



# U.S. Hydropower Market Report 2017 Update (April)

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These slides provide updates to some of the key metrics included in the [2014 Hydropower Market Report](#), which was published in April 2015. The Hydropower Market Report aims to fill the existing gap regarding publicly available, comprehensive information on the U.S. hydropower fleet and the industry that supports it and develops new projects.

The updated content shown here covers the following topics:

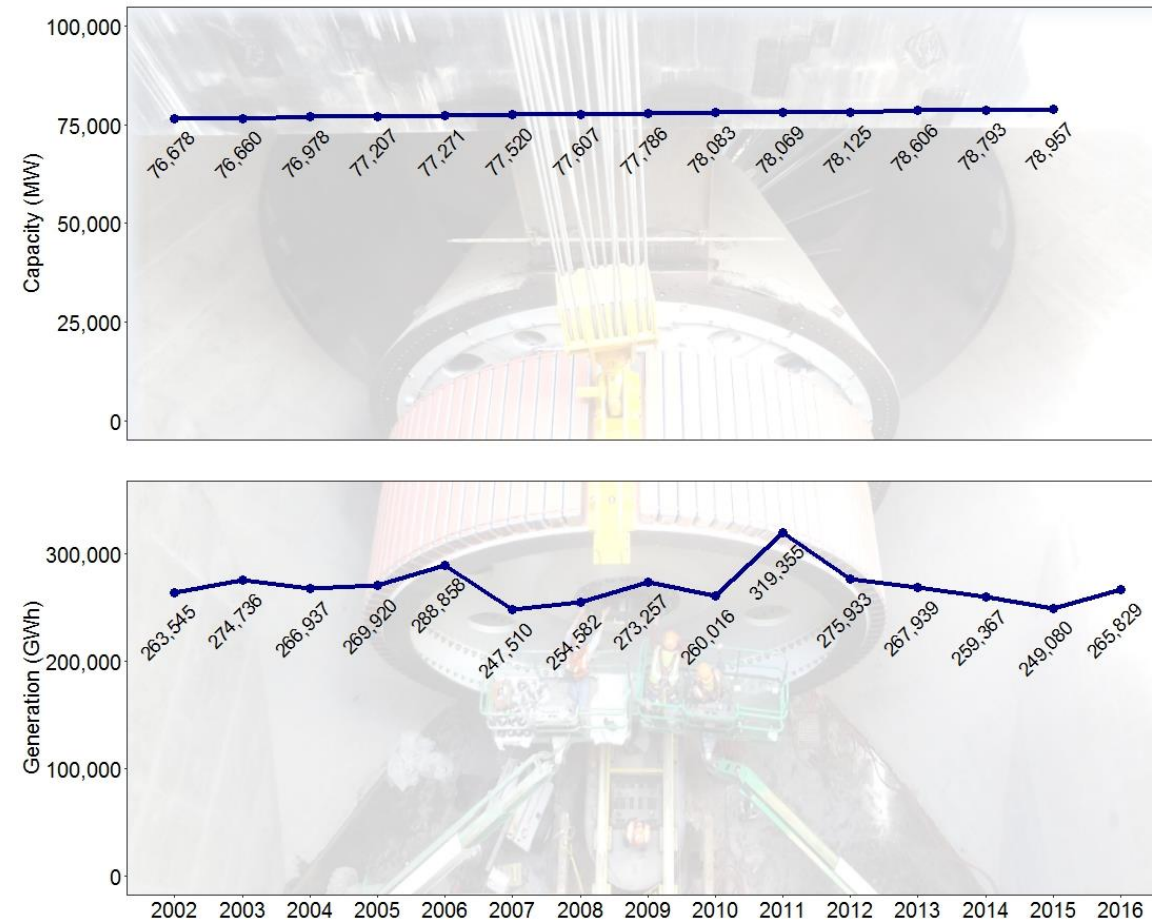
- Installed capacity and generation trends
- Investment on rehabilitations and upgrades to existing hydropower fleet
- Dec 31, 2016 snapshots of the hydropower and pumped storage hydropower project development pipeline
- Hydraulic turbine import and export trends

The last year of data shown in each of the plots will be 2015 or 2016 depending on the calendar of data releases followed by the agencies and commercial providers used as sources.

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# U.S. hydropower capacity grew slightly in 2015; hydropower generation increased in 2016 after four consecutive years of decreases.

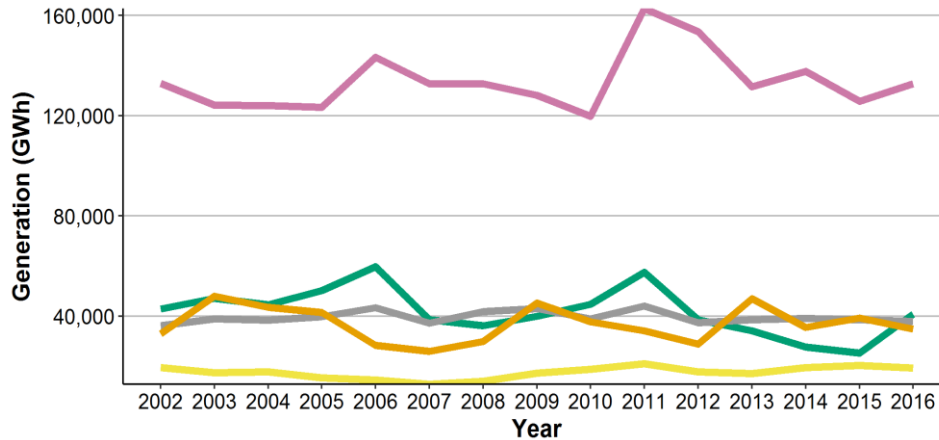


- Net capacity increased by less than 200 MW in 2015.
  - Added capacity in 2015 resulted from a combination of:
    - Capacity increases at existing turbine-generator units in existing facilities: 181.6 MW
    - Addition of new turbine-generator units at existing facilities: 6.4 MW
    - Repowerings: 0.96 MW
    - New hydropower facilities on conduits: 12.2 MW
  - Capacity decreases and unit retirements at existing facilities amounted to 23.9 MW
- Hydroelectric generation in 2016 was 265,829 GWh (7% more than the previous year).
  - Hydropower generation accounted for 43.6% of renewable electricity generation and 6.5% of total electricity generation.

Sources: EIA Form 860 (capacity), EIA Form 923 (2002-2015 generation), Electric Power Monthly (2016 generation)

Note: EIA Form 860 capacity data for 2016 is scheduled for release in October 2017.

# Increase in U.S. hydropower generation in 2016 relative to 2015 was driven by improvements in Western drought conditions.



Legend

— Northwest — Southwest — Midwest — Northeast — Southeast

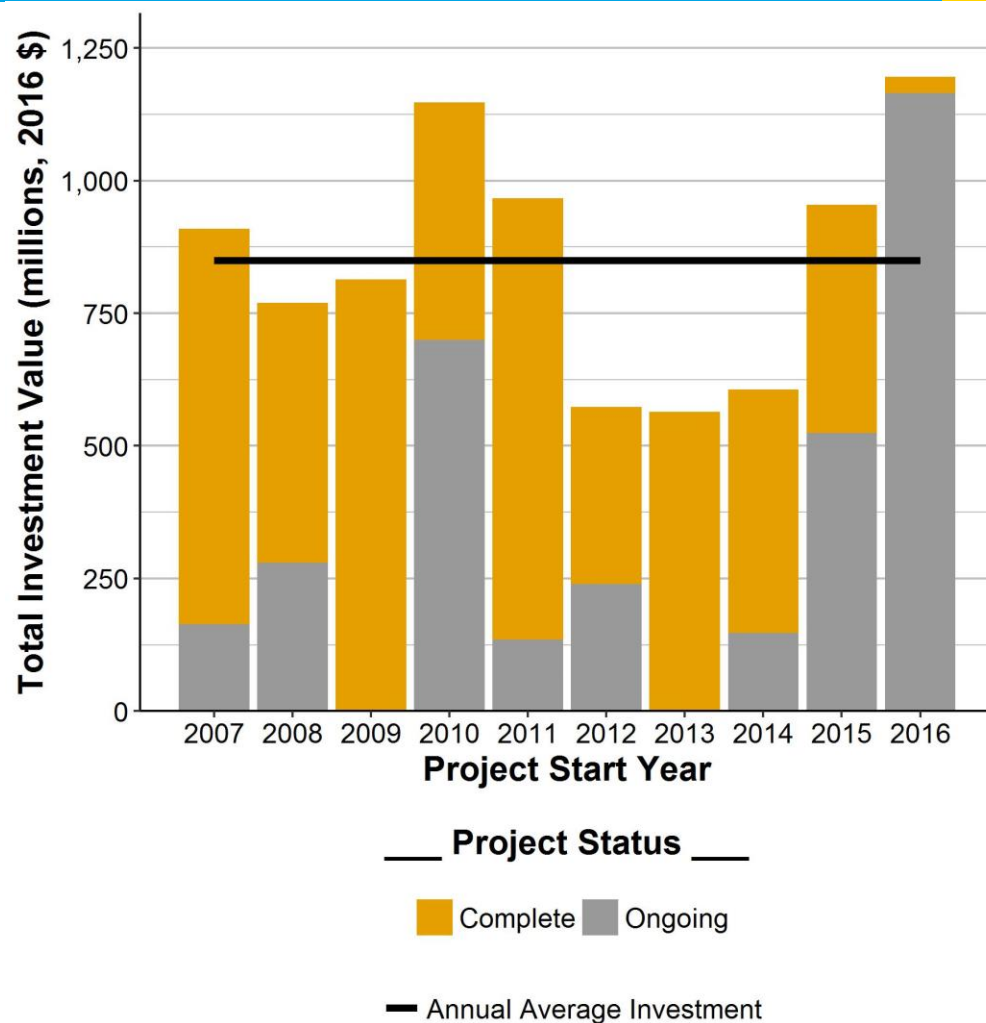
Region	2014 (GWh)	2015 (GWh)	2016 (GWh)	2002-2016 average
Northwest	137,617	125,740	132,719	133,701
Southwest	27,634	25,218	40,868	41,874
Midwest	19,525	20,259	19,312	17,532
Northeast	39,123	38,539	37,988	39,549
Southeast	35,468	39,324	34,900	36,844
Total	259,367	249,080	265,829	269,503



- Increases in 2016 hydropower generation in the Northwest and Southwest regions were larger than generation decreases elsewhere (mostly in the Southeast) leading to a net increase in generation at the national level relative to 2015.
- The regional changes in generation mirrored the evolution of drought conditions in 2016:
  - The fraction of the West under drought conditions decreased considerably in 2016 and drought severity lessened in most of the remaining portion of the region that is still under drought.
  - The Southeast became abnormally dry or under drought by the end of 2016.  
(<http://droughtmonitor.unl.edu/MapsAndData/MapArchive.aspx>)

Sources: EIA Form 923 (2002-2015 data), Electric Power Monthly (2016 data)

# New investment committed to rehabilitations and upgrades (R&U) in 2016 was \$1.2 billion; the largest in the last decade.



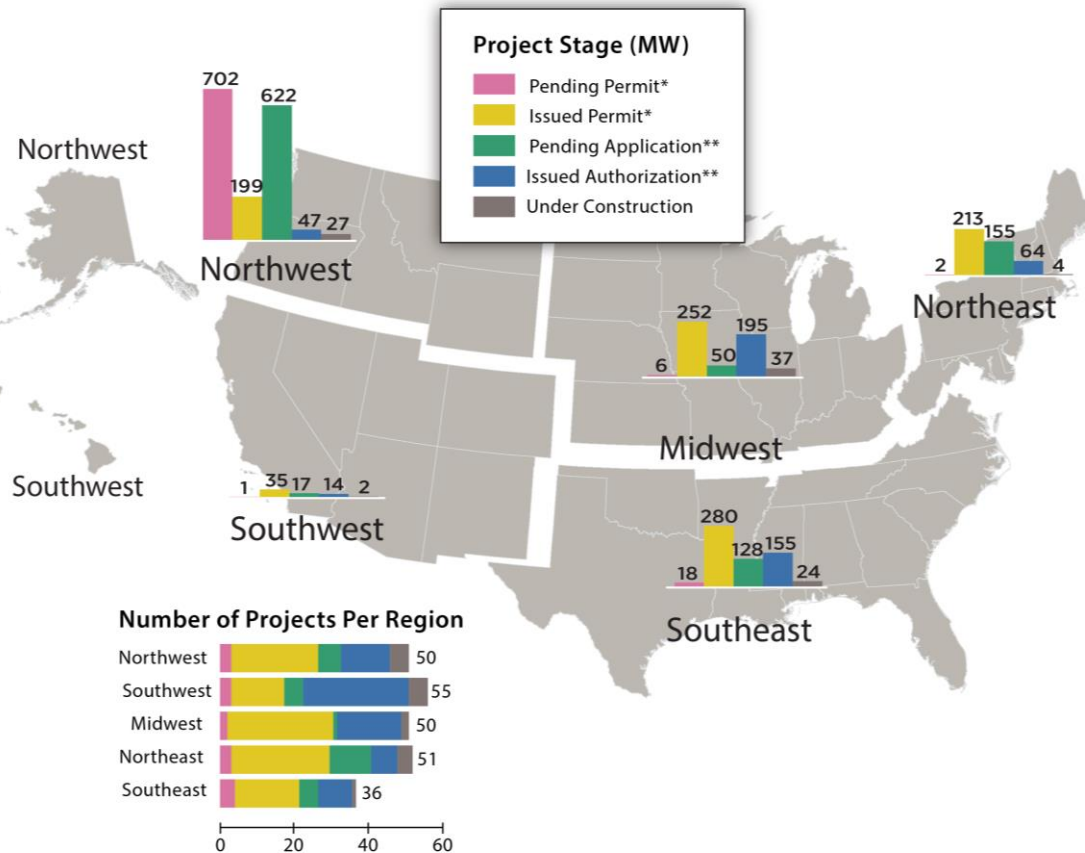
- 42 new R&U projects at 34 existing hydropower plants started in 2016 with a total estimated value of \$1.2 billion:
  - Multiyear R&U projects at two hydropower plants account for more than half of 2016 new investment:
    - Turbine replacements, governor upgrades, and generator rewinds at Grant PUD's Priest Rapids hydropower plant
    - Dam upgrades at TVA's Boone hydropower plant
  - USACE is the owner with the largest number of new projects (23) but they account for less than 10% of total investment value.
- The value of tracked R&U investment since 2007 is \$8.5 billion distributed among 143 hydropower plants.
  - Value by region: Northwest (35%), Southwest (12%), Midwest (16%), Northeast (11%), Southeast (26%)
    - Fraction of investment is significantly lower than the fraction of installed capacity (19%) in the Southwest.
    - Fraction of investment is significantly higher than the fraction of installed capacity (8%) in the Midwest.
  - Value by facility type: pumped storage hydropower (22%), hydropower (78%)
    - These fractions closely track the distribution of installed capacity between hydropower and pumped storage hydropower facilities.

Source: Industrial Info Resources

Note: This plot provides a December 2016 snapshot of completed or ongoing R&U projects started since 2007.

See *Technical Notes* for further details about the data shown in this plot.

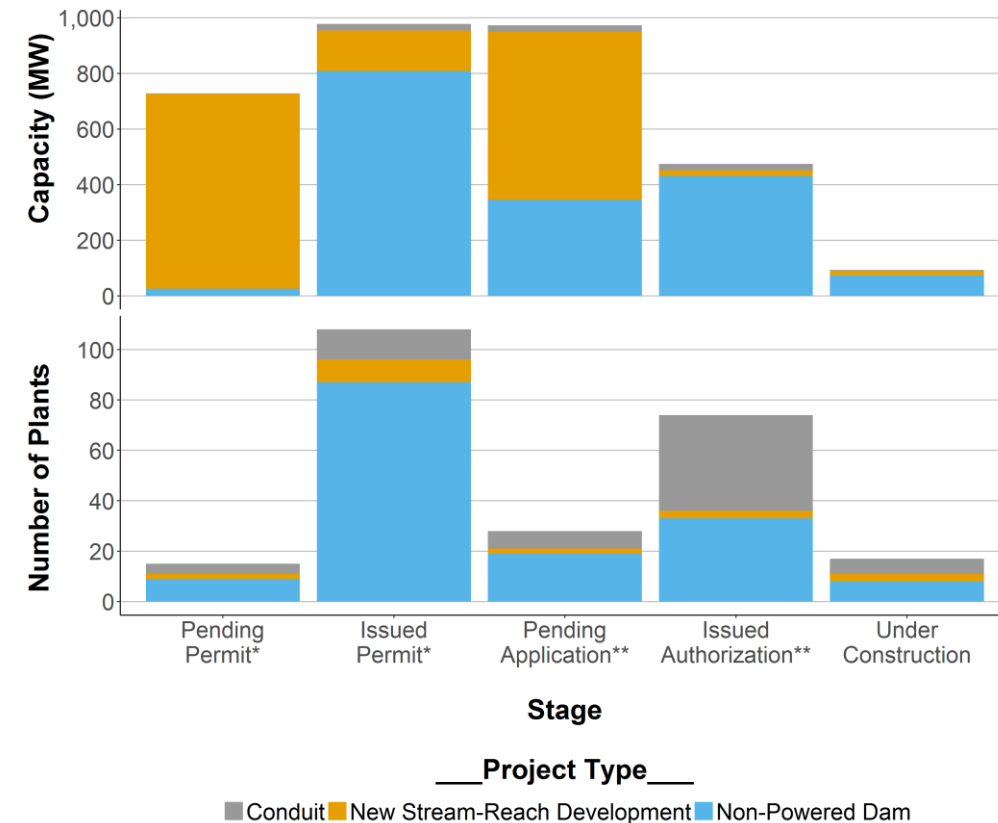
# 242 new hydropower projects with a capacity of 3.25 GW were in the U.S. development pipeline as of the end of 2016.



Sources: FERC, Reclamation LOPP database, HydroWorld, and web searches  
 Note: Map only includes projects with a capacity greater than 0.1 MW.  
 See *Technical Notes* for details about the authorization stages

- Snapshot includes projects pursuing any of the following authorization pathways:
  - FERC original license or exemption (193)
  - “Qualifying conduit” determination from FERC (37)
  - Lease of power privilege from Reclamation (12)
- 2016 permitting activity highlights:
  - FERC issued 44 preliminary permits, 11 licenses, and 2 exemptions.
  - 7 projects with capacity greater than 0.1 MW obtained “qualifying conduit” determination from FERC.
  - Bureau of Reclamation issued 2 preliminary leases of power privilege.
- The number of issued preliminary permits in 2016 was almost double the one in 2015; number of issued licenses and exemptions were very similar to the previous year.
- At least 17 projects (93 MW) were under construction at the end of 2016.
- At least 9 projects (225 MW) reached commercial operation in 2016.
  - Most of the new capacity (211 MW) is located at 3 NPD projects developed by American Municipal Power in the Ohio River.

# More than 90% of the projects proposed as of the end of 2016 would add power to conduits or non-powered dams

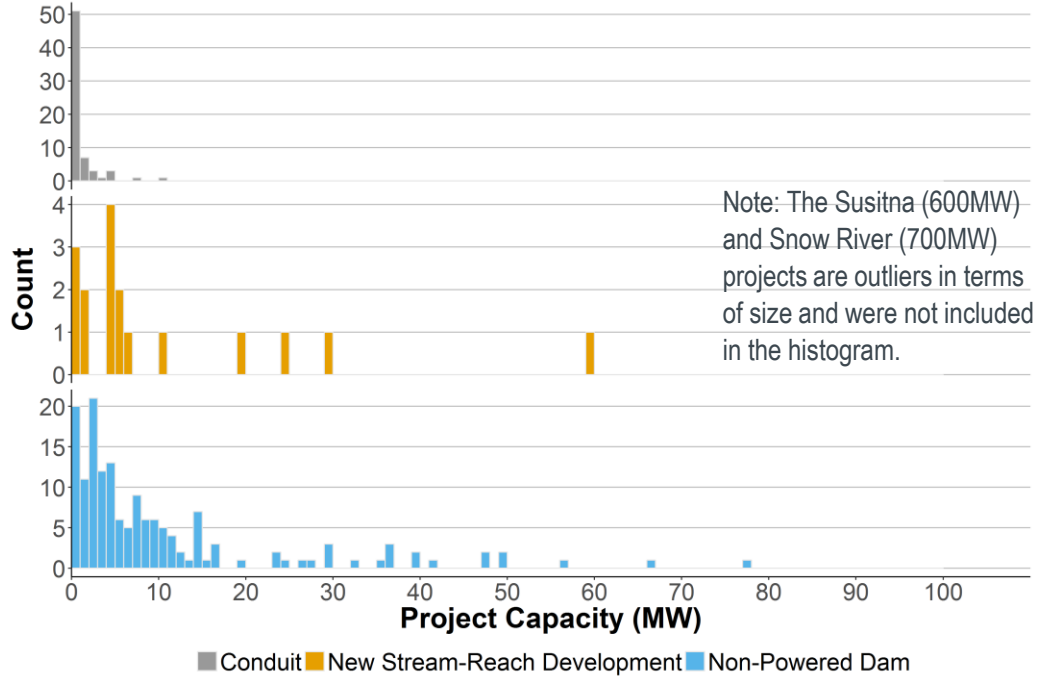
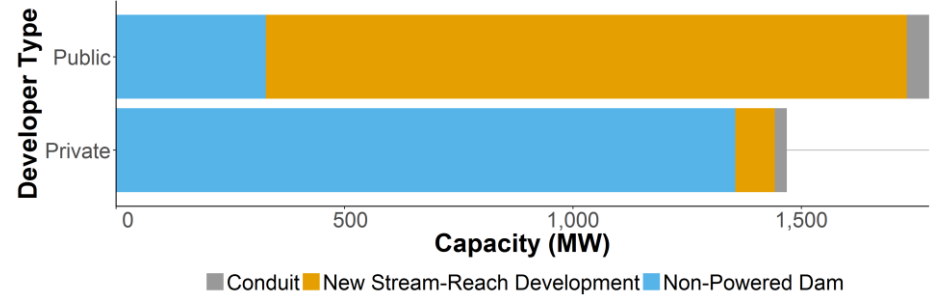
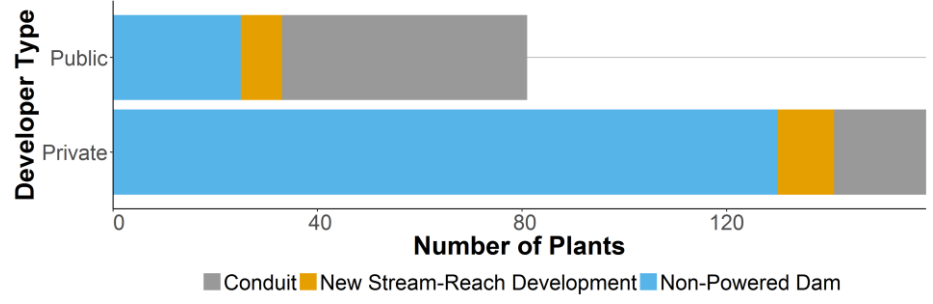


- Non-Powered Dam (NPD) projects account for 64% of projects and 52% of proposed capacity.
  - USACE owns 88 of the 156 dams for which development is being pursued.
    - An MOU signed by FERC and USACE in July 2016 aims to improve efficiency in the permitting process for projects at USACE NPDs requiring dam safety (Section 408) and water quality (Section 404) permits from USACE in addition to a FERC license
  - Most of the rest of the dams are owned by other federal agencies or non-federal public entities; only 7 are privately-owned dams.
- 87% of planned NSD capacity corresponds to two projects in Alaska: Susitna (600 MW) and Snow River (700 MW).
  - Alaska government cancelled state funding for the Susitna project in June 2016 but the developer (Alaska Energy Authority) has continued work on its license application.
- 74 projects were at the *Issued Authorization* stage; if all of them moved forward, significant construction would take place in upcoming years for certain combinations of regions and project types (e.g., 28 conduit projects in the Southwest; 17 NPD projects in the Midwest)

Sources: FERC, Reclamation LOPP database, HydroWorld, and web searches  
 Note: Plot only includes projects with a capacity greater than 0.1 MW.  
 See *Technical Notes* for details about the authorization stages



Most projects in the development pipeline as of the end of 2016 are small and pursued by private developers, but there are differences across project types.



**Developer type**

- NPD projects tend to be developed by private entities, NSD projects are distributed equally between public and private developers, and conduit projects are most often pursued by public entities.

**Project sizes**

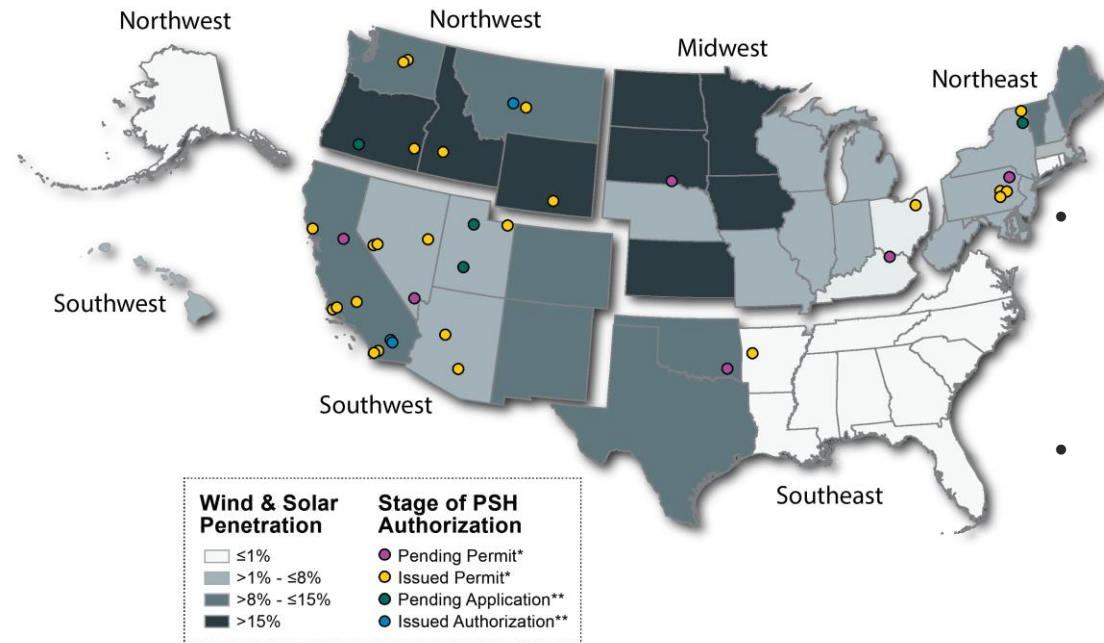
- 77% of projects belong in the *Small* category (<=10 MW).
- Only 2 projects are *Large* (>100 MW); both are NSDs in Alaska with public entities as developers.
- Median project sizes:
  - 5.2 MW for NPDs
  - 6 MW for NSDs
  - 0.5 MW for conduits

Sources: FERC, Reclamation LOPP database, HydroWorld, and web searches  
 Note: Map only includes projects with a capacity greater than 0.1 MW.  
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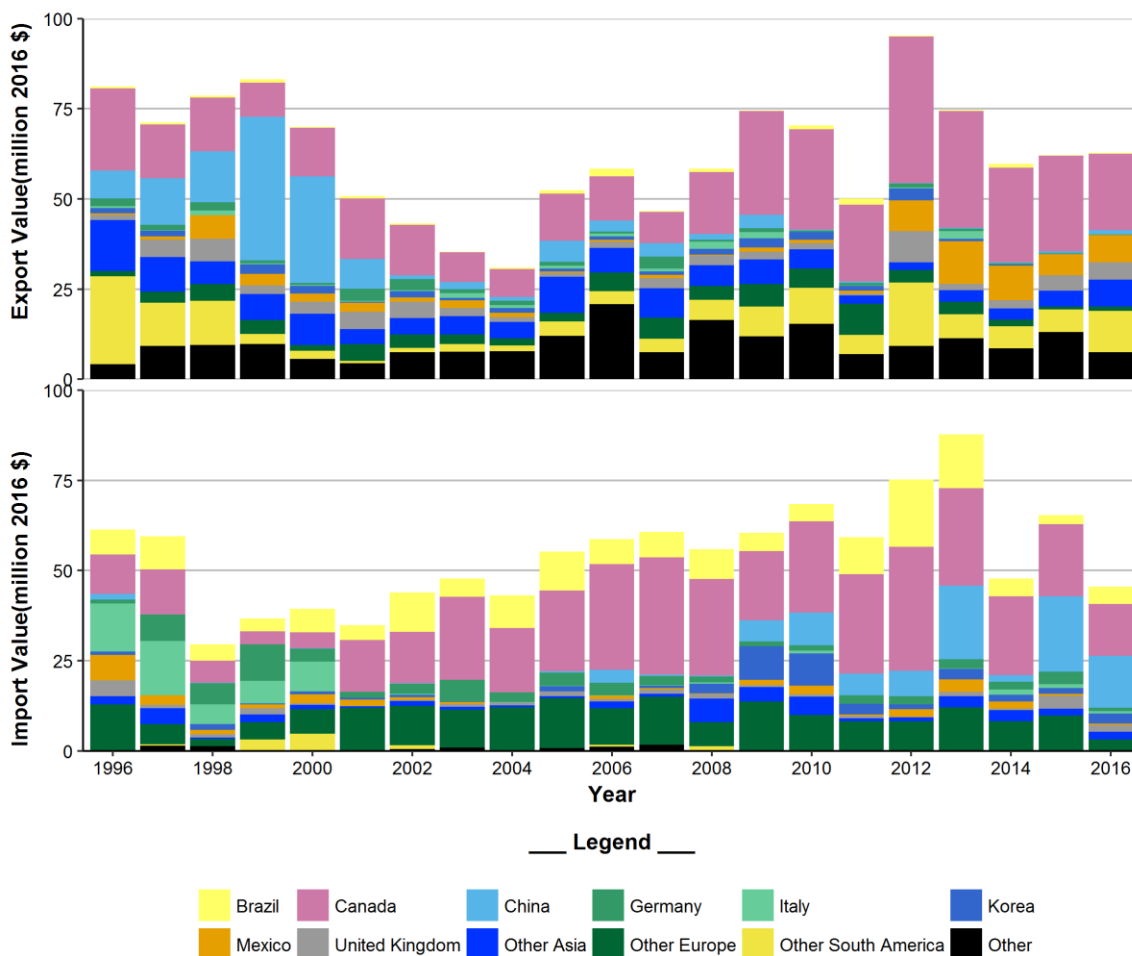
Most pumped storage hydropower projects remain at the feasibility analysis stage; in 2016, one new license was issued and one authorized project was abandoned.

- There were 38 projects in the development pipeline at the end of 2016.
  - 32 of them were at early development stages in which feasibility studies are being performed.
  - In January 2017, there was an uptick in preliminary permit applications with 21 new applications; most of them in Pennsylvania by a single developer.
  - The regional distribution of projects under consideration has changed with respect to the previous year: number of projects has decreased in the Southeast and increased in the Northeast.
- Four projects have pending license applications (Mineville, NY; Swan Lake, OR; Parker Knoll, UT; Lake Powell, UT).
  - The license application for Parker Knoll was submitted in 2011, the one for Lake Powell in 2016, and the other two in 2015.
- Two projects have a FERC license authorization but have not started construction.
  - Gordon Butte (MT) was authorized in December 2016.
  - In March 2016, FERC approved a request by the developers of the Eagle Mountain project (CA) to extend the deadline to commence construction by two years (until June 2018).
- In February 2016, the Sacramento Municipal Utility District (SMUD) announced it would not pursue the licensed Iowa Hill project citing increased cost and financial risk estimates.
  - In October, FERC approved SMUD's request to remove the Iowa Hill authorization from its Upper American River project license.



Sources: FERC, HydroWorld, and web searches  
See *Technical Notes* for details about the authorization stages

# U.S. international trade of hydraulic turbines and parts has slowed down in recent years and the list of top source and destination countries is experiencing some changes



- Hydraulic turbines and turbine parts are the only hydropower equipment component for which international transactions can be tracked from USITC data.
- During 2016, USITC published final data for 2015 and provisional 2016 data.
  - Total export value remained stable at ~\$60 million in 2015-2016 after pronounced decline in 2012-2014.
  - Import values have fluctuated significantly year to year after the peak reached in 2013.
- 54% of U.S. exports in 2012-2015 have gone to Canada or Mexico; an additional 13% went to Central or South America.
- 53 % of U.S. imports in 2012-2015 also came from the Americas (primarily Canada and Brazil); however, China was the top exporter of hydraulic turbines and parts to the United States for the first time in 2015.

Source: USITC Interactive Tariff and Trade Data  
See *Technical Notes* for country selection criterion

- U.S. hydropower rehabilitation and upgrade (R&U) projects with a total estimated value of \$1.2 billion started in 2016.
  - Estimated value of R&U project starts has averaged \$850 million/year in 2007-2016.
- Installed U.S. hydropower capacity increased by ~200 MW in 2015 with most of the increase originating in capacity increases at existing facilities.
- U.S. hydropower generation increased in 2016 after four consecutive years of decreases due to a reduction in severity and reach of drought conditions in the West.
- 242 hydropower projects were at some stage of the development process in the United States at the end of 2016.
  - 64% of the projects would add power to non-powered dams and more than half of the dams proposed to be powered are owned by USACE.
  - The only two large (>100 MW) projects in the pipeline are proposed new stream-reach developments in Alaska.
- 38 pumped storage hydropower projects were at some stage of the development process in the United States at the end of 2016.
  - 32 projects are at the earliest stage of project development which has a very high attrition rate, 4 projects have pending licenses, and 2 projects have issued licenses.
  - No construction starts have taken place in 2016.
- More than half of U.S. hydraulic turbine and turbine part exports in 2012-2015 have gone to Canada and Mexico; in 3 of the last 4 years, China and Canada have been the two top exporters of hydraulic turbines and turbine parts to the United States.
- Federal production and investment tax credits are no longer available for hydropower projects starting construction after December 31, 2016.

## Slide 5:

- The full value of each project is assigned to the project start year. The grey portions of the bars in slide 5 correspond to projects that have not yet been completed as of December 2016.
- Minimum total investment value of projects tracked by Industrial Info Resources (IIR) is \$1 million.
- Additional refurbishment and upgrade project types are being tracked in the December 2016 snapshot relative to those shown in the December 2015 snapshot published in May 2016. Additional tracked project categories explain the higher total investment value reported for some of the years.
- Updates to project value or completion date can also result in changes in the total estimated value for a given year from one snapshot to the next.
- The value of refurbishment and upgrade projects started before 2007 is not reported due to the finding that IIR PECWeb Dashboard queries produce incomplete results for projects completed earlier than that year.

## Slides 6-9:

### Project authorization stages:

- *Pending Permit* includes projects pending a preliminary lease in the LOPP process and projects pending issuance of a preliminary permit.
- *Issued Permit* includes projects that have received a preliminary lease in the LOPP process and projects that have obtained a FERC preliminary permit. Projects in the *Issued Permit* stage have very high attrition rates.
- *Pending Application* includes projects that have applied for an original FERC license, a FERC exemption, or have requested FERC to be considered a “qualifying conduit” hydropower facility.
- *Issued Authorization* includes projects that have been issued an original FERC license or a FERC exemption, projects that have been approved by FERC for “qualifying conduit” hydropower status, or projects that have a final lease contract under the LOPP process.

## Slide 10:

- The 8 individual countries shown in the plot correspond to the 8 countries with the largest total trade flows (imports or exports) over 1996-2016.

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