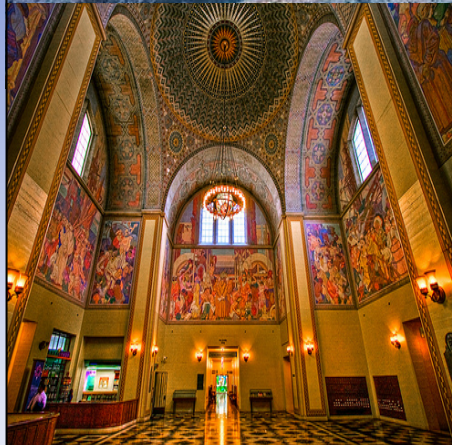




Power Industry Overview & Timelines

***Office of Public
Accountability/
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December 5, 2020



Overview

– **Scale of North American electric system**

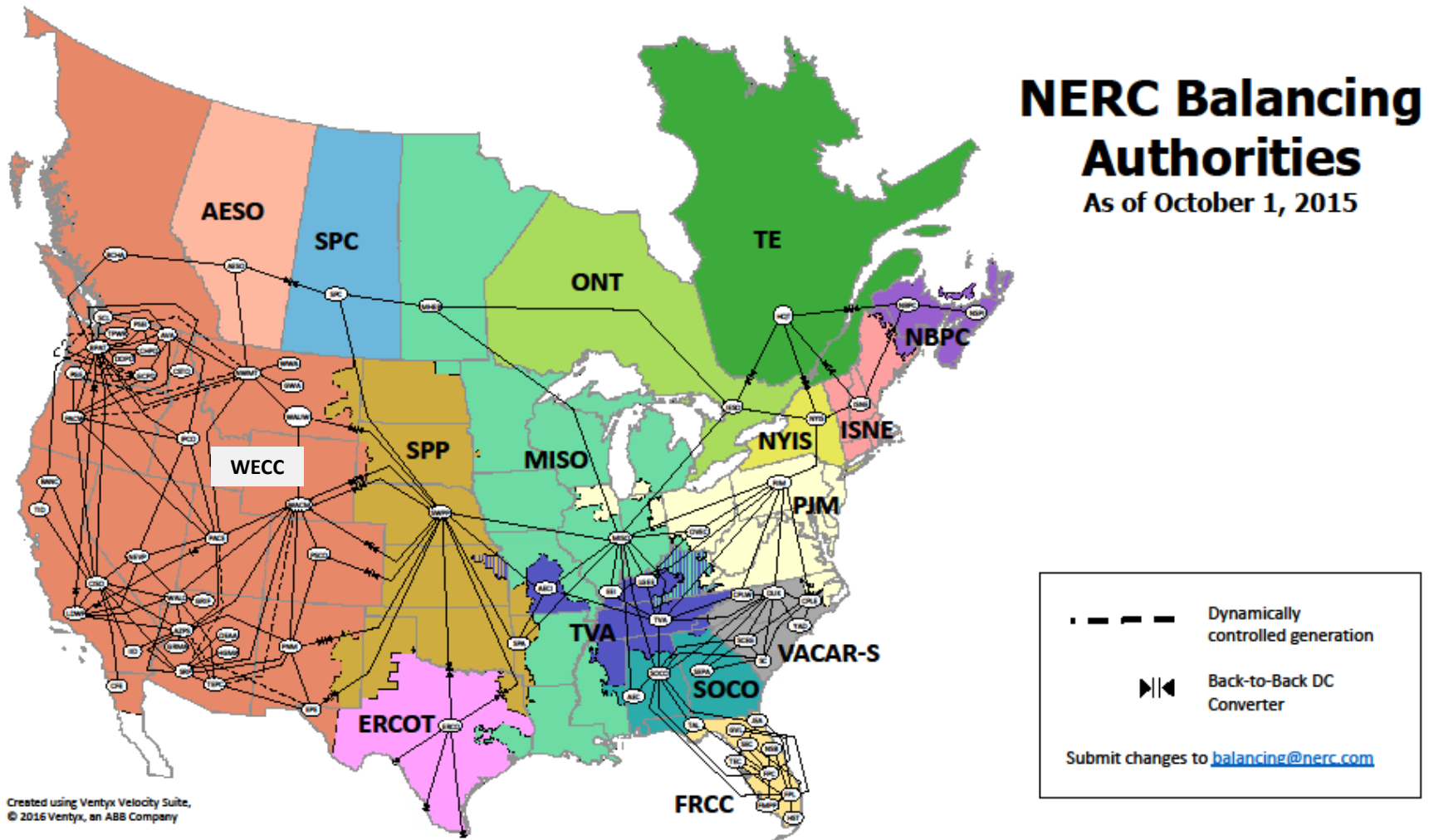
- Geographic scope
- How big is big in power and energy?
- **Scope of DWP's system**
- Segments of the technology

– **Power industry timeline**

- **Power systems generation & transmission planning & operation timeline**
- Timeline with bulk power markets
- **Innovation timelines**

Today's National Electric Reliability Corp.

About 350 million people, 1,000 GW capacity, 211,000 miles HV transmission, and over \$1 trillion in assets



How Big is Big, in Power Capacity?

• LED light equivalent to 60 W incandescent	9 watts or 0.009 kW
• Standard incandescent light	60 watts or 0.060 kW
• Typical house load	1 - 4 kW
• Big stand-by generator	1000 kW or 1 MW
• 100,000 sq ft office building	1200 kW or 1.2 MW
• 100,000 sq ft “server farm”	12,000 kW or 12 MW est.
• Refinery	100 MW
• 1,000,000 sq ft “server farm”	120 - 200 MW est.
• Typical new generation plant	300-600 MW
• Nuclear unit	650 - 1200 MW
• City of Los Angeles DWP, 2015 resources	7,640 MW
• Southern California Edison	22,771 MW
• California peak resources, summer	53,458 MW
• WECC summer peak resources (US, BC, BC, AB)	184,000 MW
• US & Canada, peak resources, summer	1,012 GW or 1,012,000 MW

Sources: F H Pickel, NERC ESD 2017 for 2017, SCE and CAISO reports, LADWP 2015

Power is an instantaneous measurement, typically measured in Watts, which are Volts times Amperes.

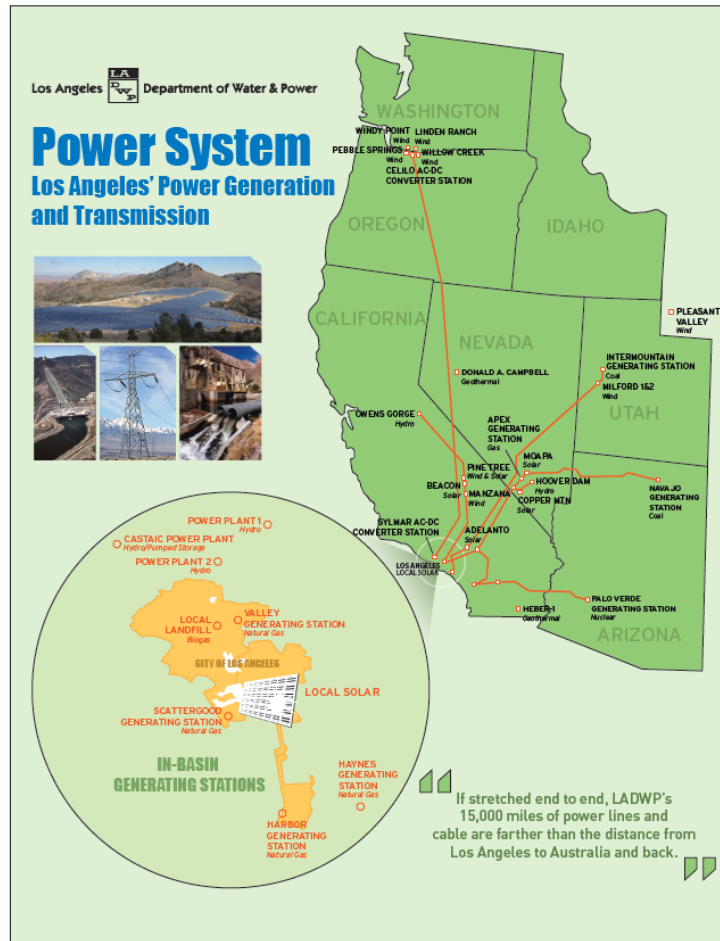
How Big is Big, in Energy Terms?

- LED 60 W equivalent, half time 3.3 kWh/month
- 60 W incandescent, half time 21.9 kWh/month
- Single family residential bill 300 - 1000 kWh/month
- Average US residential user 10,000 kWh/year
- Average US commercial user 70,000 kWh/year
- Standby generator, 200 hr 240,000 kWh/yr
1,200 kW for 200 hours
- Average US industrial user 1,900,000 kWh/year or
or an average of 220 kW for 24/7
- Average US nuclear unit 5,600,000,000 kWh or 5,600,000 MWh
or 5.6 TeraWh/yr (TWh)
or annual average of 650 MW 24/7
- City of Los Angeles DWP, 2017 22,700,000,000 kWh/yr or 22,700 GWh or 22.7 TWh
- SoCal Edison customers, 2017 72,200,000,000 kWh/yr
or 72.2 TeraWatt-hours/yr (TWh)
- All California generated 271 TWh or 271 billion kWh/yr
- US, Baja, Canadian WECC generated 893 TWh or 893 billion kWh/yr
- US and Canada generated 4,550 TWh

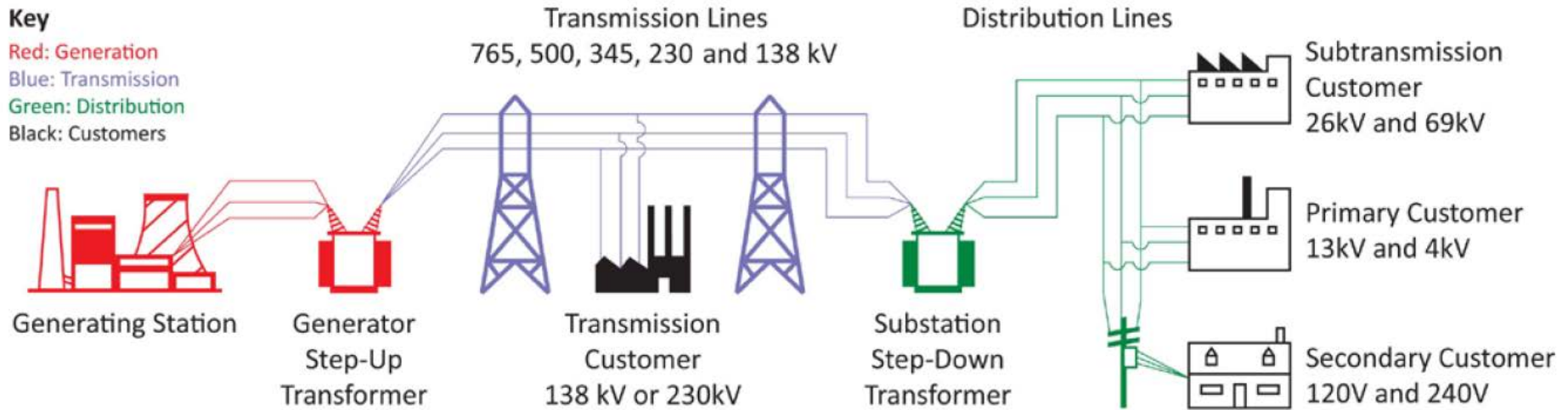
Sources: F H Pickel, NERC ESD 2017 for 2017, SCE and CAISO reports, DOE/EIA 2017
Electric energy is typically measured in Watt-hours, which is Watts times hours.

Geographic reach of Water & Power

(15th US on power revenue, 32nd on MWh sales, 18th on customers)

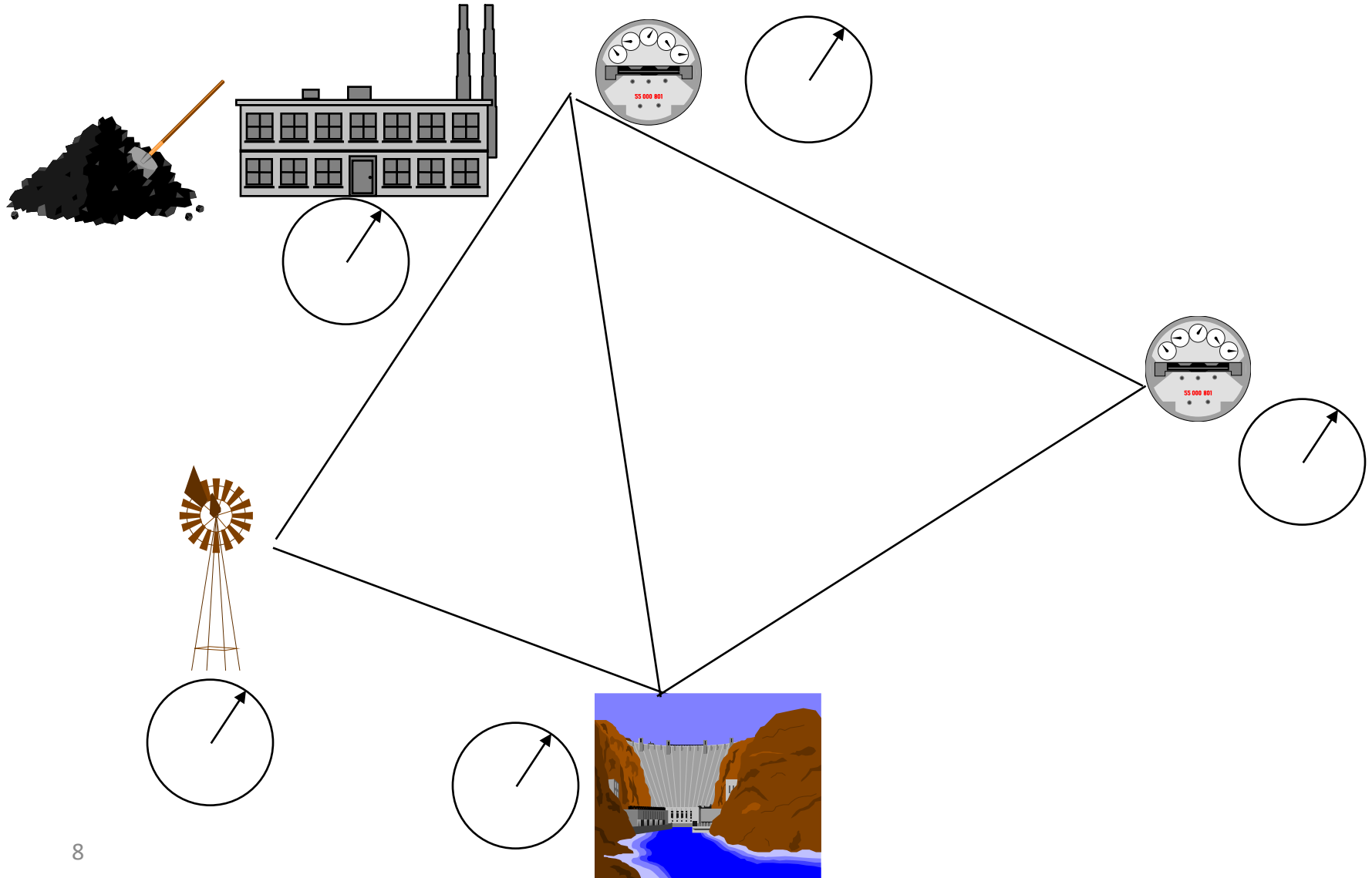


“Bulk Power System”

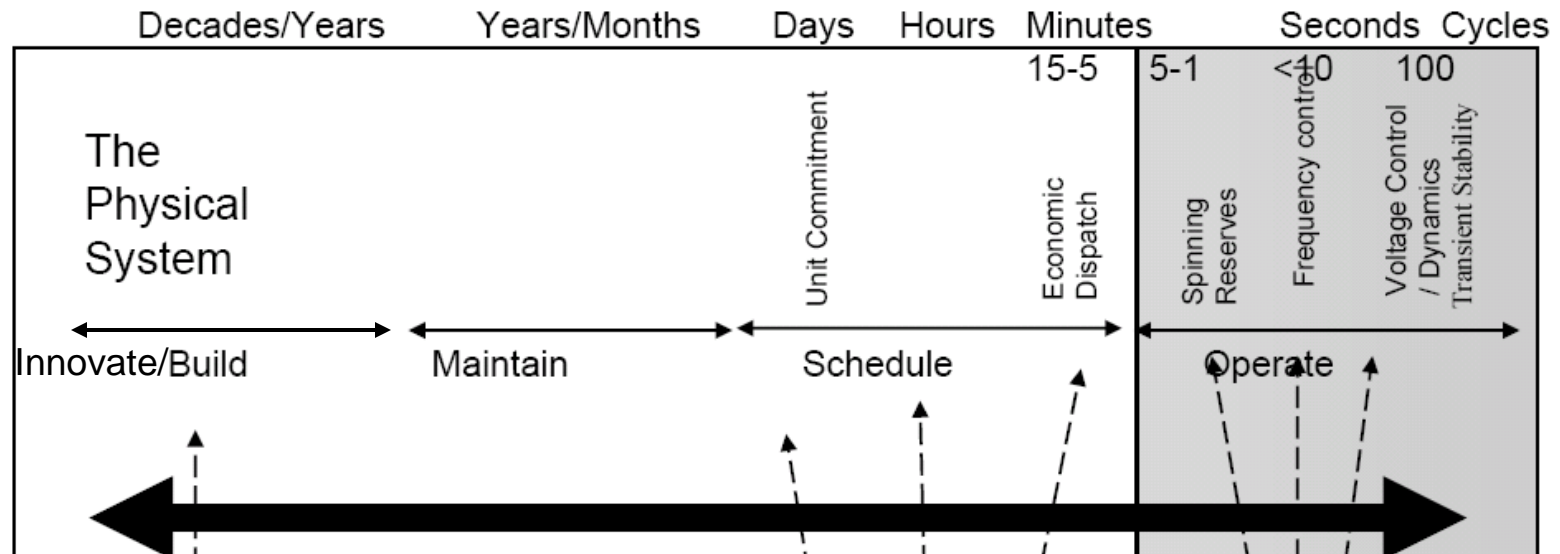


Source: NERC

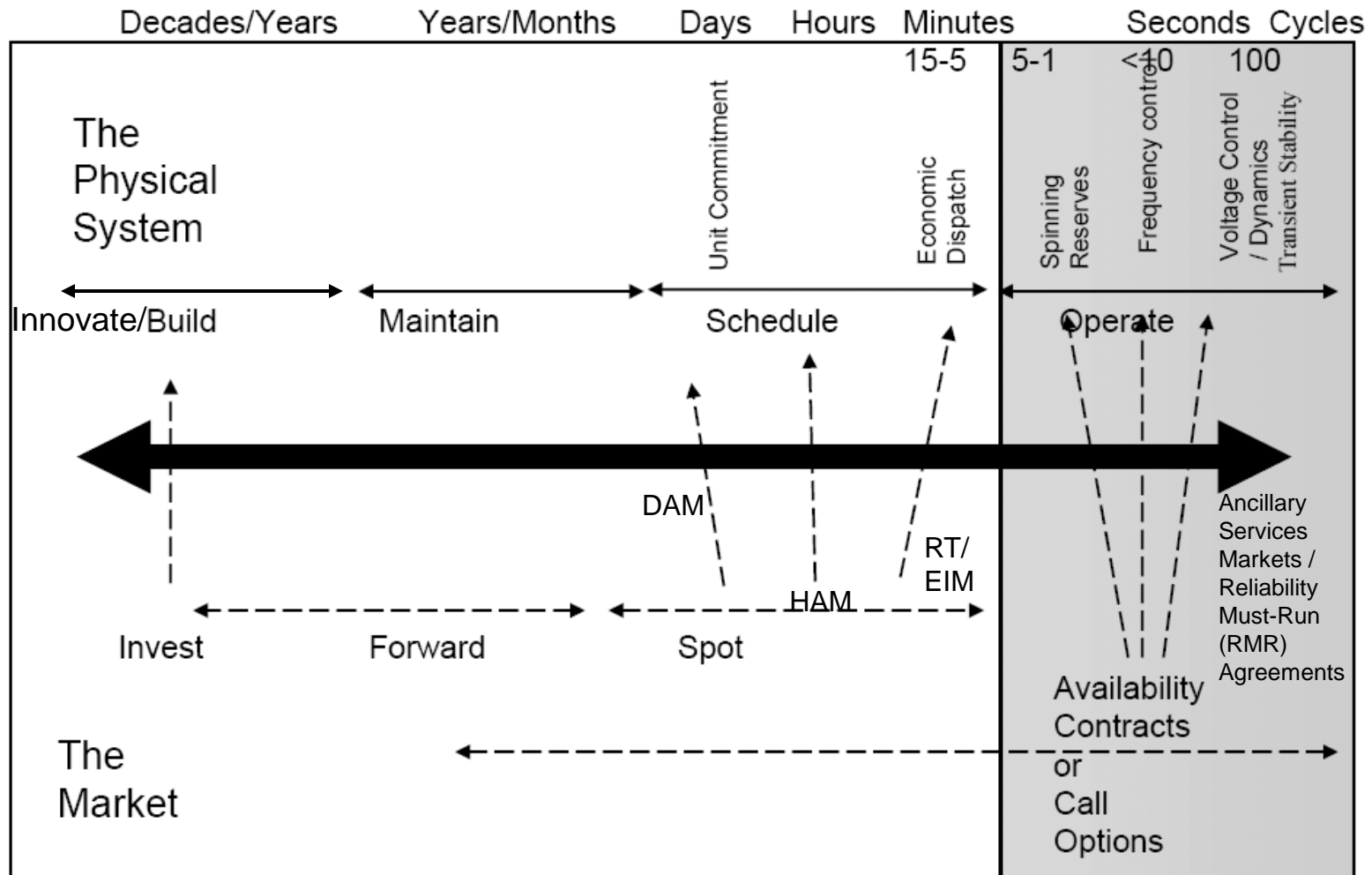
Transmission Networks



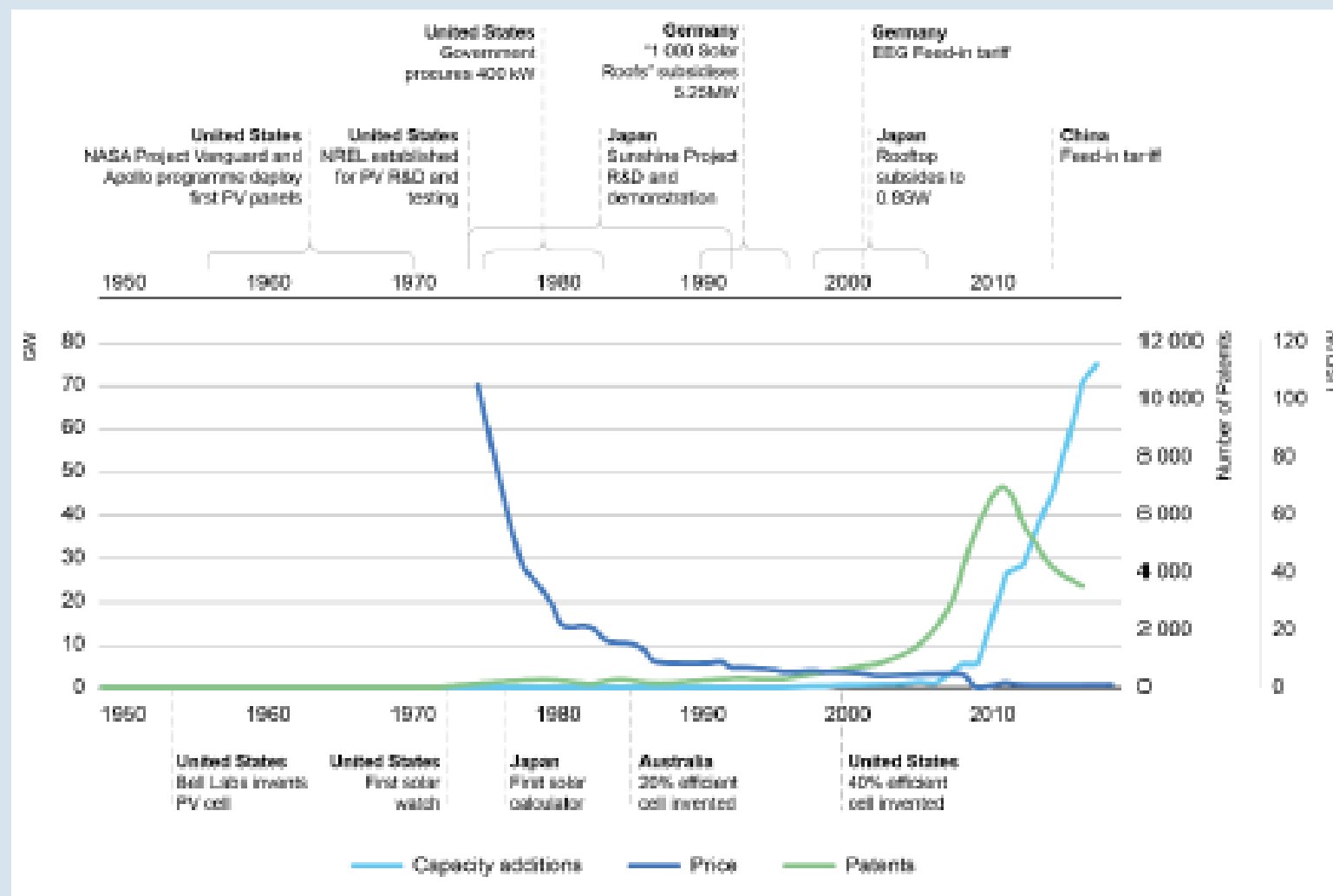
Power Systems Generation & Transmission Planning & Operation Timeline



Timeline With Bulk Power Markets



Key government programmes (top) and milestones (bottom) in PV development



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Note: NREL = National Renewable Energy Laboratory; EEG = Renewable Energy Sources Act In German; PV = photovoltaics; R&D = research and development.

Source: Nemet (2019); Persat et al. (2019); Kavlak, McNerney and Trancik (2018).

The price of electricity from new power plants

Our World
in Data

Electricity prices are expressed in 'levelized costs of energy' (LCOE). LCOE captures the cost of building the power plant itself as well as the ongoing costs for fuel and operating the power plant over its lifetime.

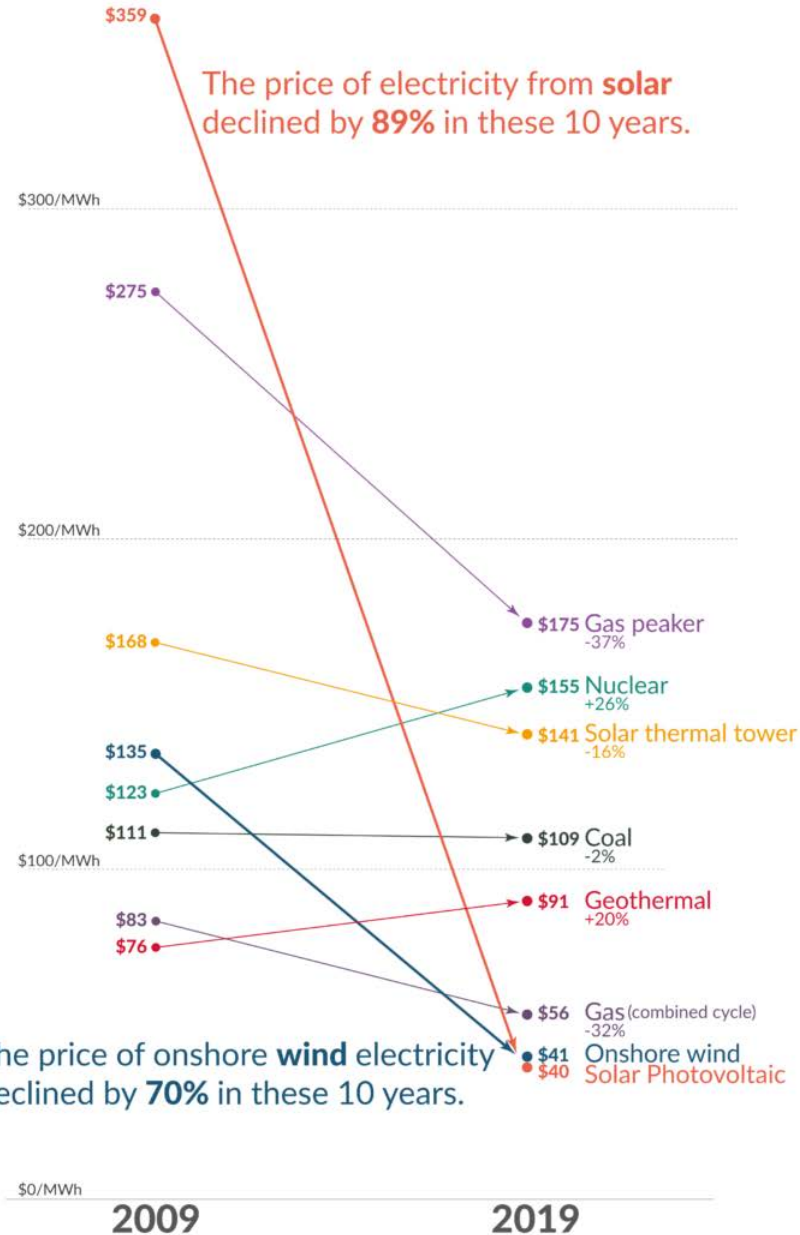
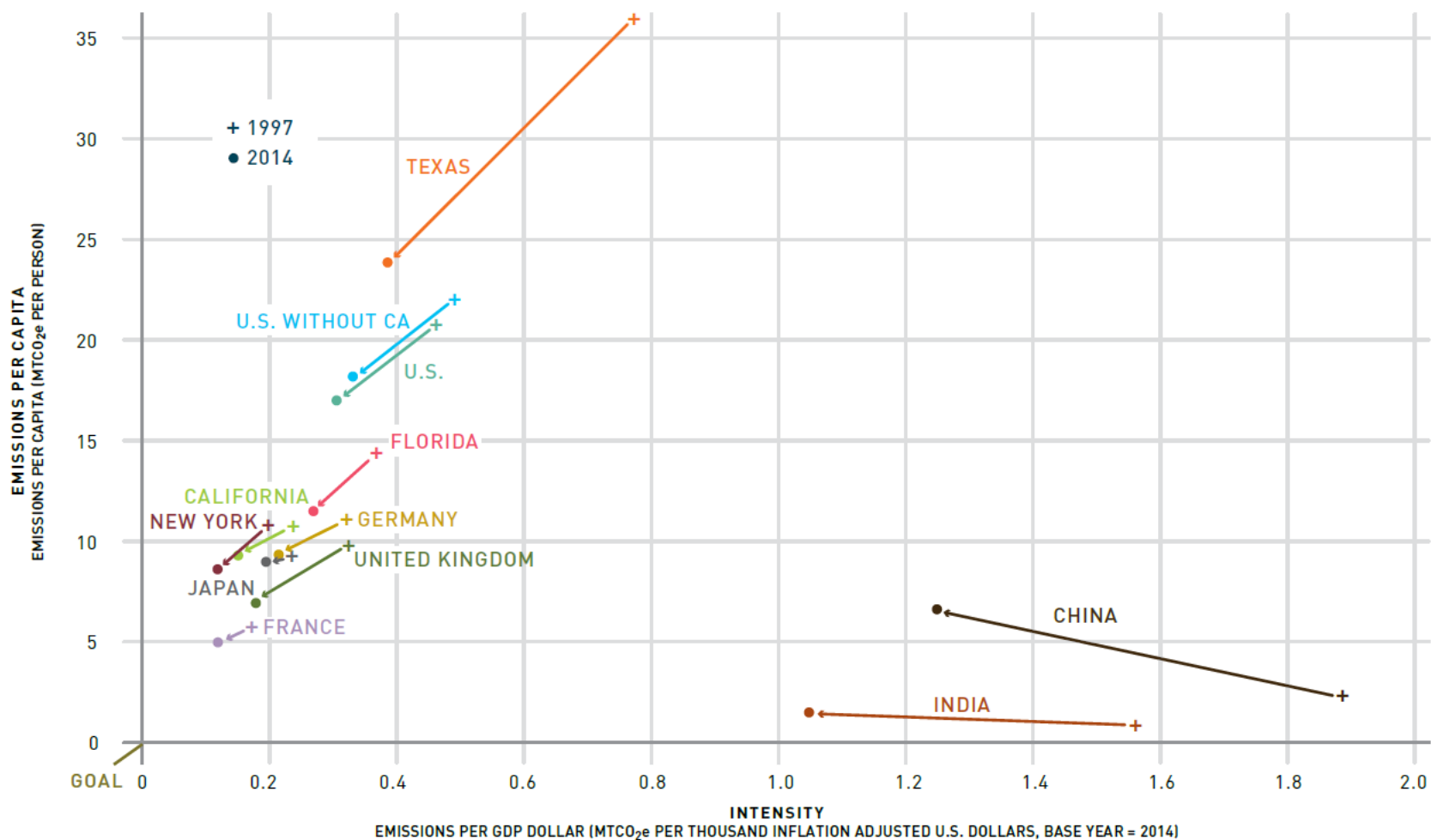


FIGURE 1. GLOBAL FOSSIL FUEL COMBUSTION IN CALIFORNIA AND OTHER REGIONS

CARBON INTENSITY & EMISSIONS PER CAPITA 1997 TO 2014



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Note: GDP in Real 2014 U.S. Dollars. Greenhouse gas emissions are from consumption of energy. Data Source: U.S. Energy Information Administration; U.S. Bureau of Economic Analysis, USDA Economic Research Service; U.S. Census Bureau. NEXT 10 / SF · CA · USA