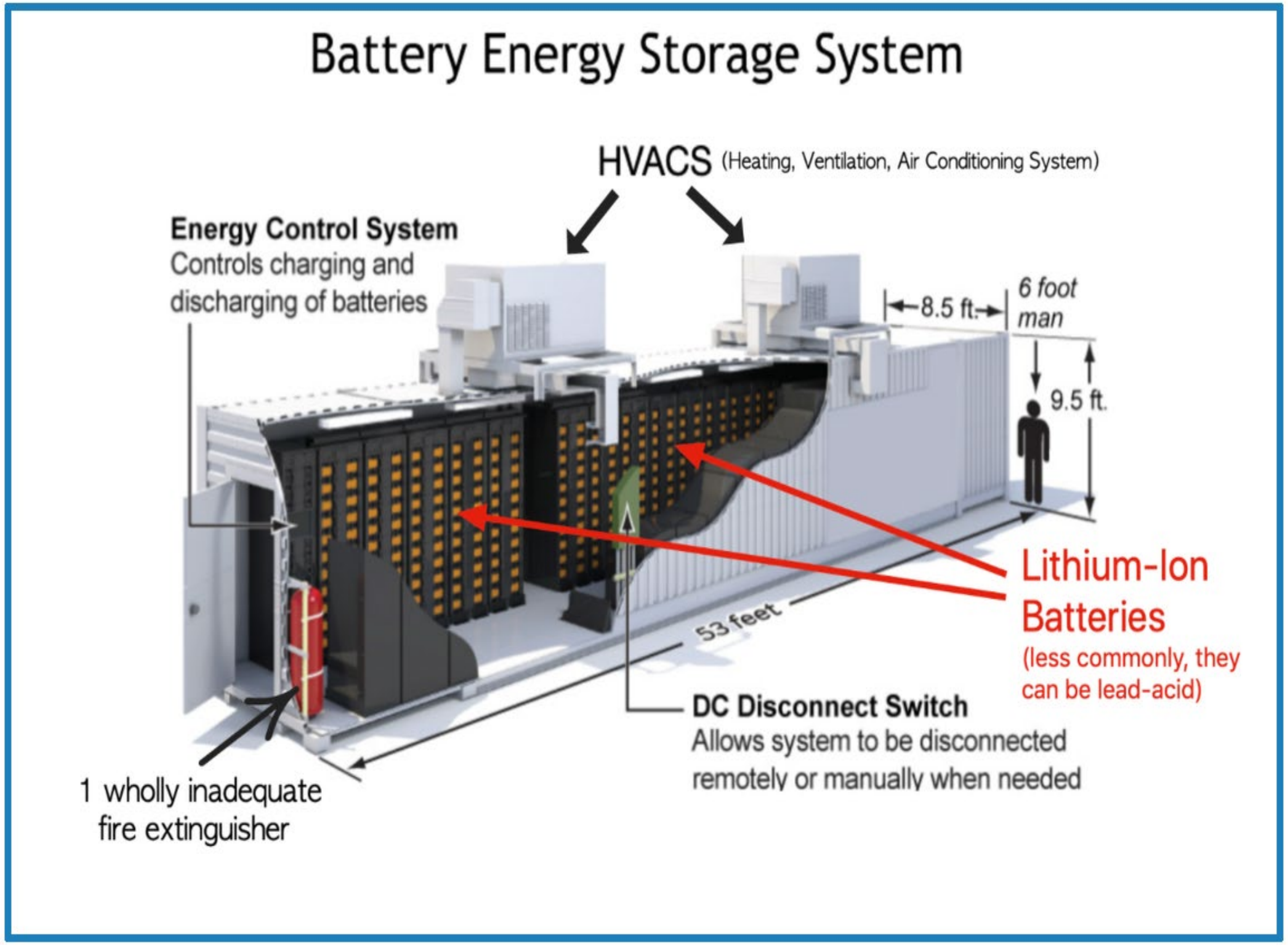
- Load Growth can be beneficial and it can be impactful.
- Efficient load growth is added when the system is lightly loaded. This can be related to the hour of the day (Early Morning) or the month of the year (Spring and Fall).
- Los Alamos Utilities is planning to implement a time-of-use rate design to encourage a shift in usage to off-peak hours. This would be easy for consumers to do with electric car charging since most systems can be programmed to charge after midnight.
- New combination washer/dryer units offer a delay start and dry clothing with heat pump technology. They can move their cycle to off-peak hours.

Efficient Load Growth

- It is expected that school buses will charge during the day while solar power is producing.
- It is expected that transit buses will charge during the night when homeowners are charging their electric cars.
- The installation of heat pumps in residential homes will improve annual load factor since homeowners will be able to cool their home with the same equipment and will do so.

Additional Mitigation being Evaluated

- The report suggests the evaluation of adding Battery Energy Storage to assist in peak load management. The Department of Public Utilities has been evaluating the use of such systems and where one or more could be placed to benefit the community. These could lower wholesale power costs.



Summary

- The supportive detail is contained in the Electrification Study provided by 1898 & Co. – a division of Burns and McDonnell Engineering, Architectural and Construction Firm.
- This study utilized local, national and international concepts and data to support the analysis related to additional growth due to consumer behavior. This behavior drove 15 and 30 year forecasts in electrical consumption patterns and the effect such growth will have on the electrical system of the Department of Public Utilities.
- The study also identified that most of existing infrastructure has the capacity to serve an increased load but significant capital investment will be required due to the aging infrastructure that is currently serving the community.