



## Pumped Storage Profile



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# Brookfield Asset Management



# Brookfield Asset Management

## *A global asset management company*

- Brookfield Asset Management is an asset management company 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



▶ 120 million sq. ft.  
office and retail space



▶ 162 renewable  
power plants



▶ 2.5 million acres  
of timberlands



▶ 11,000 km of  
transmission lines

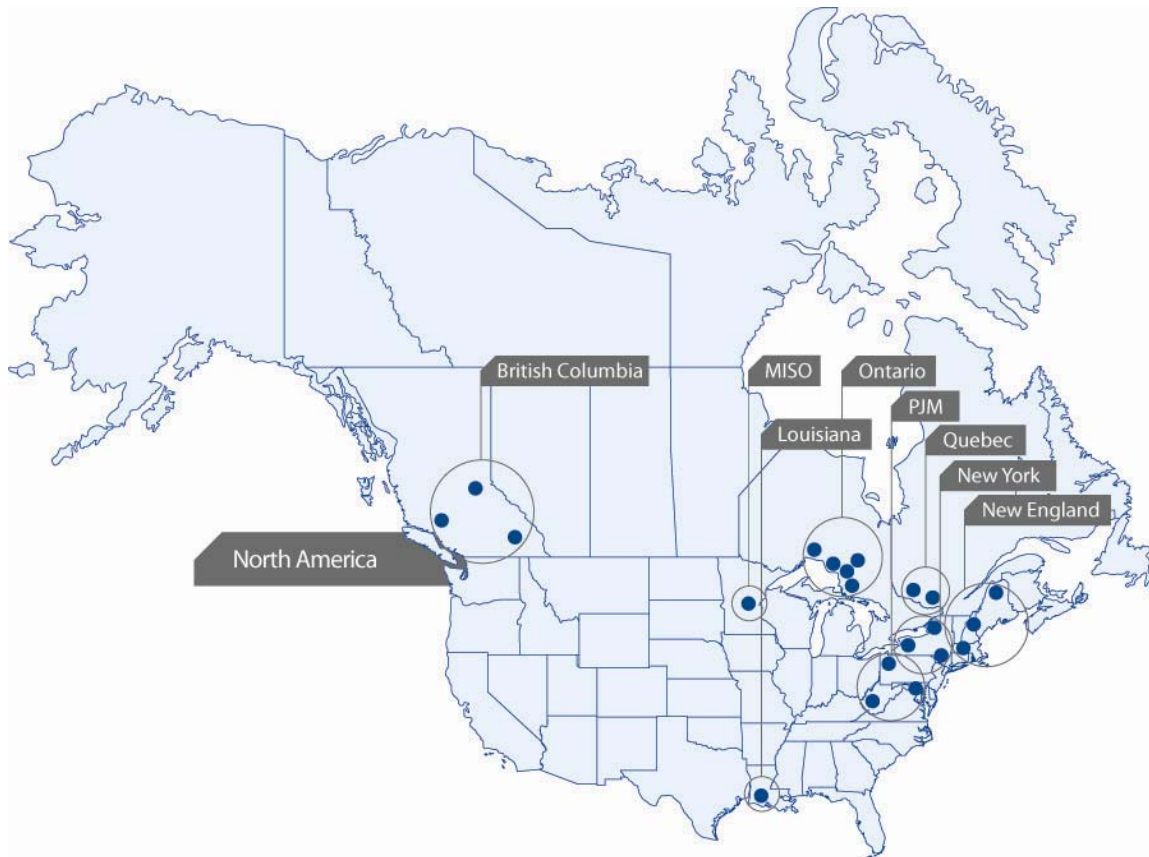


# Brookfield Renewable Power



# Brookfield Renewable Power

- Brookfield Renewable Power is a leading producer and developer of renewable energy focused on hydroelectric and wind technologies
- Over US\$13 billion of assets owned and under management
- Over 3,500 MW of hydro capacity



- 3 countries: United States, Canada and Brazil
- 9 markets
- 63 river systems



# Brookfield Renewable Power

## ***Growth Objectives***

- Accelerate growth in renewable power market through acquisition and development
- Projected \$5 - \$10 billion dollars in spending on new generation projects over the next ten years
- Over 6,700 MW of growth in existing pipeline, 35% from Pumped Storage



## ***Brookfield Strengths***

- Strong financial position
- Synergies with other Brookfield Asset Management companies – property & transmission
- Owners, Developers, & Long Term Operators of generation assets
- Employees – solid engineering, operating, and marketing & trading expertise
- Over 100 years of power generating experience



# Pump Storage Profile

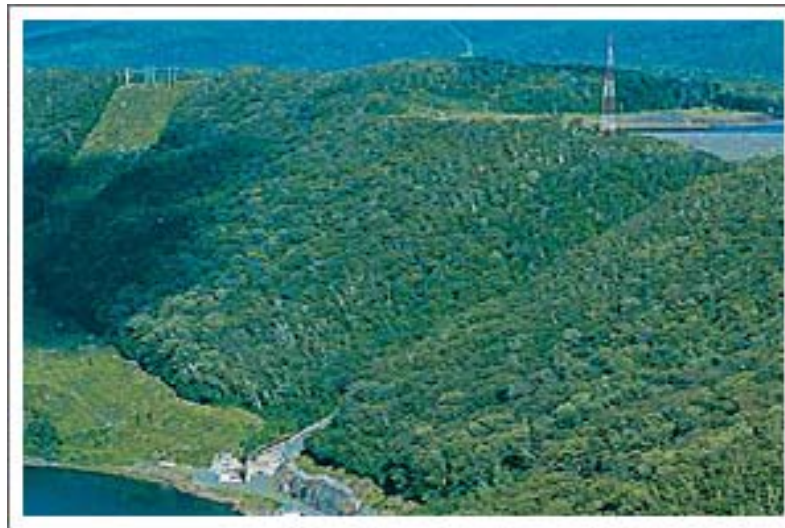




# Pump Storage Profile

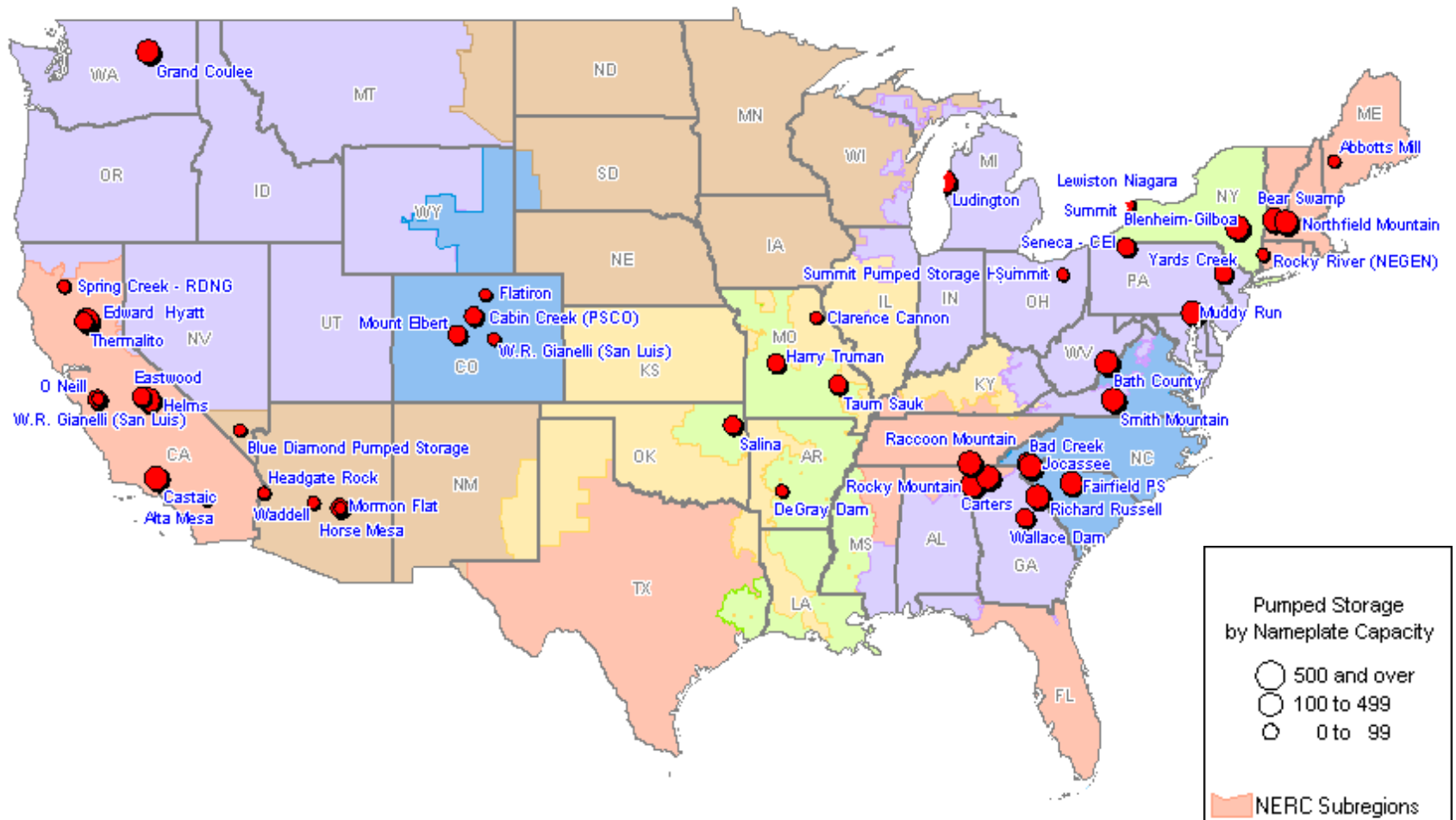
## ➤ Why Pumped Storage?

- Wide range of ancillary product offerings well suited to complement intermittent generation such as wind, available on demand
- Load Following ability
- Ability to store Renewable energy for use during peak hours
- No environmental emissions
- Mature, dependable technology
- Service life of 50 years – longer than gas alternatives



# Pump Storage Profile

## Operating U.S. Pumped Storage Plants



Source: Platts Power Map



# Pump Storage Profile

## ➤ Pumped Storage Considerations

- Limited in generation – usually hours, as determined by upper reservoir size
- Larger in scale, scope, & complexity than alternatives
- Long build time coupled with more complex licensing dynamics
- Full advantages not widely understood in the market
- Limited developers can fully execute - project scope, schedule, and cost complexities will require experienced developers with financial strength



# Pump Storage Profile

## *Components of a successful project*

### ➤ **Site Selection**

- Sites with high head, natural reservoir formations where possible, and minimized distance between upper & lower reservoir (Low L/H ratio)
- Water availability – for evaporation makeup and initial fill for closed loop systems
- Low recreational / civic use of land
- Proximity to un-congested transmission resources
- Favorable geotechnical conditions – low possibility of reservoir seepage, underground construction of penstocks, powerhouse placement, etc.

### ➤ **Market**

- Regional environmental concerns need to favor this “clean” alternative over other options
- Regions whose need for regulatory and ancillary products has increased substantially as a result of significant renewable integrations – wind, solar, etc.

### ➤ **Cost**

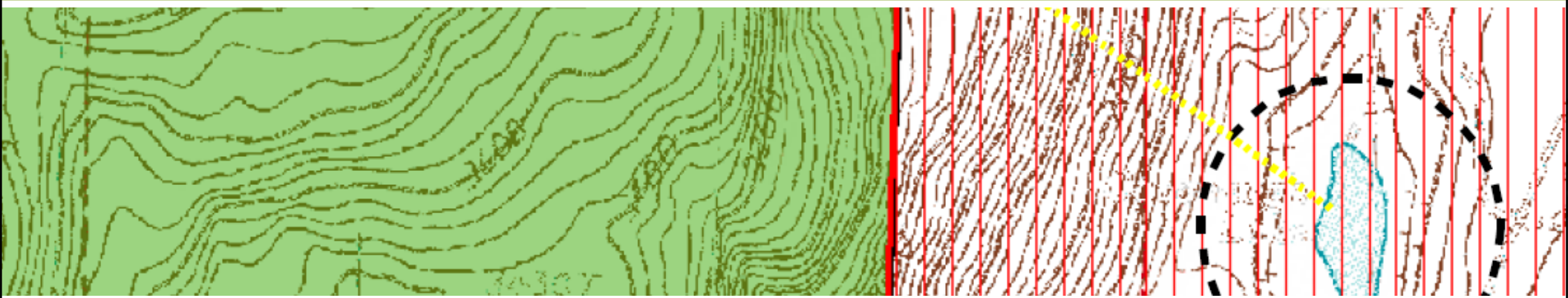
- Driven mainly by site selection, must be competitive with alternatives

### ➤ **Developer Selection**

- Project size & complexity requires a developer and operator with solid expertise, substantial resources, and financial strength
- Experience needed with permitting & licensing, plant operations, and the ancillary markets



# Brookfield Pumped Storage Projects



# Brookfield Pumped Storage Projects

## *Mulqueeney Ranch*

- Located in California
- 280 MW
- Preliminary Permit granted 10/2007
- Closed Loop system – will not reside on any existing waterways
- Water source identified
- Within one mile of transmission corridor
- Preliminary site control established
- Located in a market where the value of capacity is still evolving



PROJECT LOCATION MAP



# Brookfield Pumped Storage Projects

## ***Banks Lake***

- Located in Washington
- 1,040 MW
- Preliminary Permit process underway
- Utilizes an existing lake for lower reservoir – irrigation source with low recreational activity
- Within 5 miles of transmission corridor
- Increased wind generation driving market demand for ancillary services



**PROJECT LOCATION  
MAP**



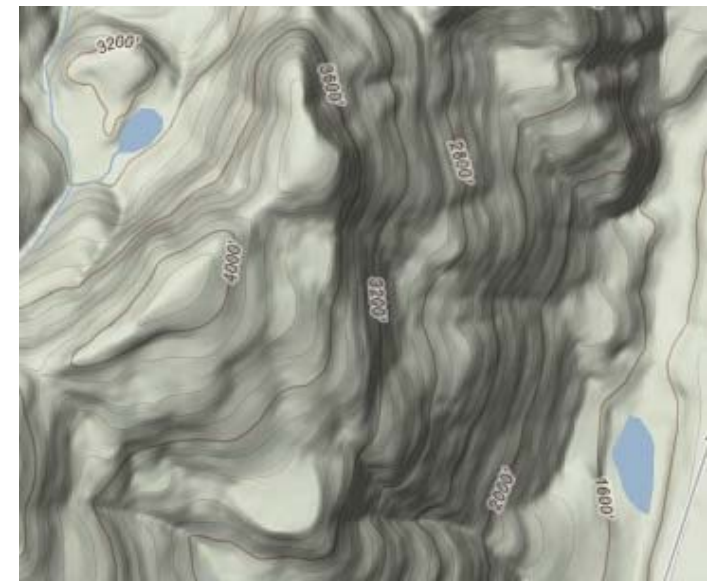
# Brookfield Pumped Storage Projects

## *Duffey Lake*

- Located in Washington
- 1,150 MW
- Preliminary Permit process underway
- Utilizes existing lakes for both reservoirs – both on Brookfield Asset Management property
- Within 5 miles of transmission corridor
- Increased wind generation driving market demand for ancillary services



**PROJECT LOCATION  
MAP**





# Brookfield Pumped Storage Projects

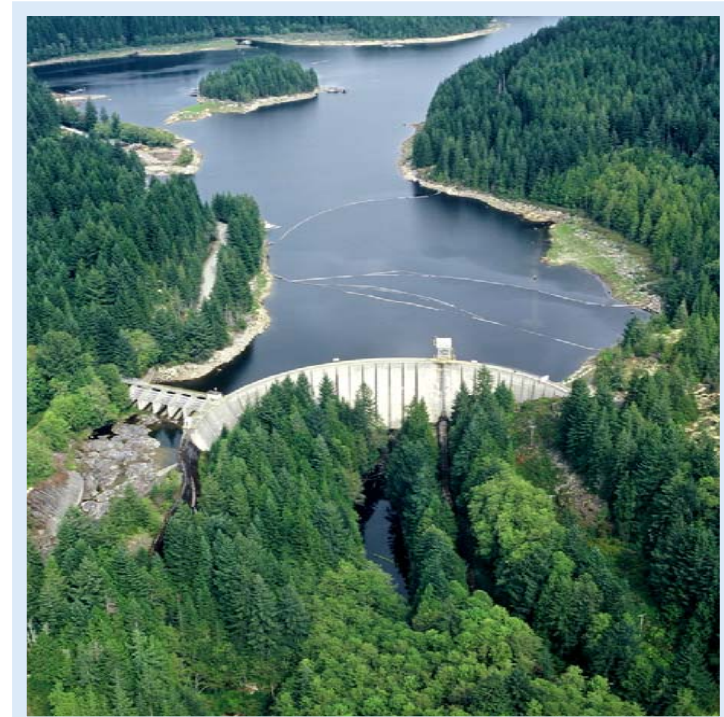
## *Lorella*

- Located in Oregon
- 1,000 MW
- Preliminary Permit process underway
- Closed Loop system – will not reside on any existing waterways
- Water resource identified
- Within 5 miles of transmission corridor
- Increased wind generation driving market demand for ancillary services



# Conclusion

- **Pumped Storage offers clean, renewable Capacity, Ancillary, and Generation services**
- **It has proven advantages over alternatives to complement intermittent generation feeding the grid**
- **Development, construction and operation of a Pumped Storage project will require an experienced organization with technical, transmission, licensing/permitting, construction, operational & marketing expertise, along with a strong balance sheet. Absent this, access to the financial marketplace will be unlikely if not impossible.**



# Thank You

