



NATIONAL HYDROPOWER ASSOCIATION

North Carolina Joint Legislative Commission on Energy Policy



MISSION

Champion the resurgence of hydropower, in all of its forms, as America's premier carbon-free renewable energy resource



VISION

Double the contribution of hydropower

Drive economic development and help achieve a sustainable and secure clean energy future



FOCUS

Advance hydropower in clean energy and market policies

Protect the existing system

Address emerging regulatory issues impacting the industry



2016 U.S. RENEWABLE ELECTRICITY GENERATION

In 2016, hydro made up about **6.5 percent** of total electricity generation and **43.5 percent** of renewable electricity generation

Approximately **102 GW of existing capacity**, includes **23 GW of pumped storage** – 98 percent of U.S. energy storage

Forty-eight states have hydropower facilities, and ten of these states generated more than **10% of their electricity from hydropower**

Hydroelectric generation in 2016 was 265,829 GWh (7% more than the previous year).



NATIONAL HYDROPOWER

Nationwide

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

At least **9 projects (225 MW)** reached commercial operation in 2016.

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



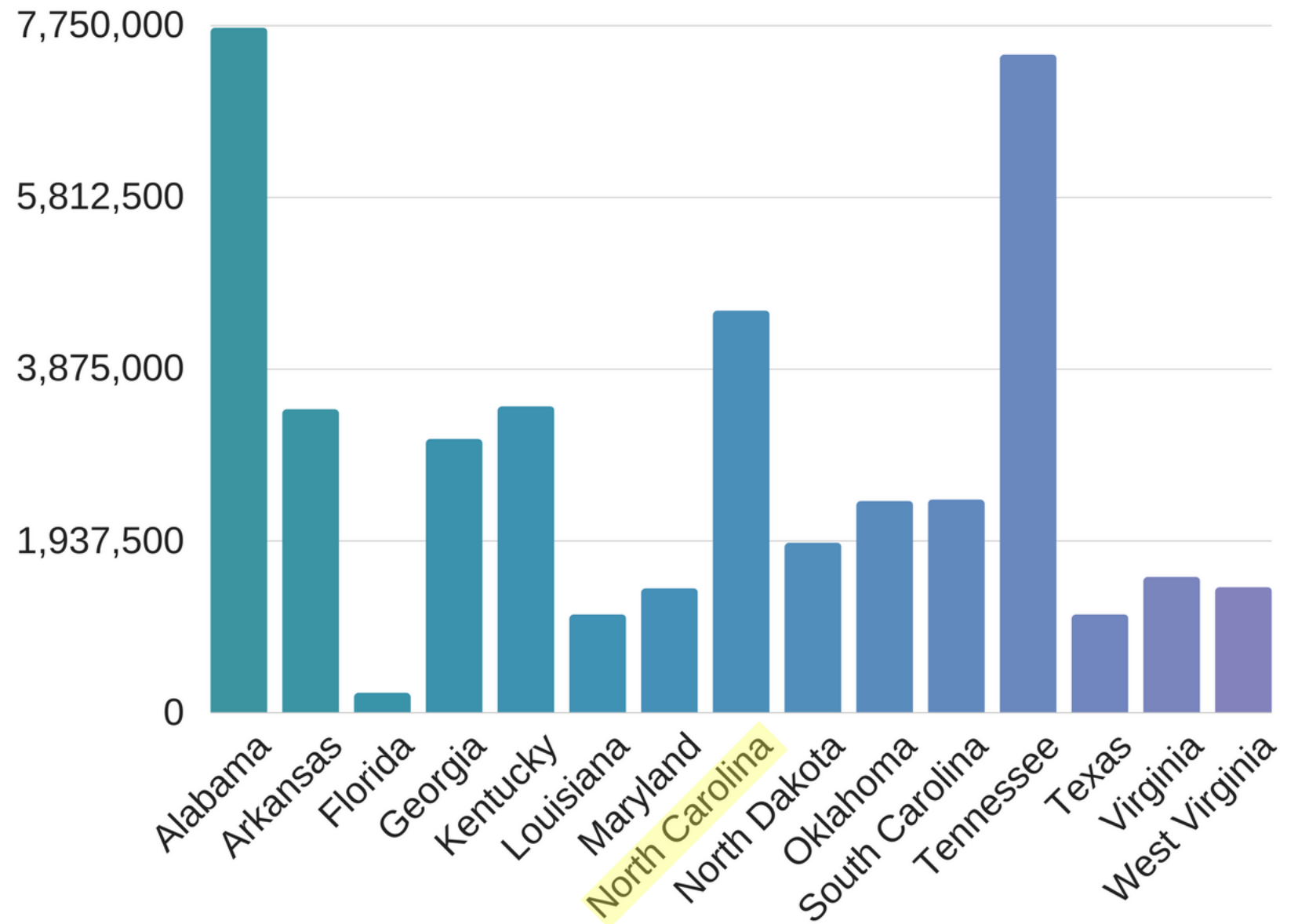
2016 U.S. RENEWABLE ELECTRICITY GENERATION

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

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.

SOUTHEAST GENERATION BY STATE IN MEGAWATT HOURS





VALUE OF HYDROPOWER

Multipurpose:

- Reliability factor
- Flood control
- Recreation
- Social values
- Frequency regulation
- Voltage support
- Inertial response
- Black-start capability

Economic Value:

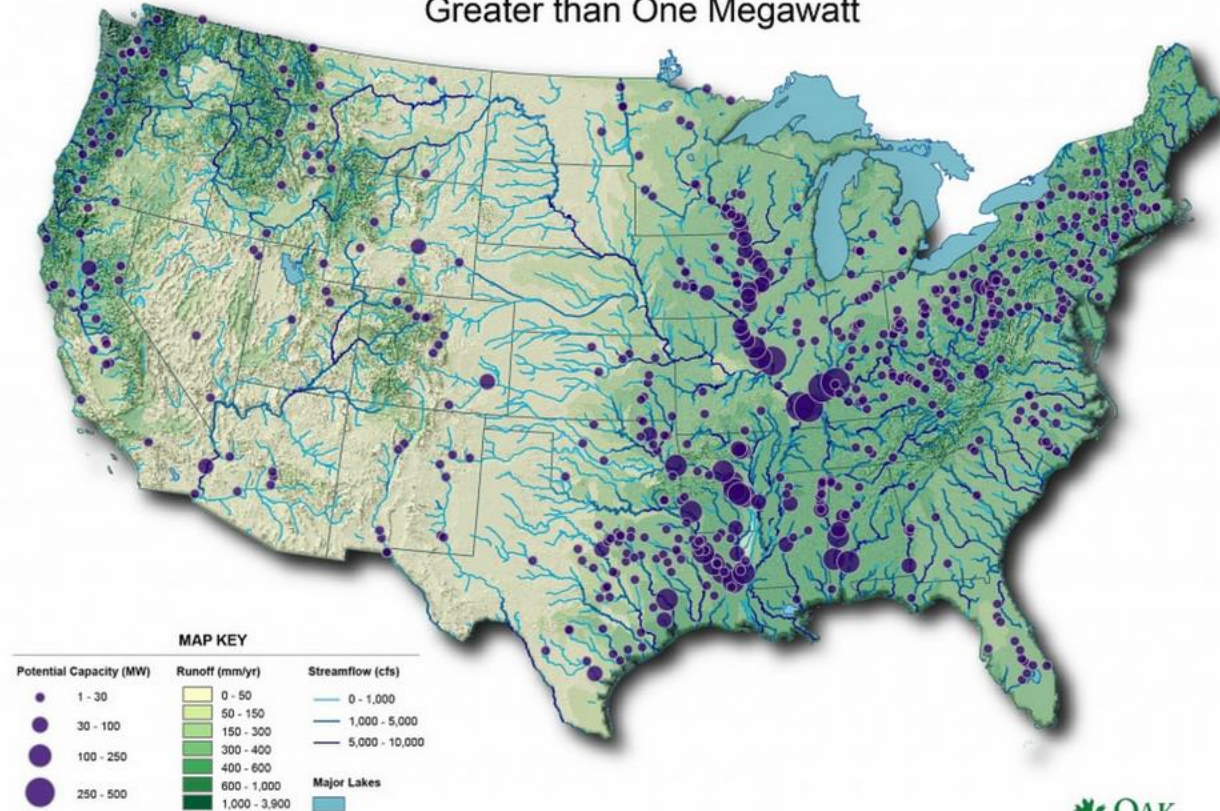
- 42 new rehabilitations and upgrades (projects at 34 existing hydropower plants started in 2016 with a total estimated value of \$1.2 billion
- Reaching the goal of 50GW by 2050 would create over 75,000 jobs
- R&U investment since 2007 is \$8.5 billion distributed among 143 hydropower plants
 - Value by region: Northwest (35%), Southwest (12%), Midwest (16%), Northeast (11%), **Southeast (26%)**

Non-Powered Dam Growth

Only 3 percent of U.S. dams are equipped to generate electricity

12GW of potential hydropower capacity exists on non-powered dams

U.S. Non-powered Dams with Potential Capacity Greater than One Megawatt



Note: This map has been generalized for cartographic purposes and some streams associated with non-powered dams are not displayed.

Author: Brenna Elrod - November 7, 2013

This map was produced by Oak Ridge National Laboratory for the U.S. Department of Energy.



North Carolina Potential

- B. Everett Jordan Dam
- Falls Lake Dam
- Lock & Dam #1
- Lock & Dam #2
- Huske Lock & Dam
- Buckhorn Lake Dam
- H.F. Lee Power Station Cooling Lake Dam
- Horseshoe Lake Dam
- Tar River Dam
- Lake Hyco Dam
- Moss Lake Dam
- Bridges Lake Dam
- Lake Mackintosh Dam
- Roxboro Afterbay Dam

OVERVIEW: NORTH CAROLINA HYDROPOWER



The U.S. Department of Energy has identified **14 non-powered dam** sites in North Carolina to add generation totaling **34 MWs**.



North Carolina currently has **17 hydropower projects** with an installed capacity **531 MWs (Pumped Storage: Duke owns two projects near the SC border totaling 1,065 MWs)**.



Small Hydro: NC has **20 exempted** hydro projects totaling **24.176 MWs**



Production Tax Credit Certifications – 12 projects with an **increase** in 28,432 MWh, with an average generation **increase was 8.6%**.



OVERVIEW: NORTH CAROLINA HYDROPOWER

North Carolina Hydro Power Producers

- Duke Energy
- Avalon Hydro
- Gravity Renewables
- Cube Hydro
- Mayo Hydro

North Carolina Suppliers

- AC CONTROLS COMPANY INC
- Andritz
- Bijur Delimon International
- Environmental Instruments LLC
- Glenn Underwater Services
- Global Service Solutions LLC
- Green Mountain International Inc
- Hall Contracting Corp
- HDR Engineering
- Hubbell Industrial Controls Inc
- HydroLogics Inc
- IMO Pump
- Kuenz America Inc
- Lenovo
- LUBROMATION INC
- North Folk Electric, Inc.
- PCX Corp
- Piedmont Hydro Technologies LLC
- Pioneer Motor Bearing Co
- Powerhouse Mechanical Repair Inc
- North Folk Electric, Inc.
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- Pioneer Motor Bearing Co
- Powerhouse Mechanical Repair Inc
- Salem Automation
- Schnabel Engineering
- SEFCOR INC
- Southland Electrical Supply
- Stainless Valve Co
- Superior Machine Co
- Thalle Construction Co Inc

INVESTMENT WILL LEAD TO NEW MEGAWATTS & IMPROVED GRID SERVICES

Companies are Reinvesting

- Duke's Hydrovision Program 1992 – 2005
 - Comprehensive life extensions
 - Efficiency improvements
 - Capacity additions
 - 40+ units with substantial upgrades
 - Over 90 MW's of conventional capacity and 100 MW of pumped storage additions
- Cube Hydro purchased Yadkin

Duke Hydro Expansion Options

- Bad Creek Pumped Storage ~ 200 MW of utility scale storage to assist with integration of intermittent renewables (2019 – 2023)
- Markland ~ 9MW uprate, 10% efficiency gain (2017 – 2021)
- Potential sites that are deemed attractive for upgrades:
 - Tillery ~ 12 MW
 - Mountain Island ~ 6 MW
 - Blewett ~ 6MW
 - Tennessee Creek ~ 2 MW
 - Cedar Cliff ~ 2 MW
 - New Min Flow Units ~ 1.5 MW
 - New Greenfield Pumped Storage ~ 3 sites, over 4.0 GW

NC OPERATORS PERSPECTIVE

FUTURE DRIVERS & CHALLENGES



- Lack of value recognition for energy storage, non-generation societal benefits and ancillary services that hydro provides.



- Limited capacity value due to low load growth requires uprate projects be justified on efficiency gain alone which is economically challenging.



- Low natural gas prices continues to drive down replacement energy cost and sets a low benchmark that hydro has a hard time competing against in the Southeast US.



- New license compliance may result in significant loss of operational flexibility and value for many hydro units leading to derating of units or early retirement in some cases.



- Tax incentives for other renewable resources creates an unfair advantage for solar and wind which makes them more competitive than hydro.

HYDROPOWER & NORTH CAROLINA'S ENVIRONMENT



Duke Energy successfully developed the Pines Recreation Area and High Falls Trail as part of the West Fork Hydroelectric Project.



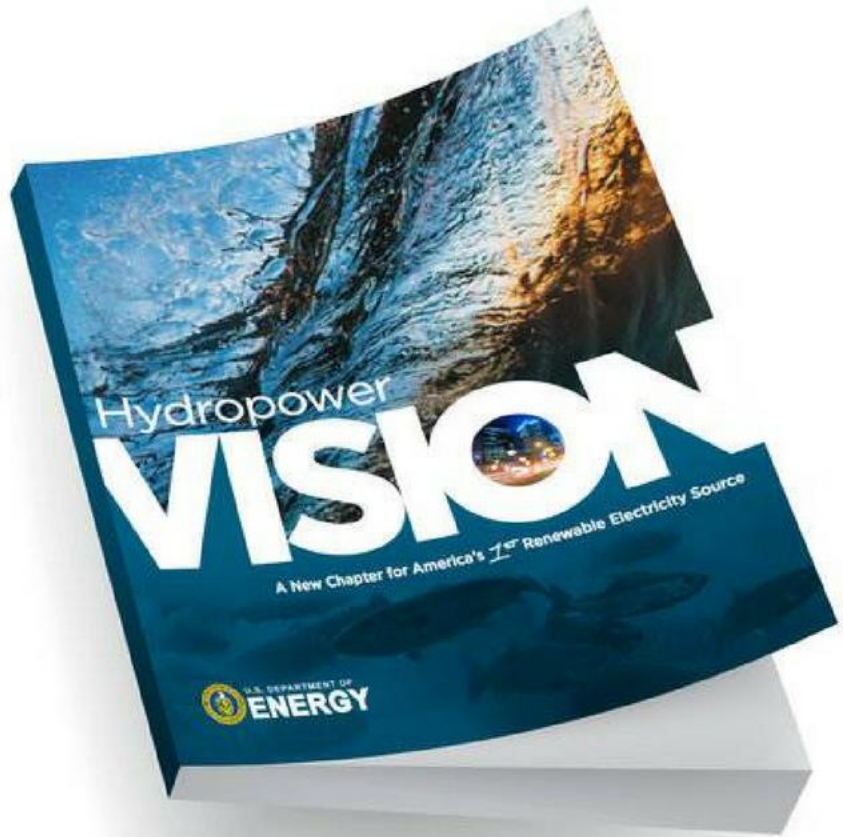
Visitors now have access to a **hiking** and **whitewater** boating access trail, fishing pier, picnic facilities, educational and historical signage, and a swim beach.



The Pines Recreation Area is located along the shoreline of Lake Glenville in Jackson County near the town of Cullowhee in western North Carolina. The Pines Recreation Area and High Falls Trail lie within the Tuckasegee River watershed, a sub-basin of the Little Tennessee River.



Department of Energy's Hydropower Vision



- With NHA as the lead partner, the Department of Energy its first-of-its-kind report of hydro's contributions to the nation's energy portfolio as well as future growth
- Hits the reset button on hydropower
- **Hydropower Isn't Tapped Out**

50 BY 2050

HYDROPOWER'S VISION FOR GROWTH



1.75 GW

New Stream-reach
development



6.3 GW

Upgrades at
existing hydropower
projects



4.8 GW

Developing on
existing non-powered
dams



35.5 GW

New pumped storage
projects and upgrades at
existing facilities

Growth Potential

- Hydro today is 102 GW
- Hydro can sustainably grow to 150 GW by 2050

Unlock Energy Potential

- Develop existing non-power dams
- Build new pumped storage
- Upgrade existing hydro facilities

Public Benefits are Immense

- Double U.S. energy storage
- Enable more wind & solar
- Power millions of more homes
- Health benefits

Lessen Carbon Footprint

- \$209 BILLION SAVINGS from avoided global damages from GHG emissions

CHALLENGES TO GROWTH



- Permitting and licensing can take over 10 years or more
 - Incentives generally extended on short-term basis
 - Numerous stakeholder involvement can add to time and cost
 - Hard to attract investment
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- In addition to licensing costs, study costs, projects can require significant up front capital. (New pumped storage projects - \$1-2 billion).
 - Projects economic over long-term, but have high immediate start-up costs
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- In power and environmental markets, hydropower isn't being valued properly
- Not being optimally used or valued in organized wholesale markets
- Not all benefits provided by hydropower facilities are readily quantifiable or easily attributable to hydropower in a market framework

OVERCOMING CHALLENGES AT THE STATE LEVEL

- Reexamining state policies that promote clean & baseload energies: Are they on a level playing field? - Example: RPS policy
 - Removing restrictions on hydro could greatly benefit and improve market environment
- Do state market rules value hydro and its attributes? An opportunity for reexamination?
- Hold the federal gov accountable for timely decision making (Biological Opinions, corps of engineers decision-making, federal permitting agencies)
- Do state clean water officials (401 permitting agencies) understand the importance of hydro to your state and the need to make timely and reasonable decisions
 - Are they coordinating with state energy officials or are decisions made within policy silos?

National Licensing Solutions

Designate FERC as the lead agency for purposes of coordinating all federal authorizations, all federal license, permits, and other approval required under federal law for a non-federal hydropower project

Require FERC to develop a schedule, in consultation with federal and state agencies and tribes, for all Federal authorizations, and directs agencies and tribes to comply with the schedule

Give equal consideration to energy values when developing conditions - federal and state

Require consideration of energy storage resources in state's integration long-term planning processes; including requiring equal consideration with traditional resources

Establish an alternative, streamlined licensing process for low-impact pumped storage hydropower, such as off-channel or closed-loop projects



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