

REINVIGORATING HYDROPOWER

A cornerstone of our clean, affordable, reliable electric future

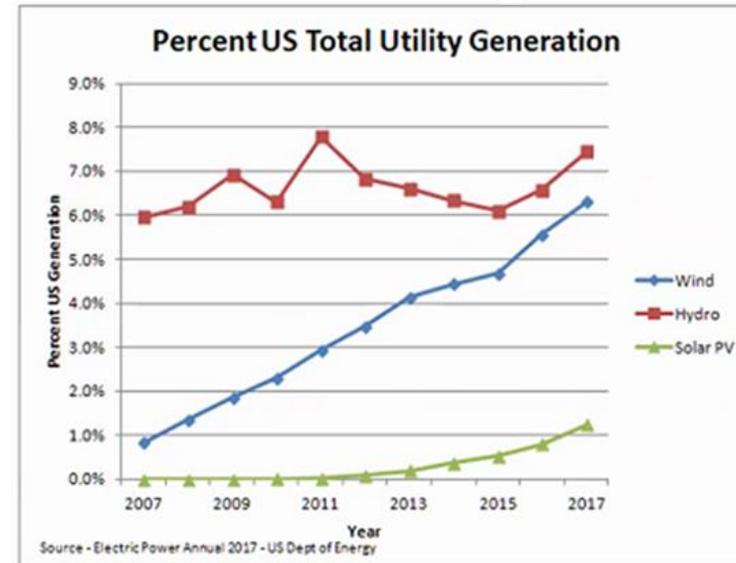
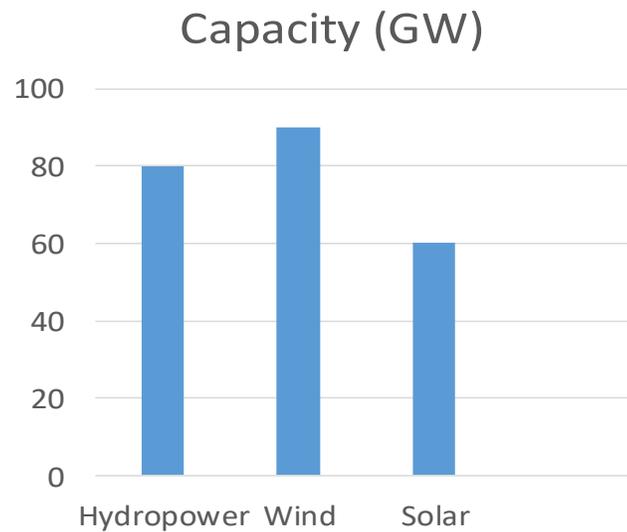


Prepared by
National Hydropower Association and
Chelan County Public Utility District

Reinvestment Environment

- ▶ Between 2019 and 2030, the federal operating licenses of 325 hydropower projects will expire (an installed capacity of over 16 gigawatts)
- ▶ Licensees are evaluating whether and how to relicense projects, and at what acceptable cost.
 - ▶ Markets that do not value hydropower grid services
 - ▶ State renewable portfolio policies limit hydropower eligibility and tax policy disfavors hydropower
 - ▶ Corporate purchasing policies favor “new” wind and solar
 - ▶ Hydropower has the longest licensing process of any generating resource
 - ▶ Research budgets underfund hydropower compared to other resources
 - ▶ Quality and contracting issues are affecting equipment longevity

How does hydro stack up?



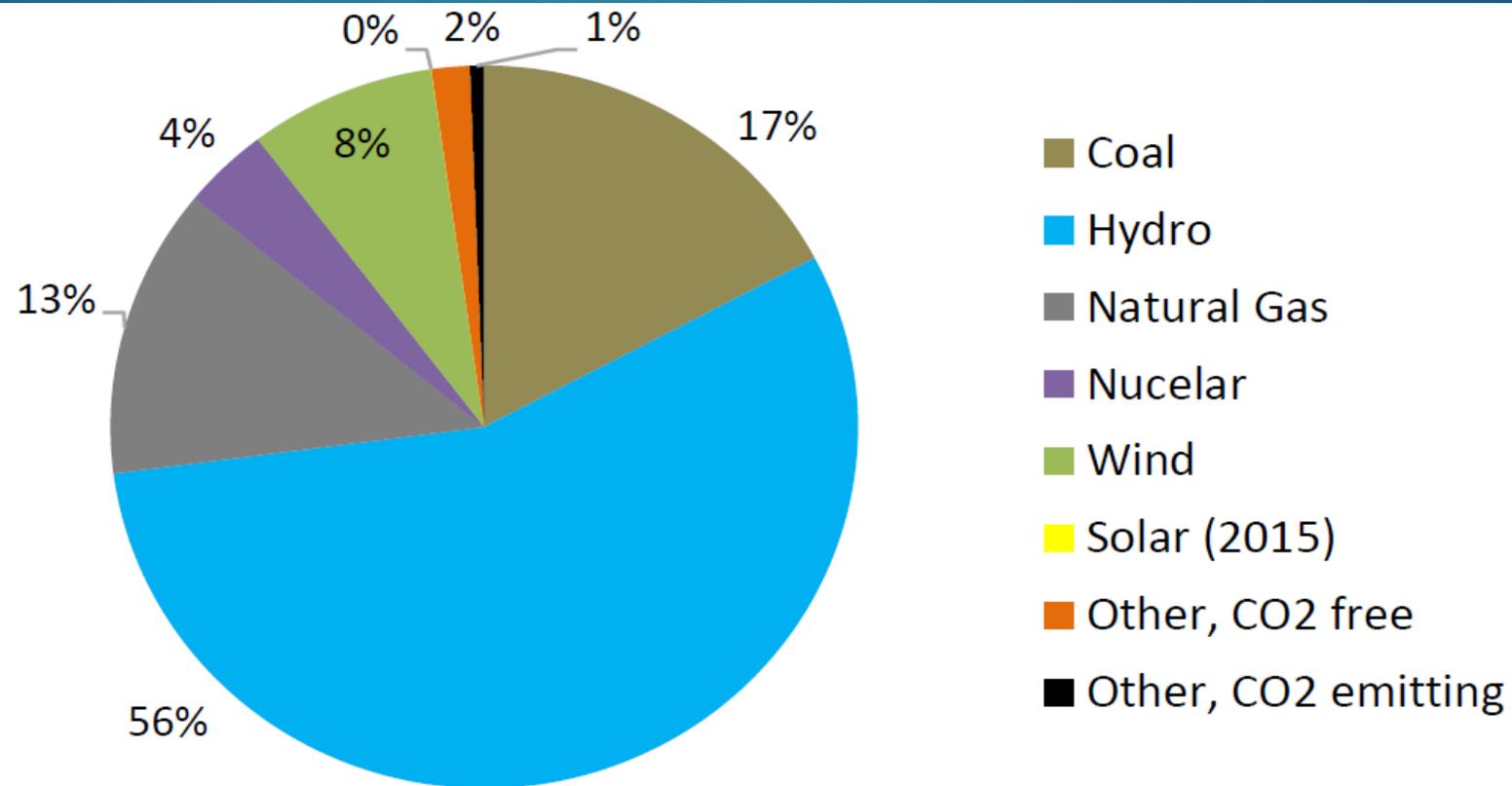
Wind and solar power have grown exponentially over the last decade. Hydropower has remained fairly steady, depending on water availability.

Comparison of Electric Power Resource Characteristics

	Flexible Capacity	Firm capacity	Annual energy	Regulation	Spin reserves	Non-spin reserves	Long-Term Storage	Inertia	Black Start	Carbon-Free
Hydroelectric (large project)	yes	yes, water dependent	yes, water dependent	yes	yes	yes	yes	yes	yes	yes
Gas (CCCT)	yes	yes	yes	yes	yes	yes, could be limited	no	yes	yes	no
Gas (SSCT)	limited	yes	yes, could be limited	yes	yes	yes, could be limited	no	yes	yes	no
Coal	no	yes	yes	limited	limited	no	no	yes	no	no
Nuclear	no	yes	yes	no	no	no	no	yes	no	yes
Biomass	limited	yes	yes	yes, could be limited	yes, could be limited	yes, could be limited	no	no	no	limited
Geothermal	no	yes	yes	yes	yes	yes	no	no	no	yes
Solar, PV	no	location dependent	yes, location dependent	yes, limited by energy potential	yes, limited by energy potential	yes, limited by energy potential	no	no	no	yes
Solar, thermal	no	limited to yes	yes, location dependent	yes, limited by energy potential	yes, limited by energy potential	yes, limited by energy potential	yes	no	no	yes
Wind	no	location dependent	yes, location dependent	yes, limited by energy potential	yes, limited by energy potential	yes, limited by energy potential	no	possibly, using synthetic product	no	yes

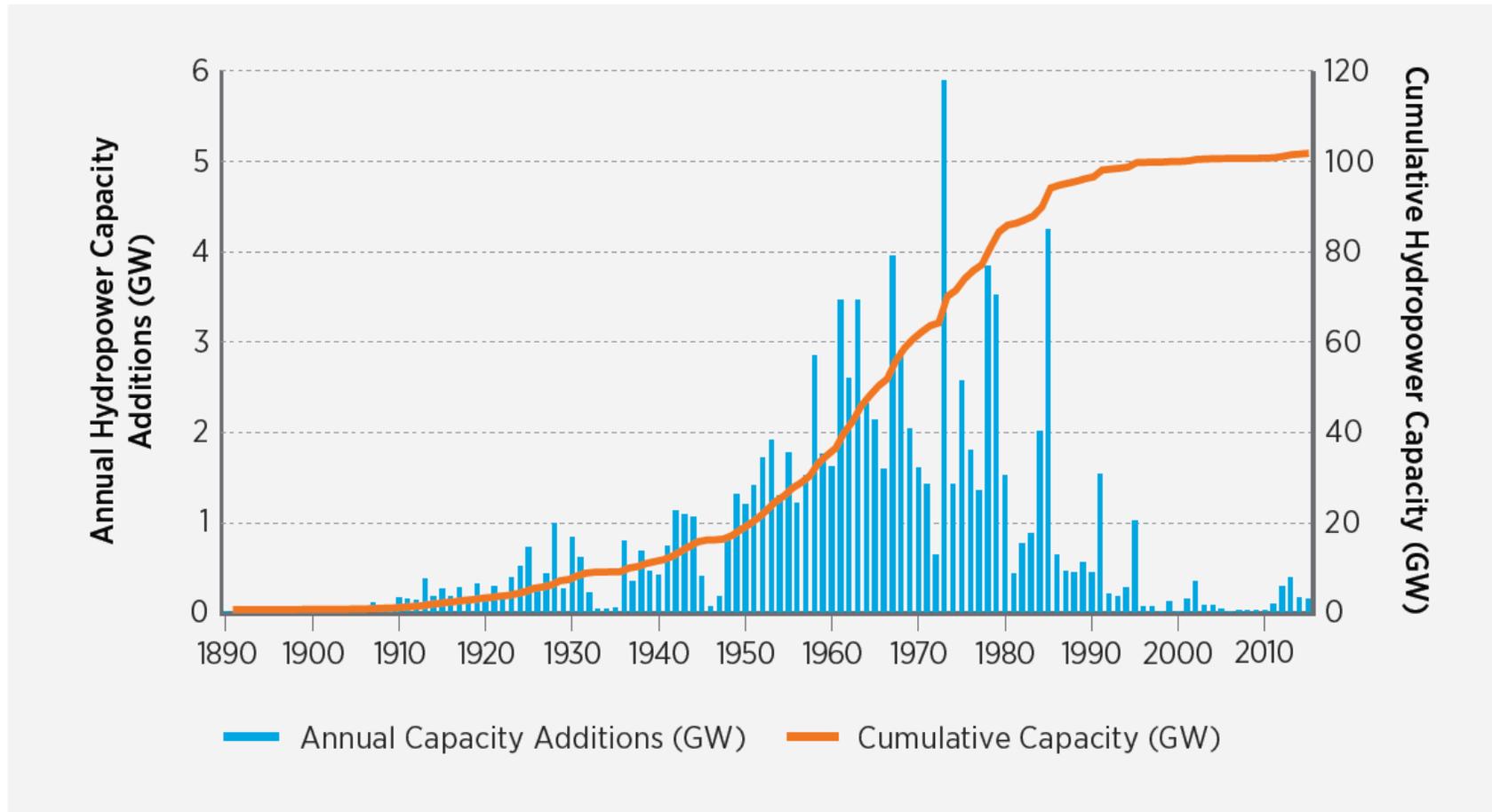


The Northwest: A Case Study



Source: Value of Hydropower to the Northwest Grid. PNUCC 2016. Northwest as defined as all generation in ID, MT, OR, WA, plus Jim Bridger and 50% of Valmy. 2013 – 2015 average.

Growth by Decade

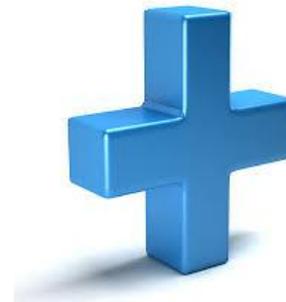


Sources: Energy Information Administration (EIA) Form 860 2011 [8], EIA Monthly Energy Review [4], Federal Energy Regulatory Commission Energy Infrastructure Updates [9]

U.S. hydropower (80 GW) and pumped storage hydropower (20 GW) annual capacity additions and cumulative capacity from 1890–2015 (GW)

How to Reinvigorate Hydropower

- ▶ Recognize market value for hydropower's attributes (e.g. capacity, flexible capacity, operating reserves, inertia, frequency response).
- ▶ Choose technology neutral policies for carbon reduction and ensure incentives treat hydropower equitably
- ▶ Allow reinvestment in existing hydropower to meet "additionality" criteria



How to Reinvigorate Hydropower

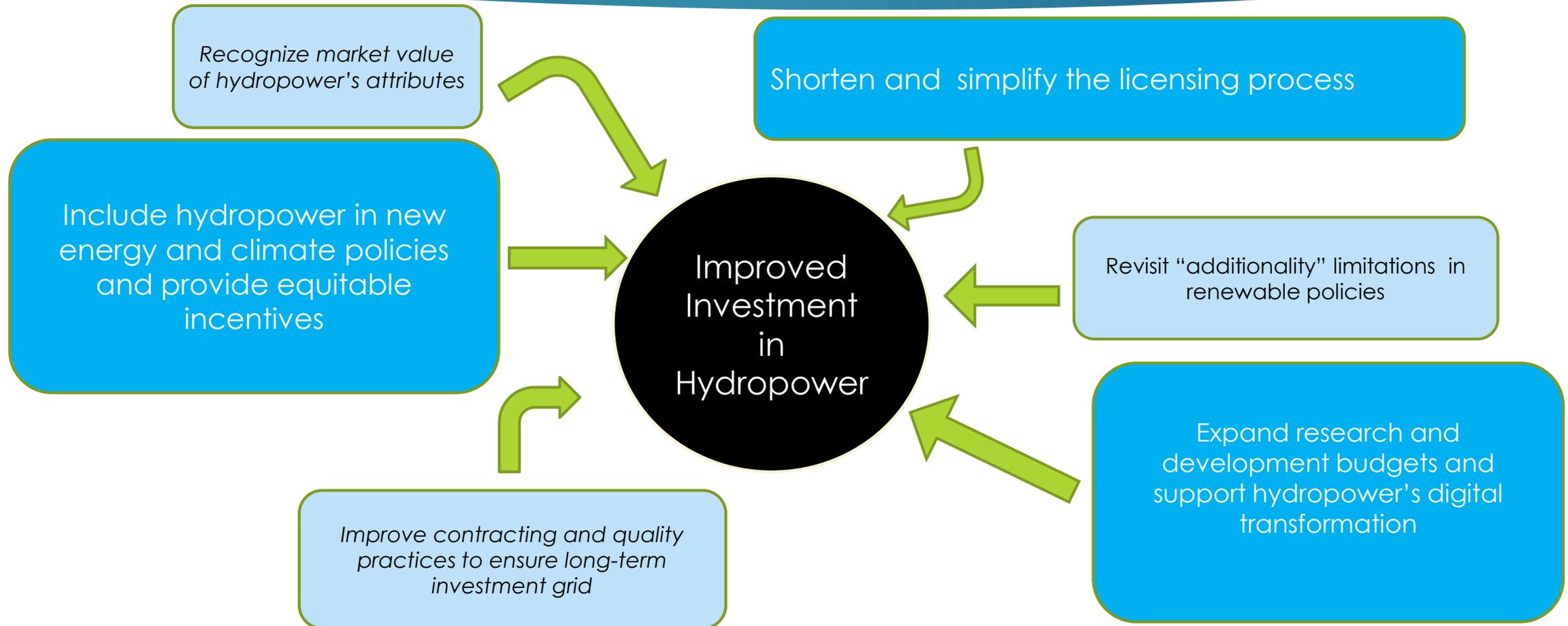
- ▶ Shorten and simplify the licensing process
- ▶ Expand research and development budgets and support hydropower's digital transformation
- ▶ Improve contracting and quality control practices to encourage long-term investments



Recent Developments

- ▶ Washington's clean energy transformation bill
 - Hydropower recognized as a renewable
 - Tax parity?
- ▶ America's Water Infrastructure Act
 - Incentivizes early investments at hydropower projects before relicensing
- ▶ Corporate purchaser outlook: Microsoft power supply contract
- ▶ Hydropower Research Institute

Highlighted: Congressional Areas of Focus



Questions?

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