Clean Coalition

Planning for the rise of distributed energy resources

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Our mission

To accelerate the transition to renewable energy and a modern grid through technical, policy, and project development expertise

Our expertise areas

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Analysis & Planning

Full cost and value accounting for DER; siting analysis

Grid Modeling & Optimization

Powerflow modeling; DER optimization

Policy & Program Design

Grid planning, procurement, and interconnection

Community Microgrid Projects

Design and implementation

Some of our utility collaborators

Clean Coalition

Agenda

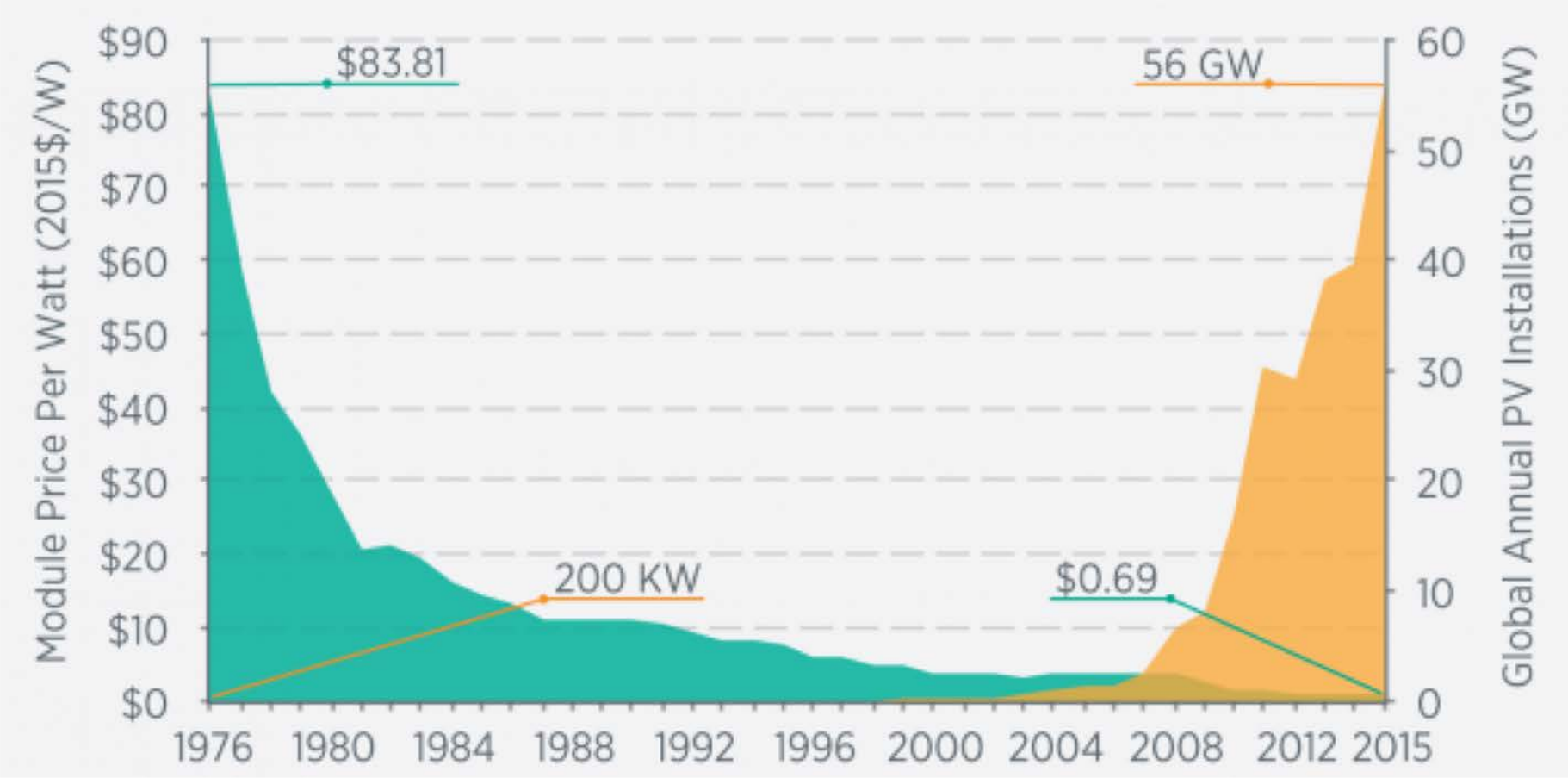
- The quickening evolution of the electric utility industry
- Key strategies for successfully navigating the rise of DER
  - 1) Proactively planning the distribution grid
  - 2) Thinking creatively about DER opportunities

The power mix is changing

- From Utility Dive's *2018 State of the Electric Utility Report*, which surveyed 686 utility industry professionals

Why is the power mix changing?

- Reason #1 — Dropping costs of renewables and other distributed energy resources (DER), like energy storage, are driving increased deployment



Source: U.S. DOE Sun Shot Initiative

DER technologies have become cost-effective

BRIEF

Minnesota solar project beats natural gas on price, gets authorization

Source: Utility Dive (December 2014)

DER technologies have become cost-effective

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BRIEF

Hawaii co-op signs deal for solar+storage project at 11¢/kWh

U.S. residential electricity prices averaged ~12.9 cents/kWh in 2017

Source: Utility Dive (January 2017) and U.S EIA

Recent record lows for dispatchable renewables

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Median bid prices in Xcel Energy 2016 ERP All Source Solicitation 30 day report

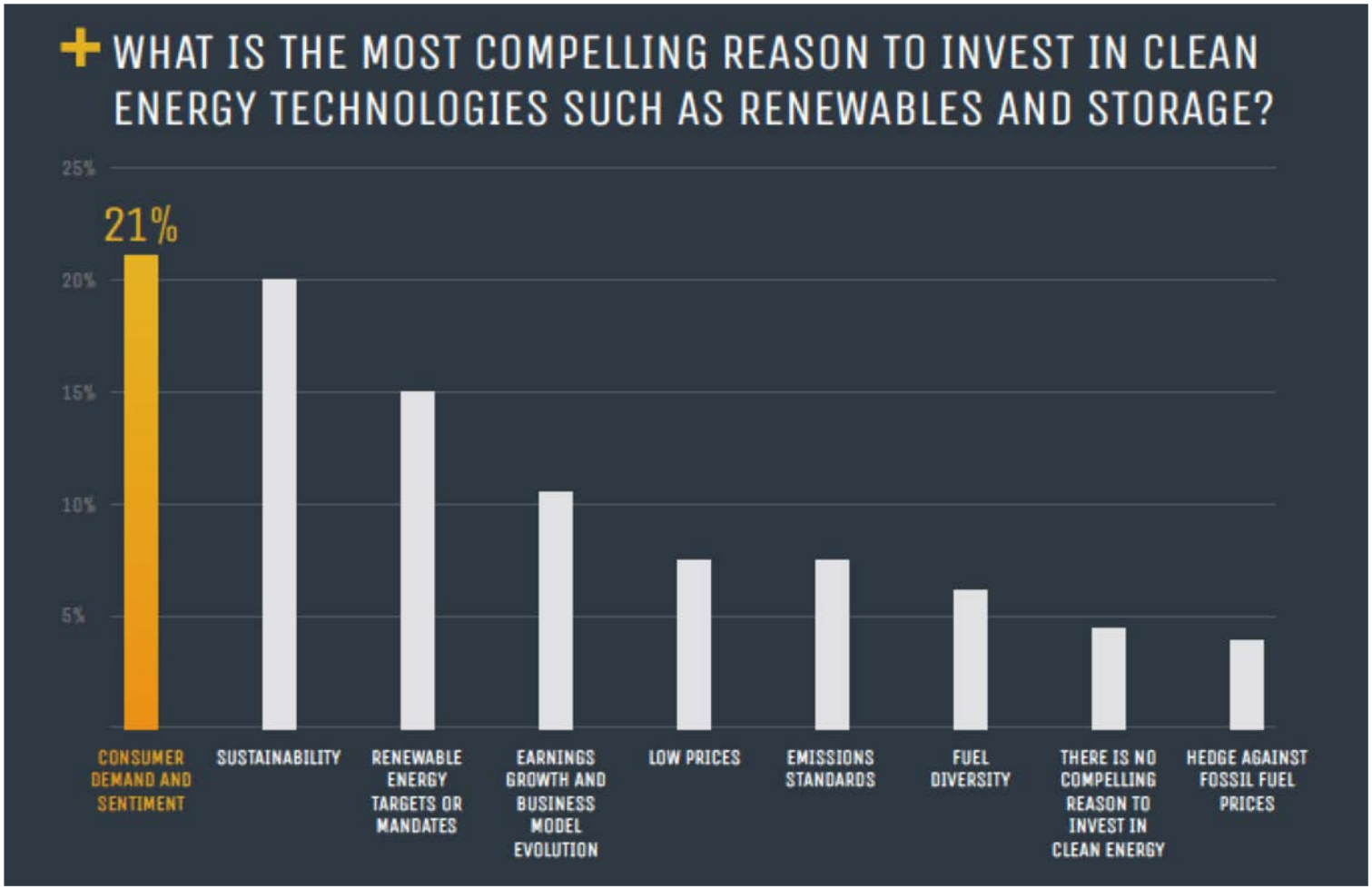
RFP Responses by Technology

Generation Technology	# of Bids	Bid MW	# of Projects	Project MW	Median Bid Price or Equivalent	Pricing Units
Combustion Turbine/IC Engines	30	7,141	13	2,466	$ 4.80	$/kW-mo
Combustion Turbine with Battery Storage	7	804	3	476	6.20	$/kW-mo
Gas-Fired Combined Cycles	2	451	2	451		$/kW-mo
Stand-alone Battery Storage	28	2,143	21	1,614	11.30	$/kW-mo
Compressed Air Energy Storage	1	317	1	317		$/kW-mo
Wind	96	42,278	42	17,380	$ 18.10	$/MWh
Wind and Solar	5	2,612	4	2,162	19.90	$/MWh
Wind with Battery Storage	11	5,700	8	5,097	21.00	$/MWh
Solar (PV)	152	29,710	75	13,435	29.50	$/MWh
Wind and Solar and Battery Storage	7	4,048	7	4,048	30.60	$/MWh
Solar (PV) with Battery Storage	87	16,725	59	10,813	36.00	$/MWh
IC Engine with Solar	1	5	1	5		$/MWh
Waste Heat	2	21	1	11		$/MWh
Biomass	1	9	1	9		$/MWh
Total	430	111,963	238	58,283		

Source: Xcel Energy Colorado

Why is the power mix changing?

- Reason #2 — Customers, from large corporations to cities to residential households, increasingly want (and demand) clean energy



Source: 2018 State of the Electric Utility, Utility Dive

Strengthening demand for clean energy

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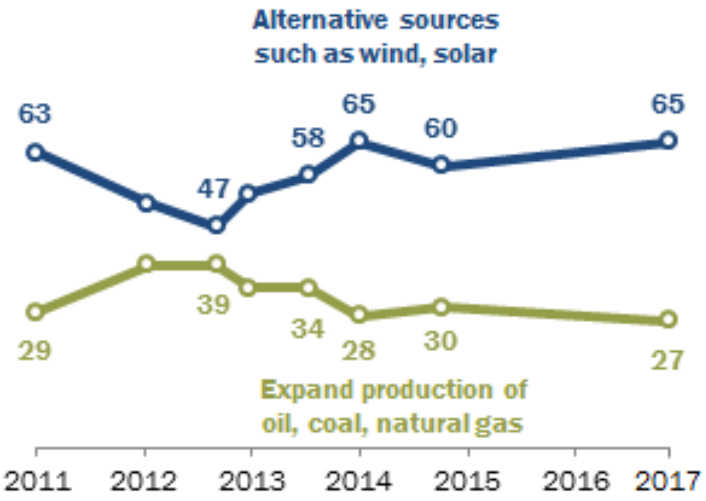
Most in U.S. give priority to developing alternative energy over fossil fuels

% of U.S. adults who say ____ should be the more important priority for addressing America's energy supply

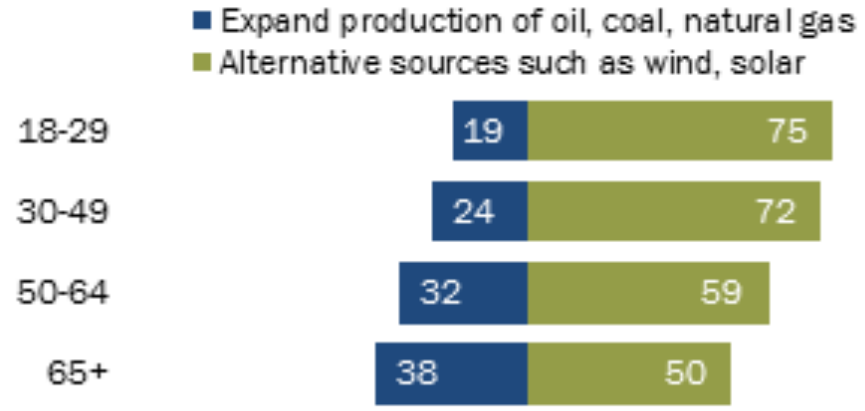


Note: Both/Don't know responses not shown.
Source: Survey conducted Jan. 4-9, 2017.

PEW RESEARCH CENTER

Younger Americans more likely to prioritize alternative energy sources

% of U.S. adults who say ____ should be the more important priority for addressing America's energy supply



Note: Both/Don't know responses not shown.
Source: Survey conducted Jan. 4-9, 2017.

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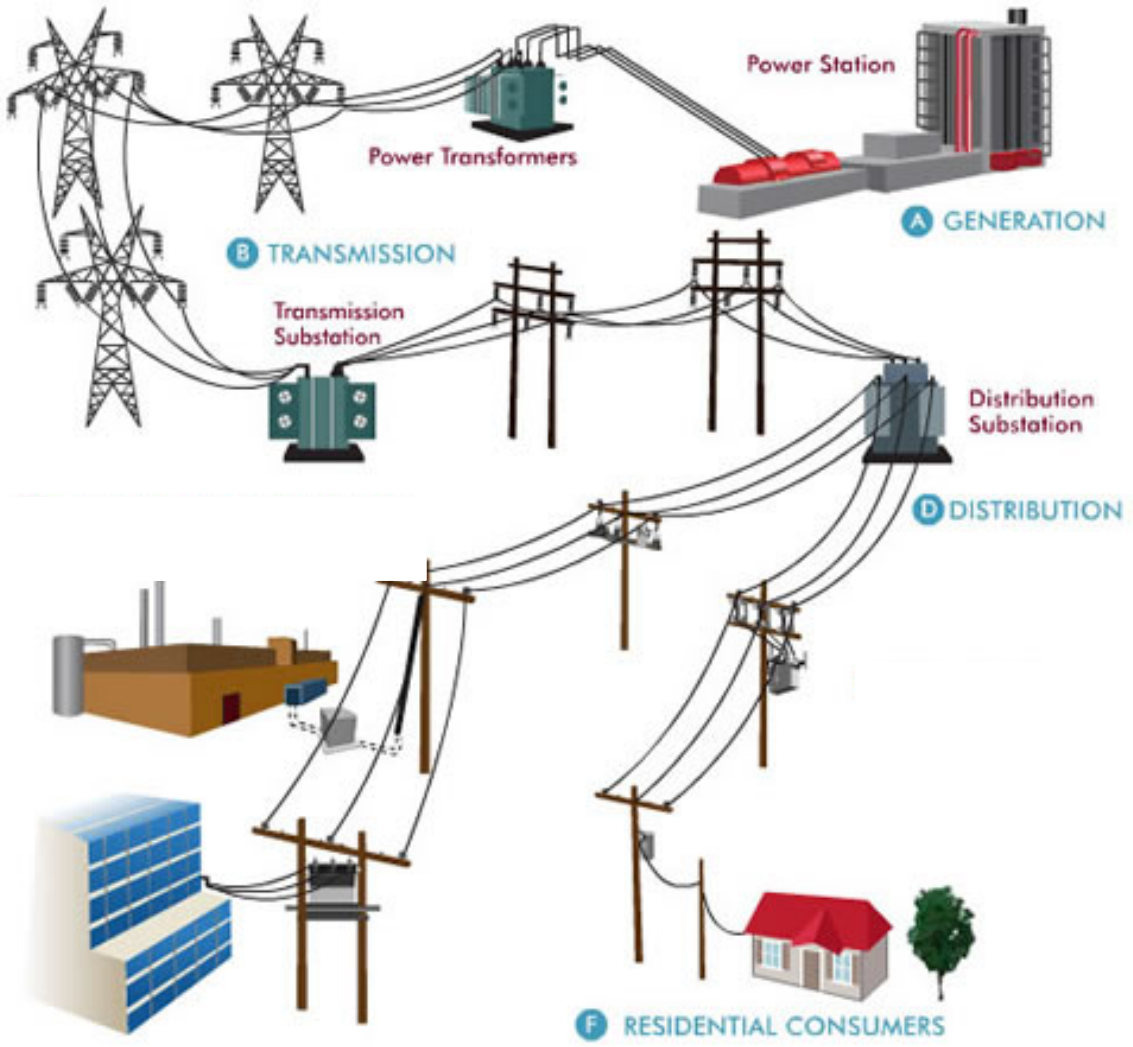
Making Clean Local Energy Accessible Now

Key strategies to navigate the rise of DER

Two ideas for consideration

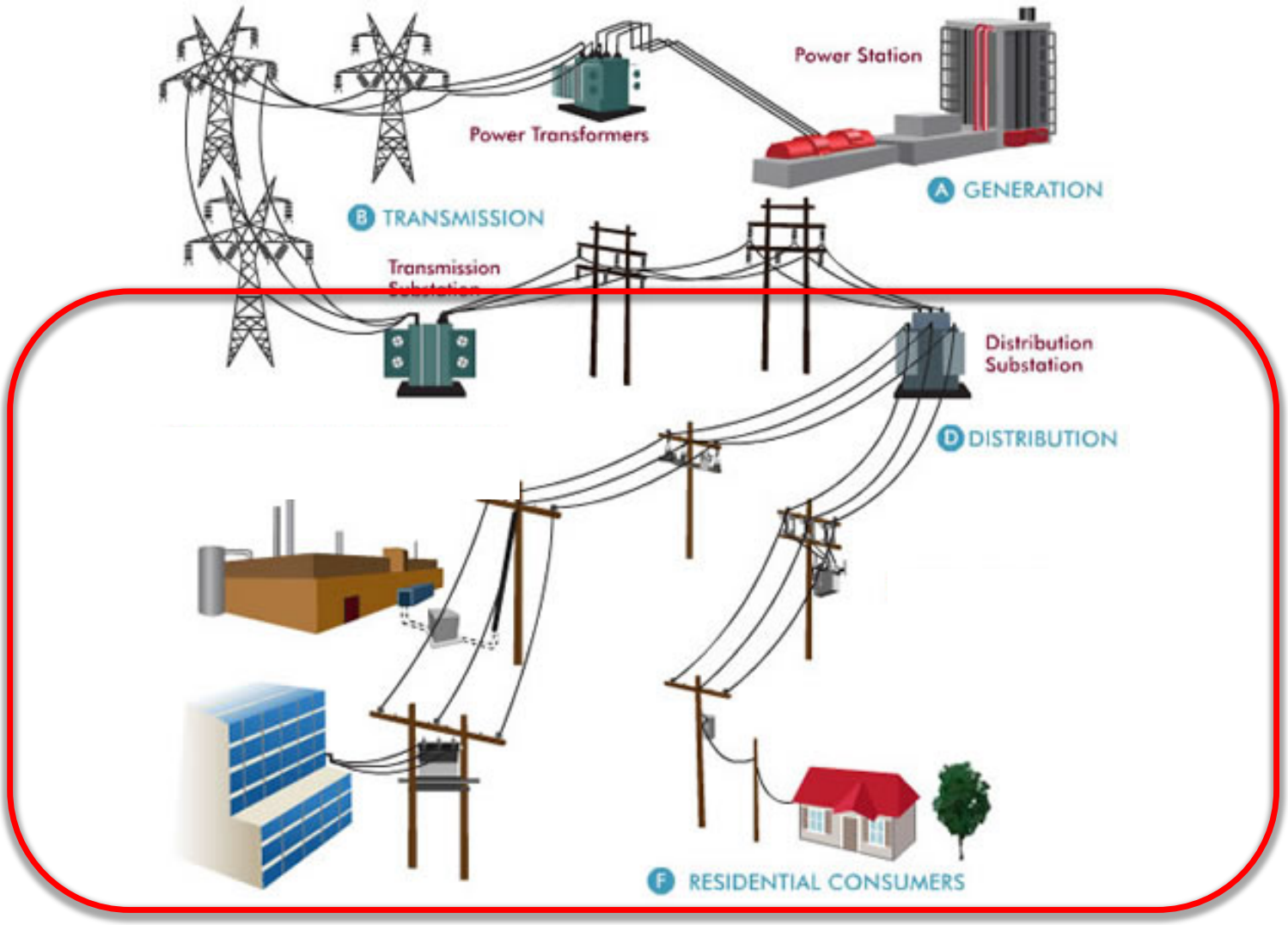
- Proactively plan the distribution grid
- Think creatively about DER opportunities

Where is the grid rapidly evolving?



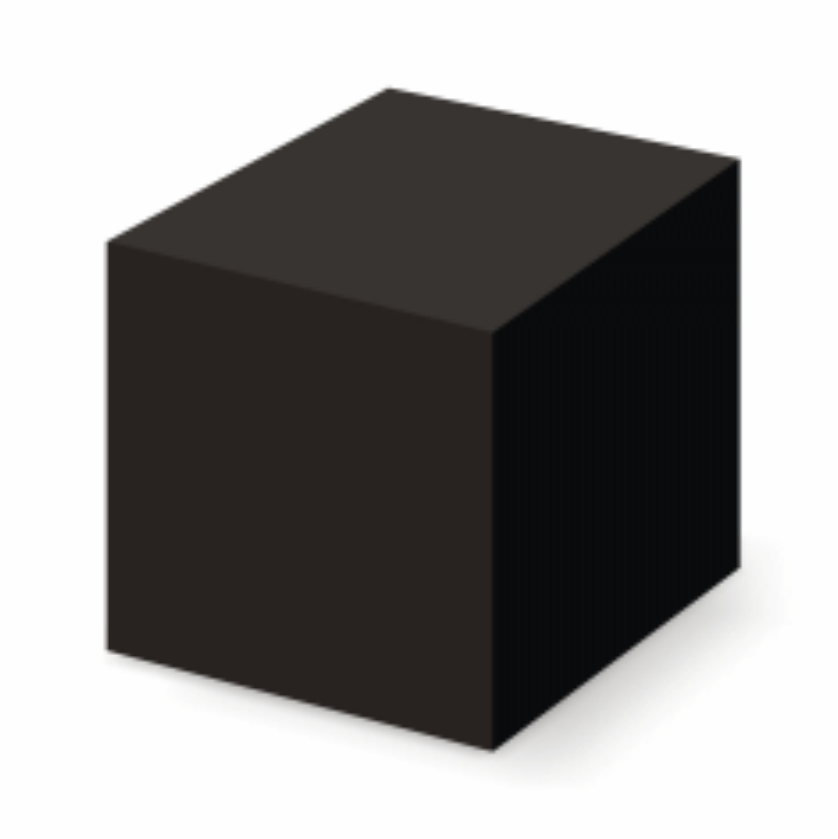
Source: Oncor Electric Delivery Company

On the distribution side



Source: Oncor Electric Delivery Company

Insufficient grid insight is a problem



Enhanced visibility and knowledge is key

The solution: Distribution Resources Planning

- DRP is a foundational policy for modernizing the grid to provide cleaner, more affordable, and more resilient power
- DRP provides a pathway to:

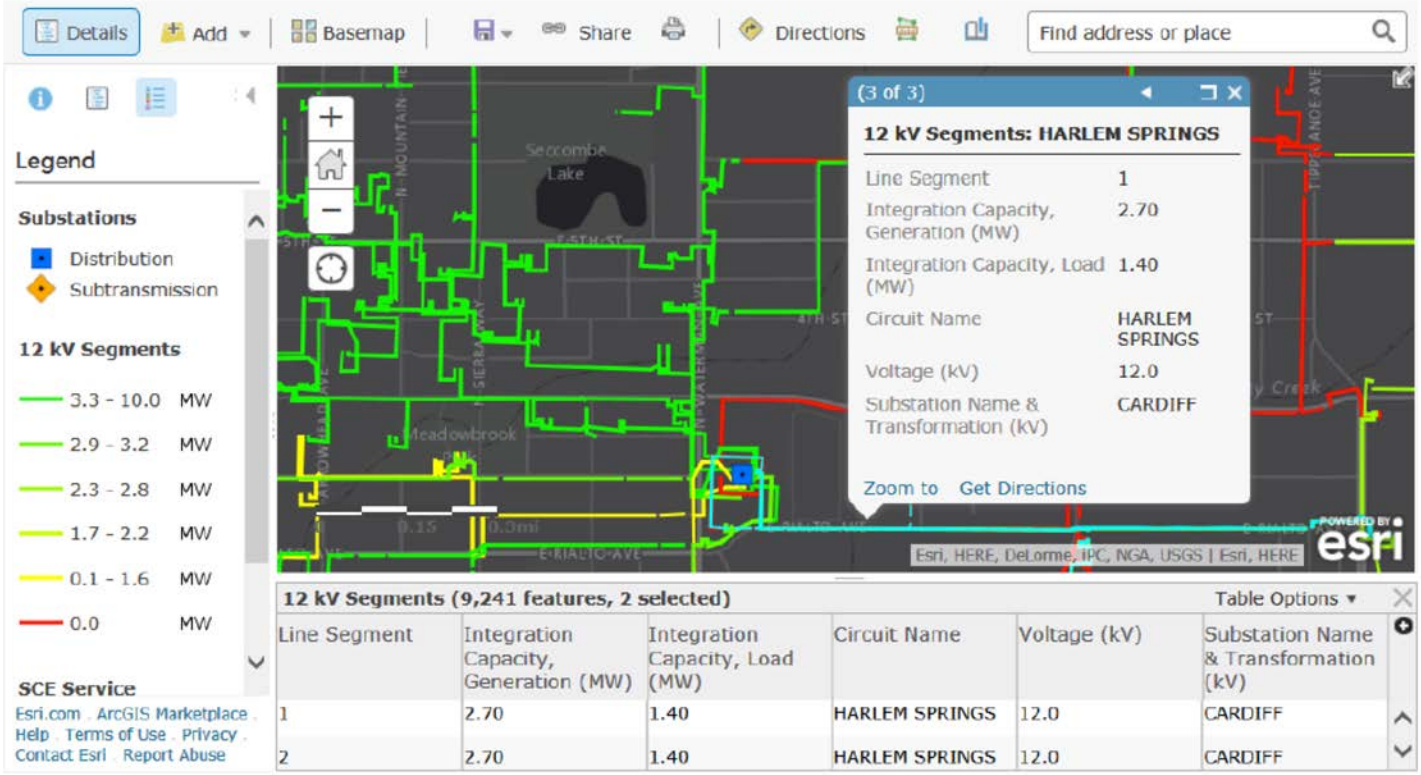
Source: Pacific Gas & Electric

Four key components of DRP

- Hosting Capacity Analysis
- Methodology to value DER
- Substation-level pilot projects
- DER and load forecasts

Hosting Capacity Analysis

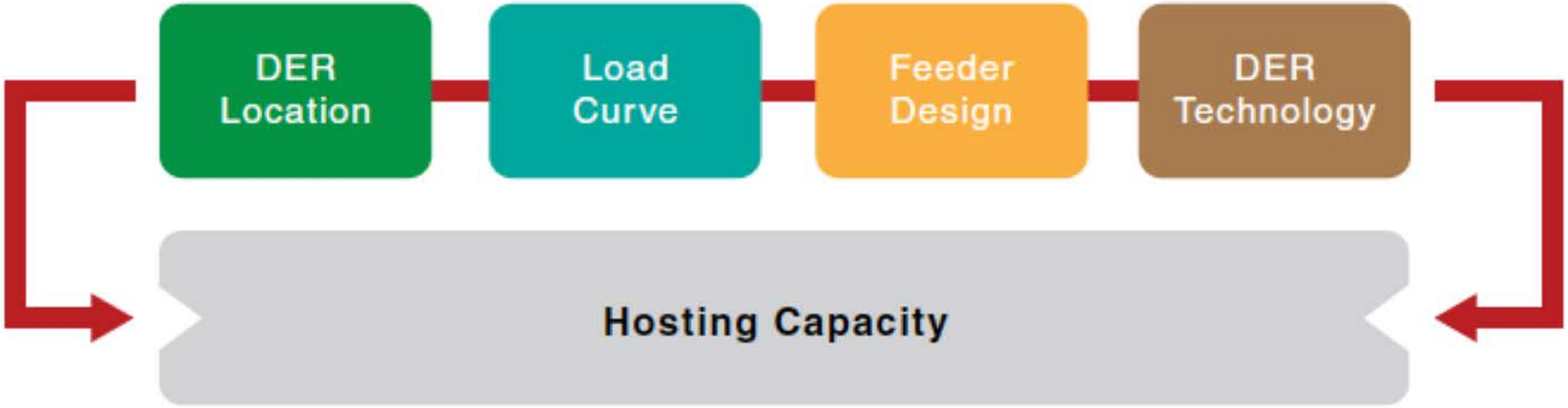
- The maximum amount of DER that can be accommodated on the distribution system, at a given place and point in time, under existing grid conditions and operations without adversely impacting safety, power quality, reliability, or other operational criteria, and without requiring significant infrastructure upgrades.



Source: Southern California Edison

Hosting Capacity Analysis

- Factors that impact the results include:



Source: Interstate Renewable Energy Council

Hosting Capacity Analysis is gaining steam

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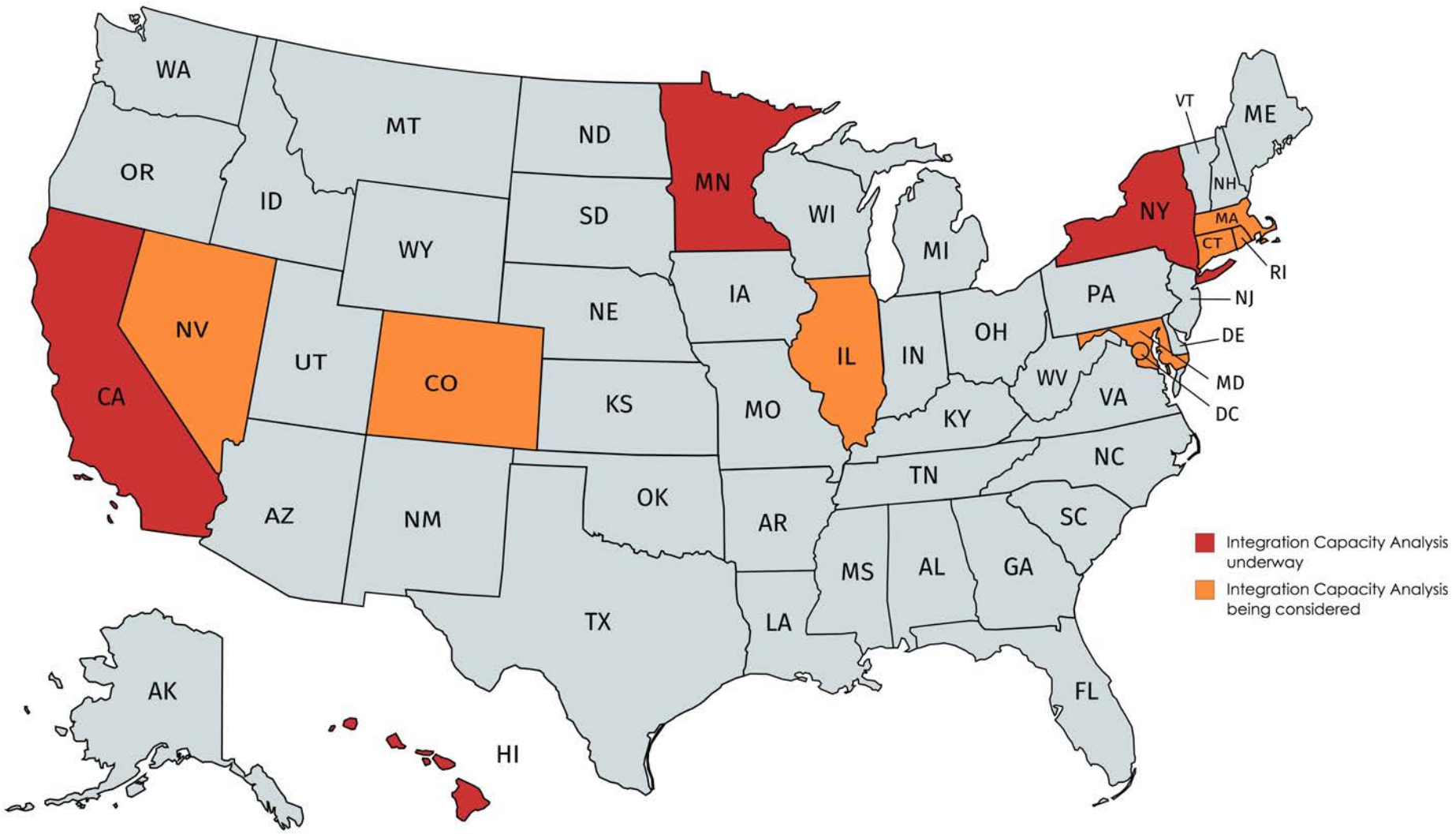
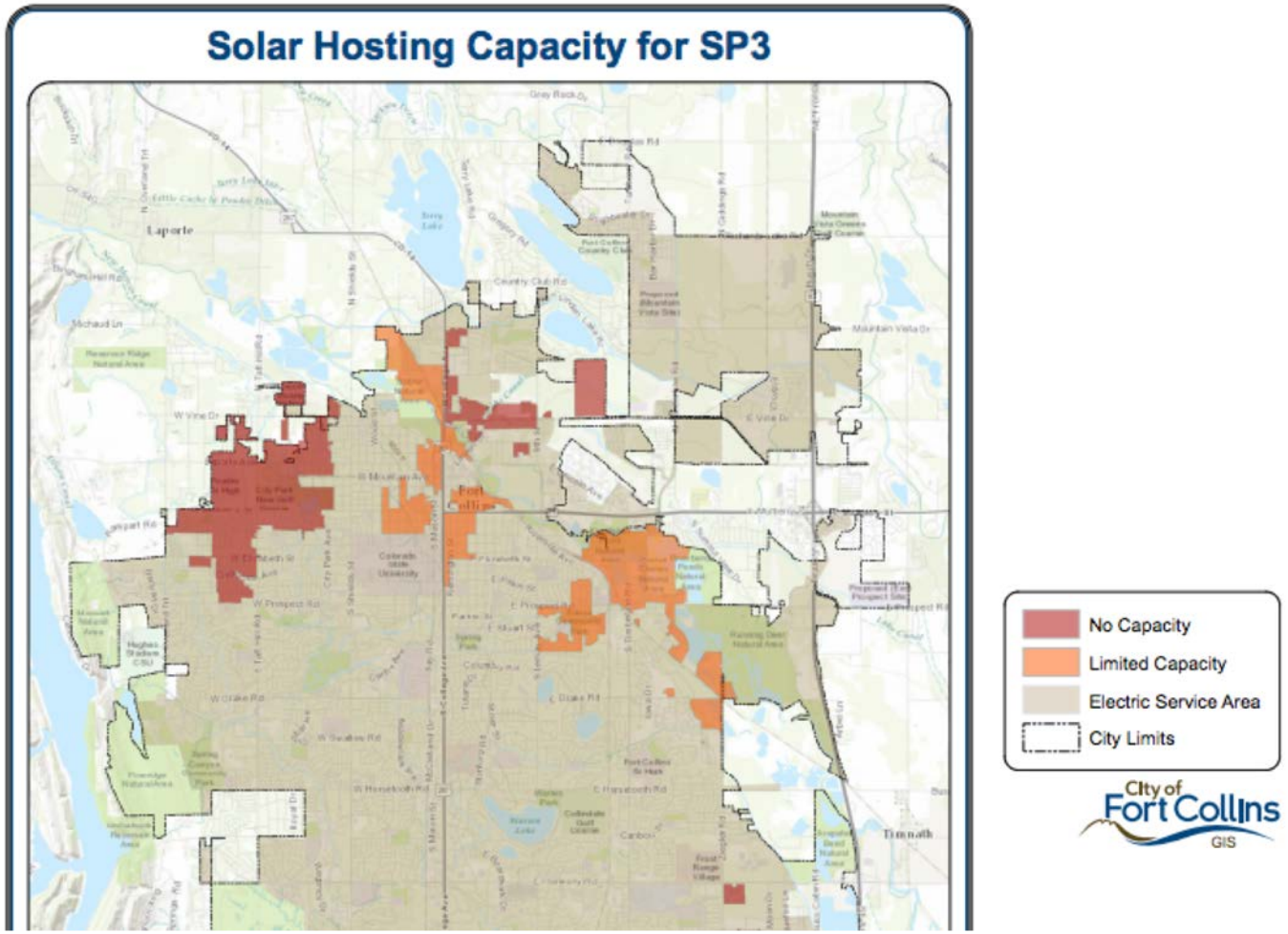


Utilities are voluntarily adopting this practice

- Assess distribution grid (substations + feeders) to direct project siting where it is most valuable: maximum benefits at minimum cost.



Methodology to value DER

	Value Component	Definition
Distribution	Subtransmission, Substation & Feeder Capacity	Reduced need for local distribution system upgrades
	Distribution Losses	Value of energy due to losses between wholesale transaction and distribution points of delivery
	Distribution Power Quality + Reactive Power	Improved transient & steady-state voltage, reactive power optimization and harmonics
	Distribution Reliability + Resiliency+ Security	Reduced frequency and duration of individual outages & withstand and quickly recover from large external natural, physical and cyber threats
	Distribution Safety	Improved public safety and reduced potential for property damage
Customer, Societal & Environmental	Customer Choice	Customer & societal value from robust market for customer alternatives
	CO2 Emissions	Reductions in federal and/or state CO2 emissions based on cap-and-trade allowance revenue or cost savings or compliance costs
	Criteria Pollutants	Reduction in local emissions in specific census tracts
	Health Impacts	Reduction in societal health costs associated with GHG emissions
	Energy Security	Reduced risks derived from greater supply diversity
	Water Use	Synergies between DER and water management (electric-water nexus)
	Land Use	Environmental benefits & avoided property value decreases from DER deployment instead of large generation projects
	Economic Impact	State or local net economic impact (e.g., jobs, GDP, tax income)

Source: Newport Consulting Group

Substation-level pilot projects

- Prove the technical and economic feasibility of DER
- Capitalize on opportunities in which DER can save ratepayers money in comparison to traditional grid investments

Con Ed Looks to Batteries, Microgrids and Efficiency to Delay $1B Substation Build

A new demand-side program will be a training ground for future utility reforms in New York.

by Katherine Tweed

July 17, 2014

Source: Greentech Media

DER and load forecasts

- Establish method to project DER and load growth and potential impacts on the grid
- These forecasts can inform Hosting Capacity Analysis for the distribution planning use case

SCE Territory Amounts of DER Deployment by 2025

Growth Type	Scenario 1	Scenario 2	Scenario 3
Base Load	27,019 MW	27,019 MW	27,019 MW
Solar PV (nameplate AC)	1,636 MW	1,905 MW	4,770 MW
AAEE (annual)	10,536 GWh	17,031 GWh	17,243 GWh
Demand Response	1,265 MW	2,087 MW	2,981 MW
CHP (annual)	6,350 GWh	8,576 GWh	13,612 GWh
EV (annual)	2,422 GWh	3,395 GWh	3,395 GWh
Storage (D&C)	270 MW	270 MW	637 MW
Storage (T)	310 MW	310 MW	731 MW

Source: Southern California Edison

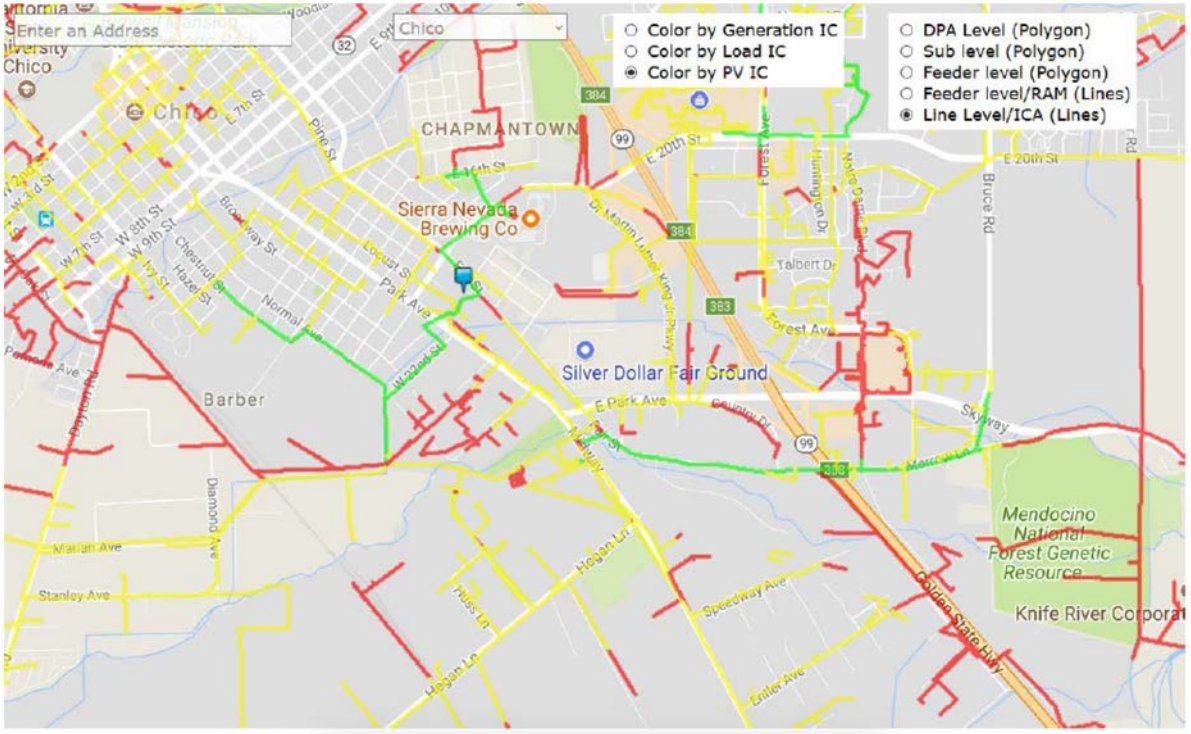
High-level benefits of implementing DRP

- A DRP process seeks to:
  - "Maintain and enhance the safety, security, reliability, and resilience of the electricity grid, at fair and reasonable costs, consistent with the state's energy policies;
  - Ensure optimized utilization of electricity grid assets and resources to minimize total system costs;
  - Increase transparency of utility investments and grid needs;
  - Ensure distribution investments will achieve a flexible, resilient grid and meet customer needs under a range of futures;
  - Evaluate cost efficient non-wires alternatives to proposed investments, including DER provided services; and
  - Improve inputs for utility Integrated Resources Plans."

Source: "Minnesota's Actions to Advance Distribution System Planning," a presentation by Nancy Lange, Chair of the Minnesota Public Utilities Commission

Streamlining interconnection of DER

- A DRP process proactively identifies optimal sites for DER project siting, which reduces project development costs and utility review time.
  - Eventually integrate these results into the interconnection process
  - Identify available capacity (kW) and primary constraint, so projects may be proposed to expand integration capacity through storage, smart inverters, etc.



Source: Pacific Gas & Electric

Guiding DER results in ratepayer savings

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SCE Share of California's 12 GW Distributed Generation Goal

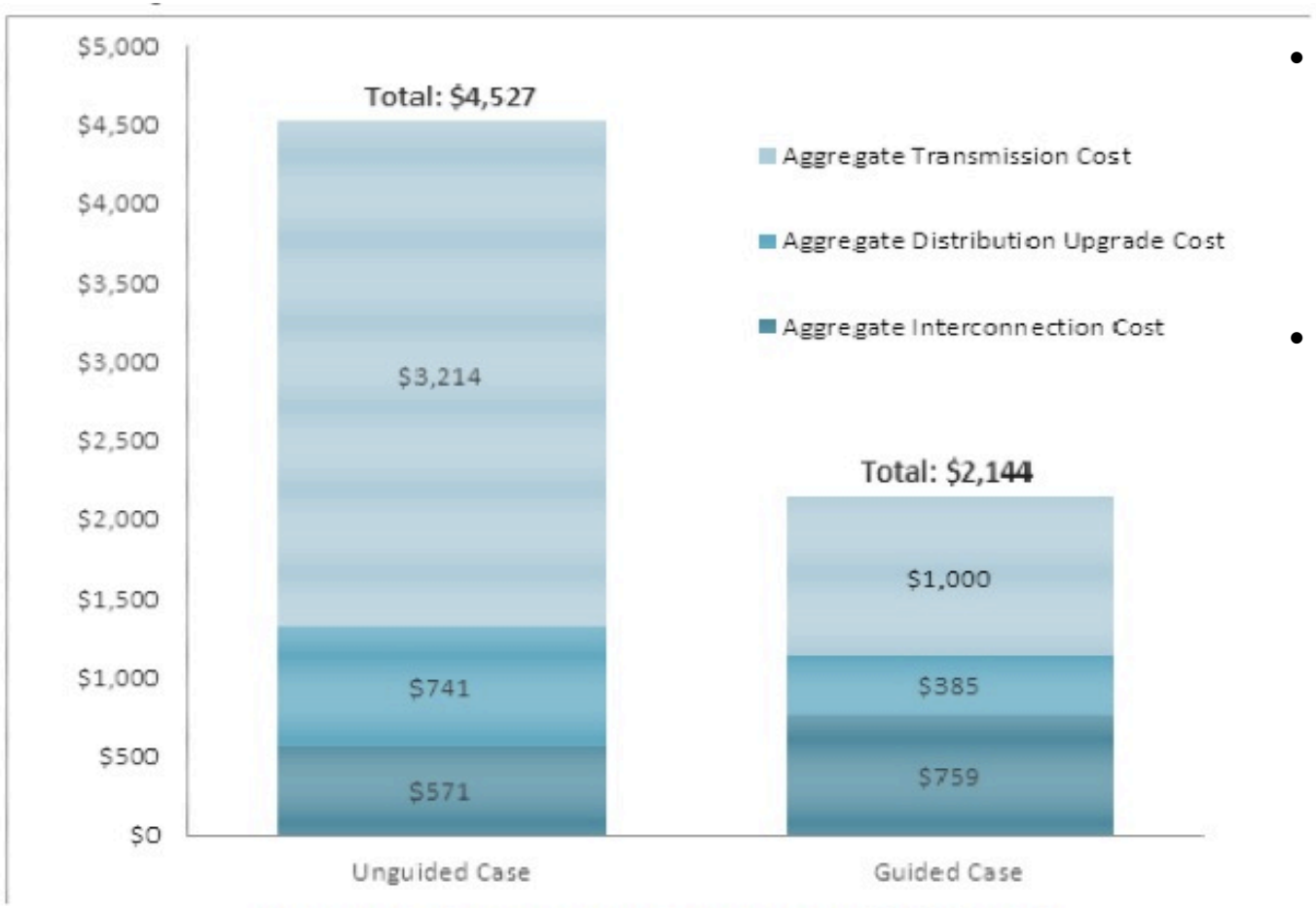

Figure 8: Total SCE System Costs of LER Proposal (Million USD)

- Locational value methodology should include transmission costs
- DRP should inform interconnection and compensation policies to guide DER deployment to optimal locations

Source: SCE Report May 2012

DER value is real and significant

Californians Just Saved $192 Million Thanks to Efficiency and Rooftop Solar

"This is really proof of what we and other energy advocates have been saying for some time."

JULIA PYPER | MAY 31, 2016

Californians Just Saved $192 Million Thanks to Efficiency and Rooftop Solar

""The need for those [transmission projects] is just not there any more... load forecast has flattened in the service area from a combination of energy efficiency and rooftop solar, which eliminates the need for these upgrades."

- Eric Eisenman, PG&E's director of ISO relations and FERC policy

Source: Greentech Media

Think creatively about DER opportunities

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Project Size

50+ MW

500 kW

5 kW

Wholesale DG

Serves Local Loads

Central Generation

Serves Remote Loads

Retail DG

Serves Onsite Loads

Behind the Meter

Distribution Grid

Transmission Grid

One example of a missed opportunity

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FITs are simple and expand eligible properties

- Standardized and guaranteed contract with a long-term, predefined rate paid for energy produced

FIT project

Utility customer

100% of the renewables generation is purchased by Georgia Power at FIT rate

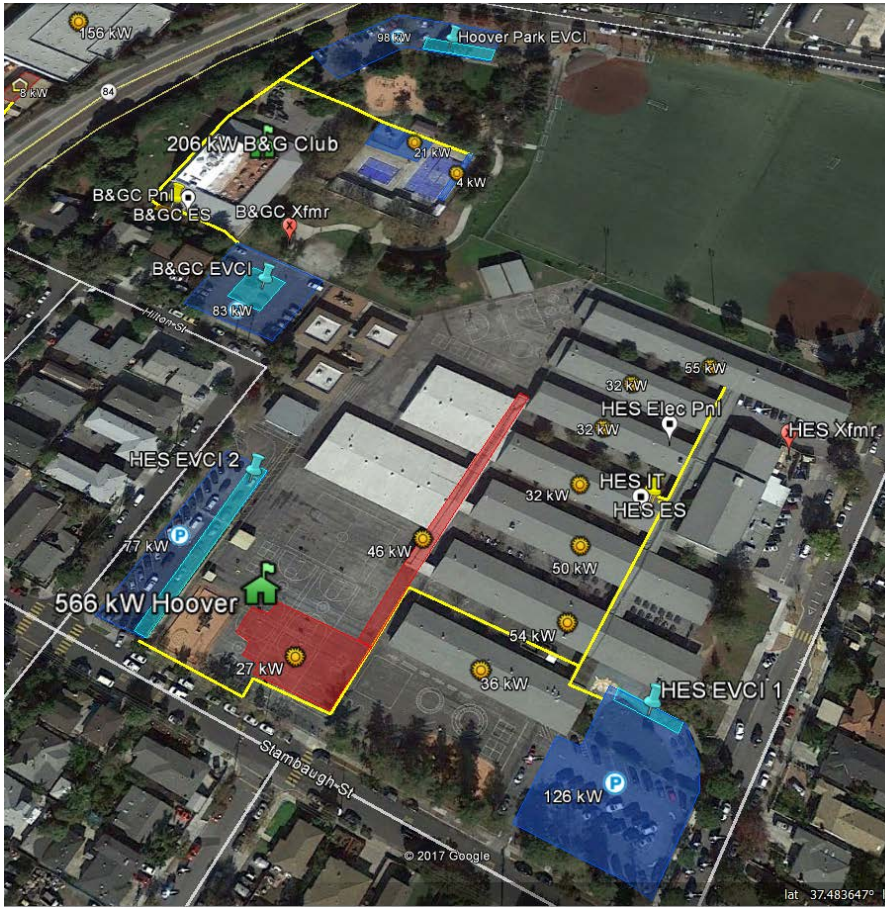
100% of customer energy usage is purchased based on a normal retail rate

Georgia Power

Understand the potential for local generation

- Identify prime siting opportunities, including municipal properties and critical facilities, of a minimum project size within a specific area

High-level, regional view



Detailed, site-specific view

Align that potential with existing grid capacity

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PV Sites		ICA	
Substation Name	Substation Survey Siting Potential [MW]	Substation Minimal Impact [MW]	Substation Possible Impact [MW]
Feeder ID	Feeder Survey Siting Potential [MW]	PV Feeder Minimal Impact [MW]	PV Feeder Possible Impact [MW]
Border	**52.59**	**6.48**	**43.17**
533	30.61	1.35	8.99
534	5.63	1.03	6.87
535	5.01	1.41	9.40
1,160	11.34	1.46	9.76
Division	**3.67**	**0.54**	**3.60**
48	3.67	1.50	10.00
Genesee	**24.02**	**1.50**	**10.00**
268	4.22	1.49	9.95
271	3.47	1.49	9.90
272	2.32	1.34	8.95
273	9.56	1.48	9.89
270	4.45	1.50	10.00
Imperial Beach	**3.59**	**7.95**	**52.99**
723	3.59	1.40	9.33
Kearney	**4.20**	**1.50**	**9.97**
711	1.40	1.50	9.97
251	2.80	0.98	6.56
Kettner	**20.92**	**8.39**	**55.92**
134	13.40	1.50	10.00
135	5.35	1.41	9.40
458	2.17	1.40	9.33

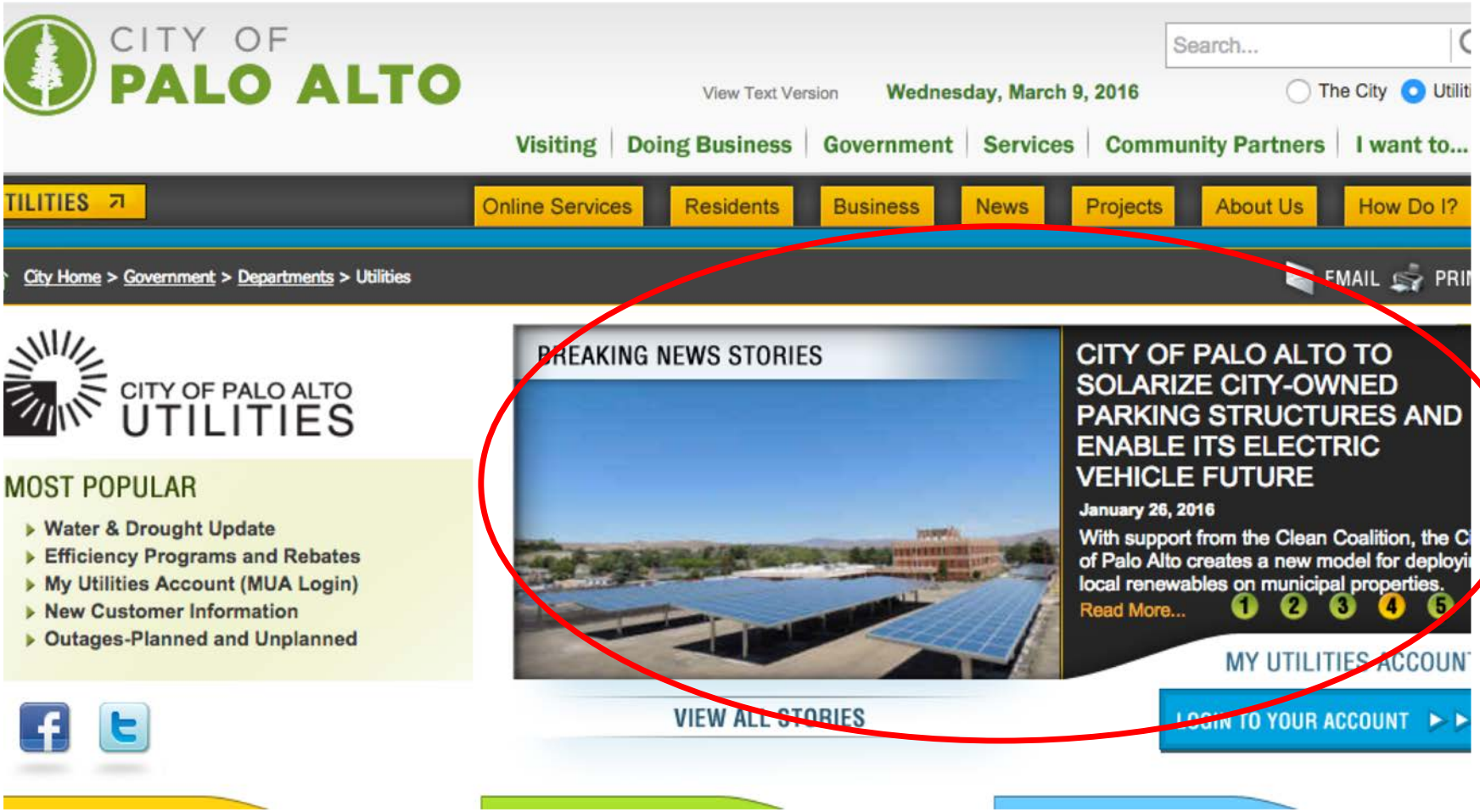
The end result

- Making it quicker, cheaper, and easier to build local renewables

Source: EcoPlexus

Look for opportunities to combine DER

- Make it simple to develop local renewables on city-owned properties with innovative and effective site lease design that also secures EV chargers



Thank you and remember…..

- *"By failing to prepare, you are preparing to fail."* – Ben Franklin

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