



**National Rural Utilities
Cooperative Finance Corporation**

SERVICE | INTEGRITY | EXCELLENCE

Distributed Energy Resources

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STATUS QUO vs. EVOLVING



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electric vehicles

rate design

energy storage

rooftop solar

electric grid

demand response

smart charging

distributed

heat-pump water heaters

smart thermostats

energy resources

heat-pump space heaters

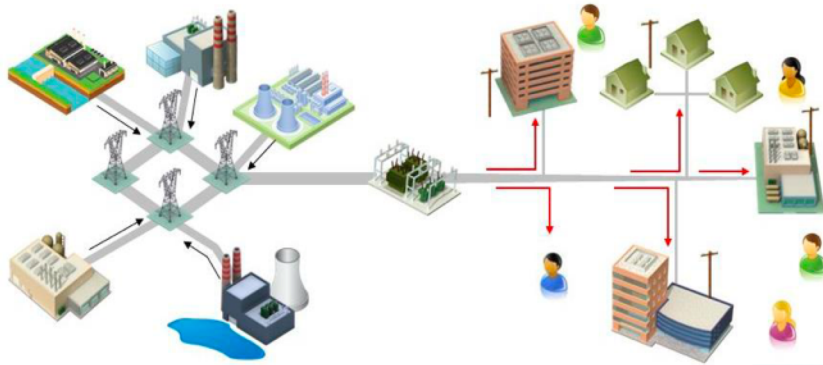
community solar

energy efficiency

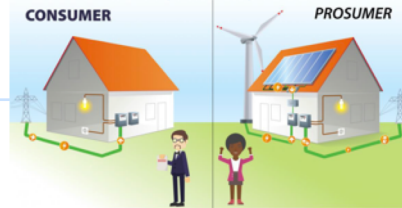
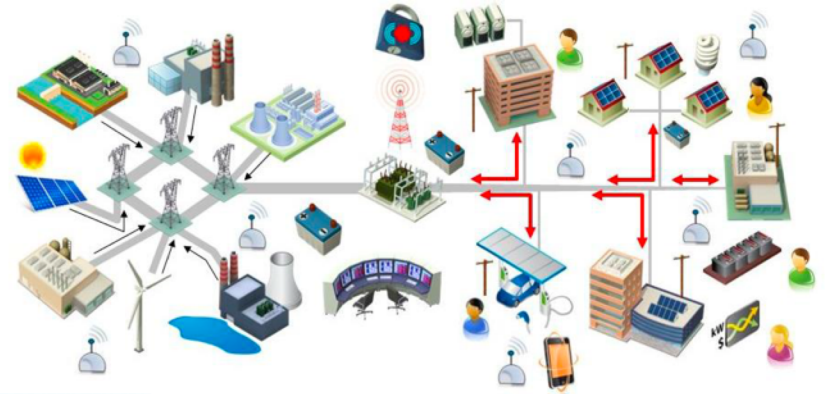
electric load EVs

solar water heating

Today's Power System



Tomorrow's Power System



Distributed energy resources, connected technologies and the concept of prosumers are turning the power system from a centralized top-down model to a distributed model

Source: EPRI



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The Internet of Things Moves In

The 2014 U.S. edition of Deloitte's Global Mobile Consumer Survey reveals that smartphone owners overindexed in their desire for Internet of Things (IoT) solutions for the home and car.

Would find value in smart HOME solutions



Would find value in connected CAR solutions



SMART HOME % of most valued technologies

CONNECTED CAR % of most valued technologies

Home Control
lights, heating and burglar alarms controlled by smartphone

47%

Home Monitoring
in-home camera footage viewed and controlled by smartphone

40%

Entertainment
entertainment systems display social media postings

20%

Appliance Control
sensors in appliances send notifications to smartphone

18%

Landscape Control
landscape systems measure plant moisture, watering only when necessary

9%

Younger Generations (18-24)

17% Compared to other consumers surveyed, the youngest generation valued landscape control the most. Do they not want to do their chores?

16% Surprisingly, the youngest generation is also the age group most interested in self-driving cars. Would they rather text than get behind the wheel?

10%

Automation

driverless operation

While the least valued connected technology is the self-driving car, **60%** of all consumers would be willing to pay for one.

18%

Fuel Tracking

fuel efficiency tracking

18%

Traffic/Weather

real-time traffic and weather updates displayed on in-car screens

40%

Navigation

mapping and route optimization

39%

Maintenance

automated diagnosis and tracking of vehicle's systems

28%

Access

remotely lock and track vehicle via Internet-connected device

23%

Entertainment

music streaming to in-car entertainment system

18%

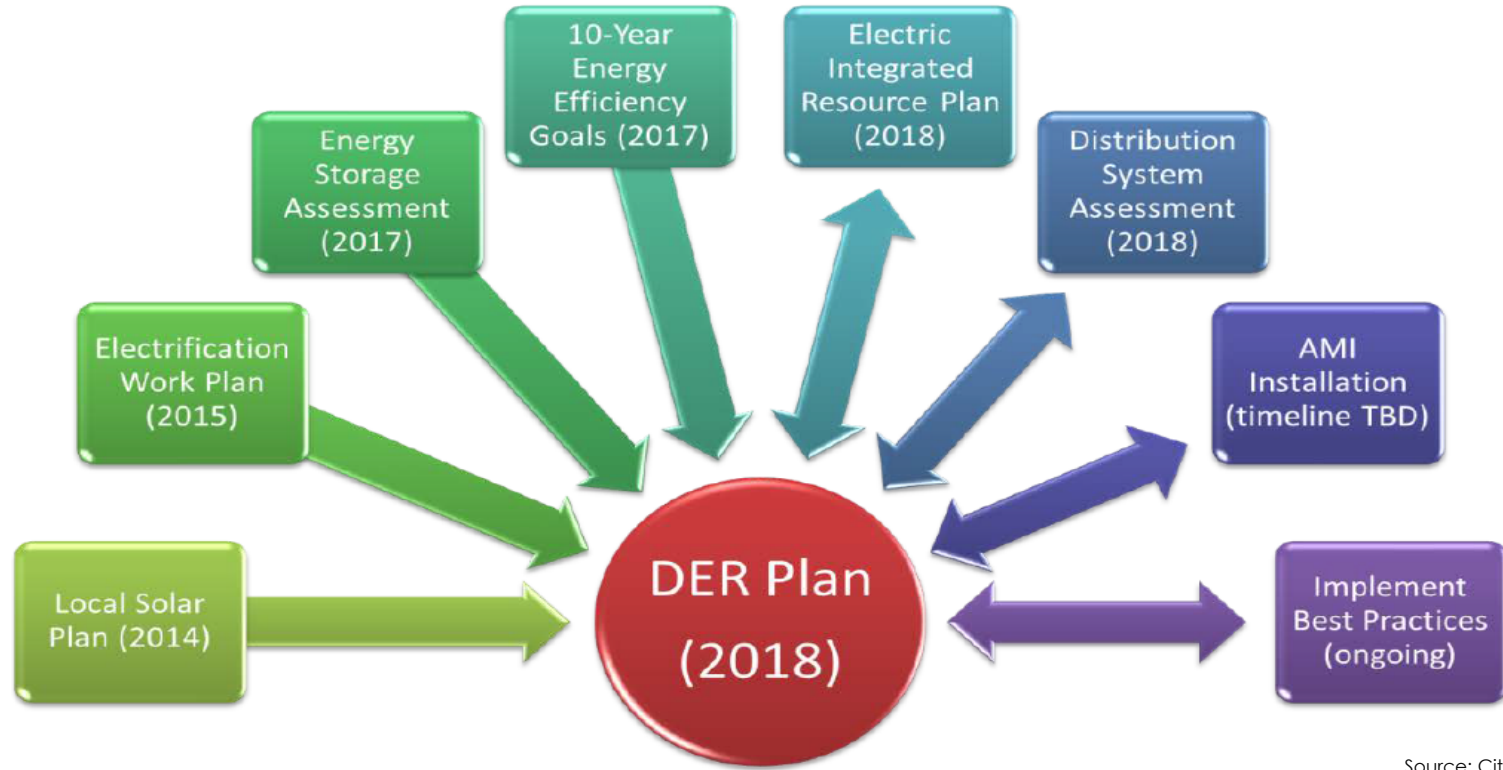
Deloitte.



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DER Planning

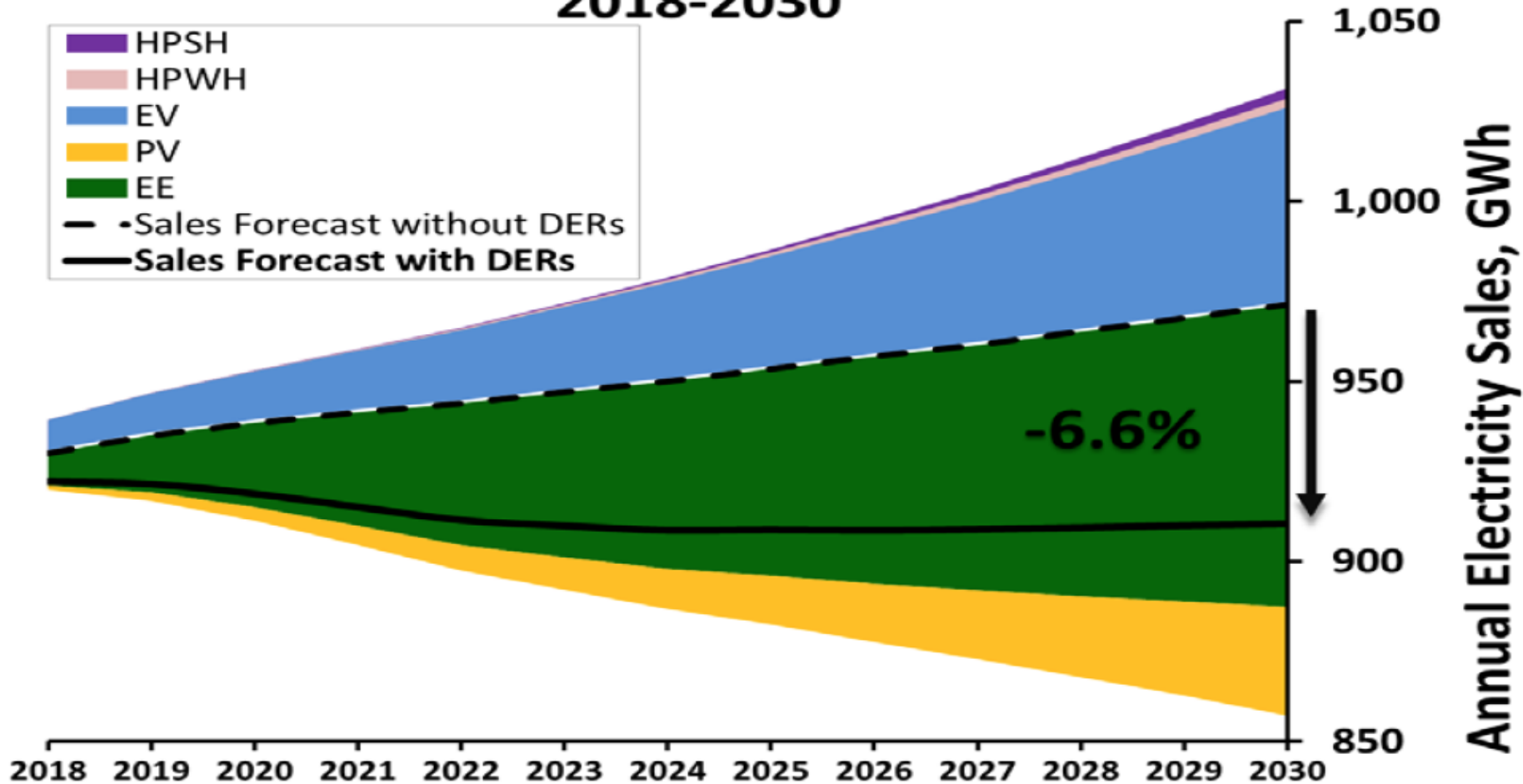


Source: City of Palo Alto Utilities



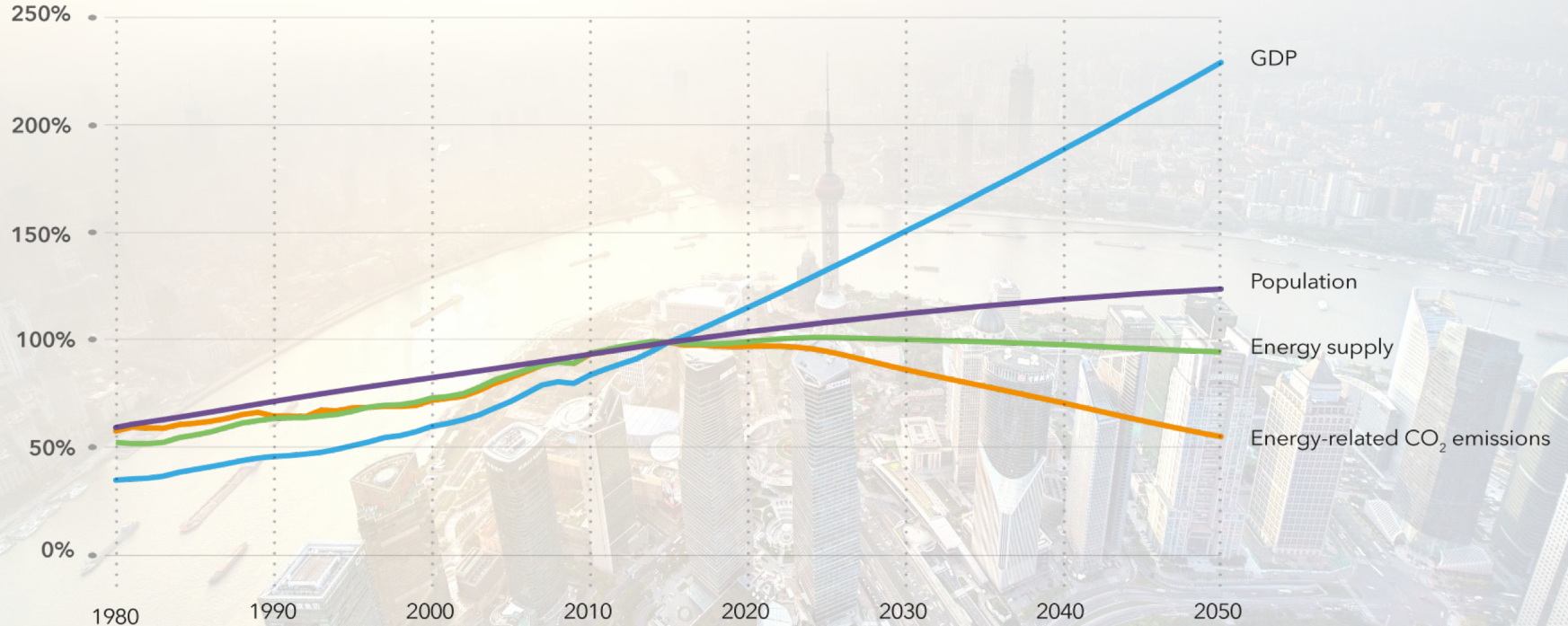
DER Impact on Annual Electricity Sales 2018-2030

Source: City of Palo Alto Utilities



Economic Growth vs. Energy Efficiency Growth

Units: Percentage of 2015 level



Source DNV GL



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Economic Growth vs. Energy Efficiency Growth

U.S. Dollar generated per kilowatt-hour

2015



2050



140% efficiency gain

Source DNV GL



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2015
37.5 MWh/year



2050
21.1 MWh/year

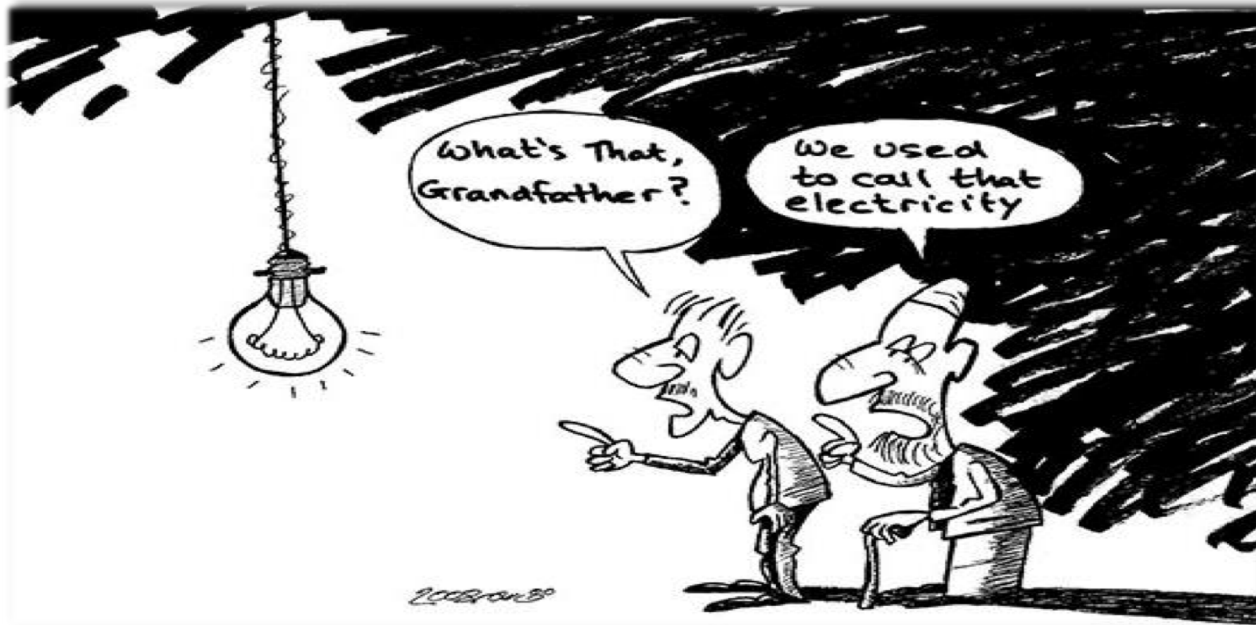


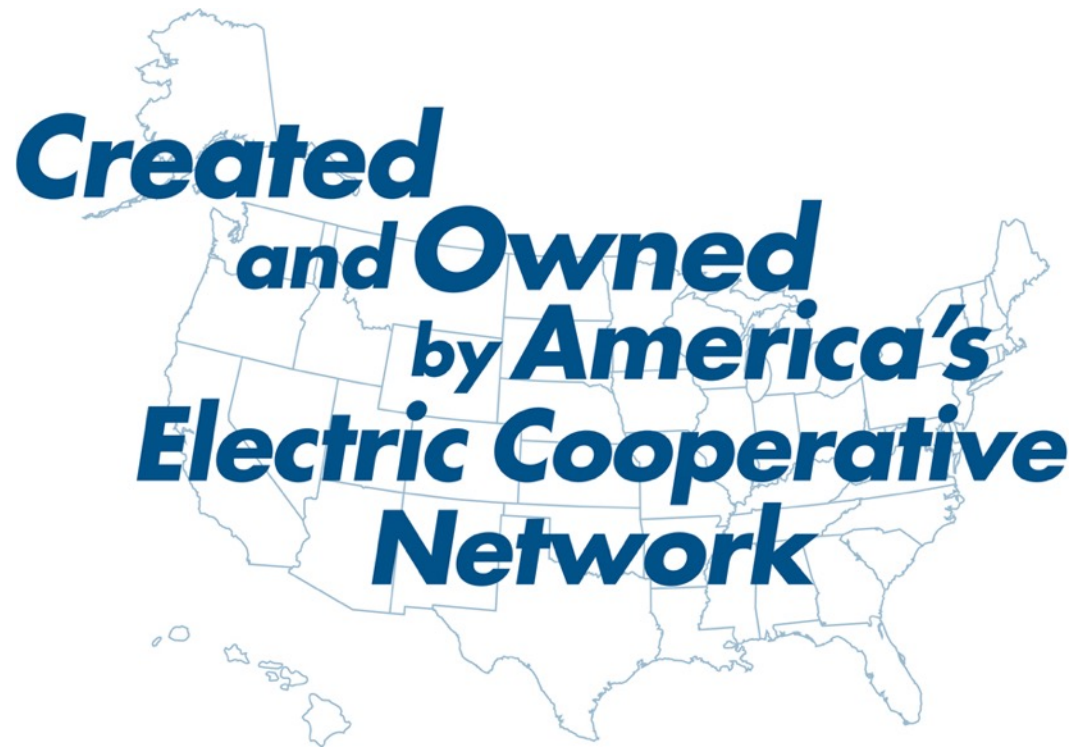
Source DNV GL



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An outline map of the United States, including Alaska and Hawaii, serves as a background for the text. The text is written in a bold, blue, sans-serif font and is centered over the map.

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by America's
Electric Cooperative
Network**

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