



Potential and Challenges of Conventional Hydropower Development in the United States

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Table of Contents

- ▶ **Brookfield Asset Management**
- ▶ **Brookfield Power**
- ▶ **Potential for U.S. Conventional Hydropower Development**
 - Capacity Gains at Existing Sites
 - Capacity Gains at Existing Non-Generating Dams
 - Conventional Hydropower Successes: Oswegatchie and Higley
- ▶ **Challenges to U.S. Conventional Hydropower Development**
- ▶ **Conclusion**

Brookfield Asset Management

Overview

Brookfield Asset Management

A global asset management company

- ▶ **Brookfield Asset Management is a global asset manager, focused on property, power and infrastructure assets**
- ▶ **Approximately US\$95 billion of assets owned and under management**
- ▶ **Approximately 10,000 employees in the Americas, Europe and Australia including 300 investment professionals**



▶ **120 million sq. ft. office and retail space**



▶ **158 hydroelectric power plants**



▶ **2.5 million acres of timberlands**



▶ **11,000 km of transmission lines**



Brookfield Power

Overview

Brookfield Power

Unique power operations focused on renewable energy

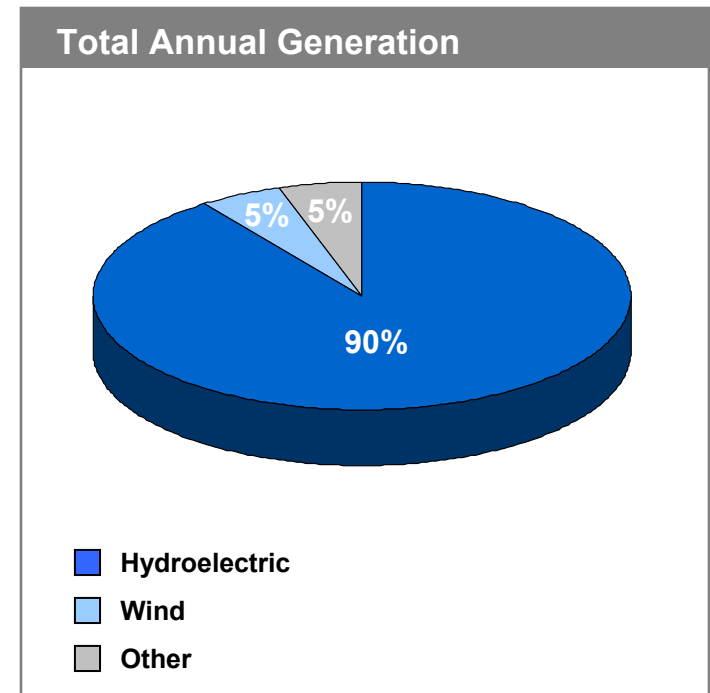
- ▶ **Brookfield Power is a leading producer and developer of renewable power focused on hydroelectric and wind technologies**
- ▶ **Over US\$10 billion of assets owned and under management**
- ▶ **Approximately 1,000 employees in North America and Brazil**



Brookfield Power

Leader in hydroelectric power in North America and Brazil

Hydroelectric Portfolio		
Markets	Stations	MW
United States		
New England	20	841
New York	75	702
PJM	3	150
Louisiana	1	192
Canada		
Quebec	6	282
Ontario	21	897
British Columbia	5	135
Brazil	27	314
	158	3,513



- ▶ **Over 90% of annual generation is hydroelectric**
- ▶ **Generating assets on 61 river systems**
- ▶ **Over 100 years of power generating experience**



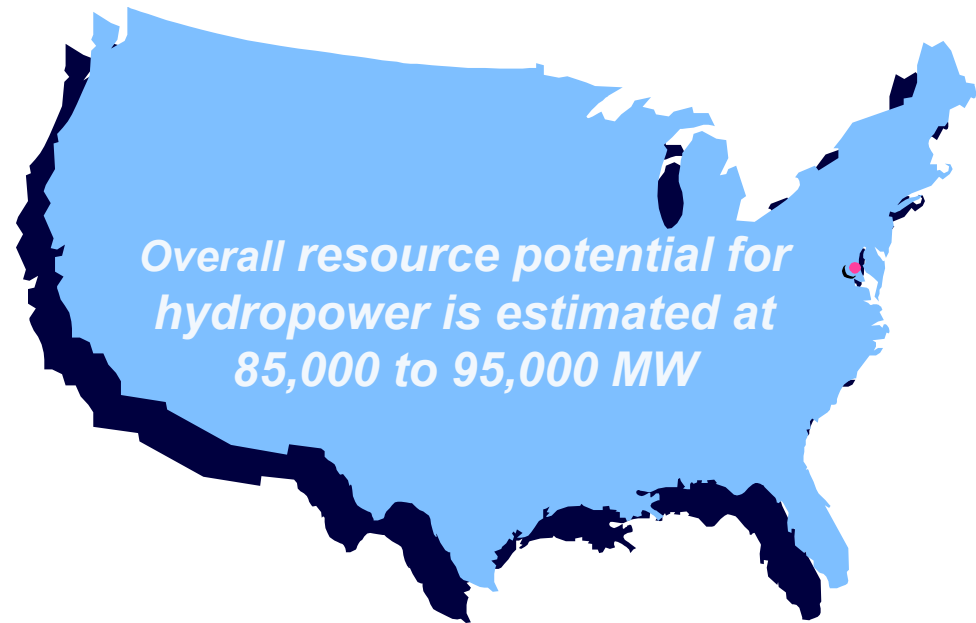
Potential for U.S. Conventional Hydropower Development

Overview

Conventional Hydropower Potential

*United States**

- ▶ **2,300 MW capacity gains at existing conventional hydropower sites**
- ▶ **5,000 MW of new conventional hydropower at existing non-powered dams**



* Source: *Assessment of Waterpower Potential and Development Needs*, Electric Power Research Institute, 2007



Existing Conventional Hydropower Sites

Capacity Gains

- ▶ Brookfield Power's program includes additional equipment, equipment upgrades, replacement of retired units
- ▶ Began in 2006, with anticipated completion of the upgrade projects by early 2009
- ▶ Many of these projects would not be feasible without the production tax credit incentives under the federal Energy Policy Act of 2005 and states' Renewable Portfolio Standards



New waterwheel at Piney

In-service projects

- ▶ Five projects
- ▶ Added more than 8 megawatts or over 31,000-megawatt hours of incremental power
- ▶ Estimated cost for upgrades is in excess of \$12 million

Ongoing projects

- ▶ Four projects
- ▶ Will add more than 9 megawatts and over 25,000-megawatt hours of incremental power
- ▶ Estimated cost for upgrades is nearly \$19 million



Existing Non-Generating Dams

Capacity Gains

- ▶ **Brookfield Power granted 26 preliminary permits for new U.S. hydropower projects**
- ▶ **16 preliminary permit applications pending with the Federal Energy Regulatory Commission**
- ▶ **24 of the issued preliminary permits and 15 of the pending preliminary permit applications are for development at non-power dams operated by the U.S. Army Corps of Engineers**
- ▶ **Potential to add more than 962 megawatts of renewable energy**
- ▶ **Projects scattered throughout 15 states**

Only 2,400 of the 80,000 dams in the U.S. generate electricity

Therefore existing dams can be used to increase conventional hydropower production

Source: U.S. Department of Energy



New Conventional Hydropower

Successes

Oswegatchie

- ▶ **Original plant built in 1913; taken out of service in 1992**
- ▶ **\$3.3 million new development project**
- ▶ **Fast track: 13 months from filing of FERC license amendment to commercial service in September 2002**



Oswegatchie hydroelectric plant

Higley

- ▶ **Original plant built in 1911 featured three Leffel double Francis-type horizontal turbines; was partially shut down**
- ▶ **New \$10 million Higley plant returns to operation in September 2003. Plant capacity boosted to 6.2 megawatts from 5.2 megawatts**



Higley hydropower development



U.S. Conventional Hydropower Development

Challenges

- ▶ **Ability to obtain license from Federal Energy Regulatory Commission, as well as states' 401 water quality certification**
- ▶ **Worldwide demand for equipment; availability of reasonably priced equipment**
- ▶ **Availability of incentives such as federal production tax credits and states renewable portfolio standards to help justify investments**
- ▶ **Global demand for raw materials such as copper, steel**
- ▶ **Worldwide demand on construction industry; availability and affordability of skilled workers**
- ▶ **NIMBY (Not In My Backyard) or CAVE (Citizens Against Virtually Everything)**



Conclusion

Hydropower

- ▶ **Domestic, climate friendly energy source**
- ▶ **Can contribute significantly to U.S. energy mix**
- ▶ **Potential is great to further conventional hydropower at non-generating dams and to increase capacity at existing hydropower sites**
- ▶ **Challenges to developing conventional hydropower exist but not insurmountable**
- ▶ **Incentives are necessary to justify new project investments**

