# DOCKETED

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| **Project Title:** | SB 100 Joint Agency Report: Charting a path to a 100% Clean Energy Future |
| **TN #:** | 234752 |
| **Document Title:** | The National Hydropower Association Comments - Small hydro costs and availability |
| **Description:** | N/A |
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| **Organization:** | The National Hydropower Association |
| **Submitter Role:** | Public |
| **Submission Date:** | 9/15/2020 4:09:34 PM |
| **Docketed Date:** | 9/15/2020 |

*Comment Received From: The National Hydropower Association*
*Submitted On: 9/15/2020*
*Docket Number: 19-SB-100*

## National Hydropower Association - Small hydro costs and availability

*Additional submitted attachment is included below.*

National Hydropower Association
NHA
601 New Jersey Ave. NW, Suite 660, Washington, DC 20001 • Tel 202.682.1700 • Fax 202.682.9478 • www.hydro.org

September 15, 2020

| | | |
|---|---|---|
| David Hochschild | Mary Nichols | Liane Randolph |
| Chair | Chair | Commissioner |
| California Energy Commission | California Air Resources Board | California Public Utilities Commission |
| 1516 Ninth Street, | 1001 I Street | 505 Van Ness Avenue |
| Sacramento, CA 95814 | Sacramento, CA 95814 | San Francisco, CA 94102 |

Dear Chair Hochschild, Chair Nichols, and Commissioner Randolph,

The National Hydropower Association (NHA) appreciates the opportunity to comment on the S.B. 100 Modeling Framework and Scenarios. NHA's comments are focused on the importance of including small hydropower in future modeling scenarios and reports, especially the Joint Agency Report. We hope you will find our comments useful in your preparation of an action plan.

NHA is a non-profit national association dedicated to securing hydropower as a clean, carbon-free, renewable, and reliable energy resource that serves the Nation's environmental and energy objectives. Our membership consists of more than 240 organizations, including public and investor-owned utilities, independent power producers, equipment manufacturers, and professional organizations that provide legal, environmental, and engineering services to the hydropower industry. NHA members are excited about the opportunities for hydropower to contribute to a 100% clean energy economy in California.

**Background:**

Small hydropower, defined as 30 MWs or less, is an eligible resource under the California Renewable Portfolio Standard and has hundreds of MWs of potential growth in California. Small hydropower was included in the CEC's August 28 "Modeling Framework and Scenarios Overview", but was excluded in the subsequent August 31 version because of "Inadequate data on new capacity cost and resource availability for modeling purposes." Our comments below attempt to provide the necessary data for small hydropower's inclusion in future reports.

There are two types of small hydropower projects with a combined 600 MWs of development potential in California – in-conduit and non-powered dams. Both of these resources take advantage of existing water infrastructure, which means they require no additional land use. In addition, these resources are located in-state, which reduces California's reliance on imported energy. Since there are serious environmental concerns with both the acreage required for new renewable resource builds and long-distance transmission lines, NHA believes in-state small hydropower provides additional environmental benefits beyond carbon free generation. While small hydropower potential is not enough to achieve S.B. 100 goals on its own, it can provide a significant slice of the pie at relatively low cost.

**1. In-conduit Hydropower Potential in California:**

76 new in-conduit hydropower facilities were constructed in the U.S. from 2006 to 2019 and there is significantly more potential for growth, especially in California.[1] In 2019, the CEC's California's In-conduit Hydropower Implementation Guidebook found that California has 414 MWs of untapped in-conduit hydropower potential. The guidebook provides extensive details on capacity costs and resource availability.

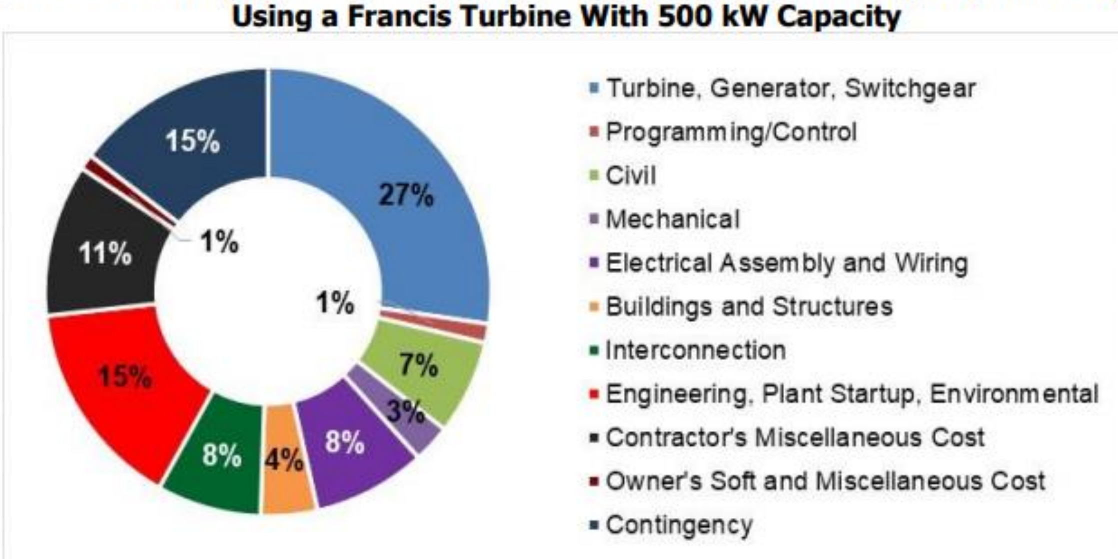
In-conduit hydropower utilizes existing water infrastructure to generate electricity, such as irrigation systems, diversion structures, wastewater outfalls, groundwater recharge sites, and other locations along the water distribution network. Given the state's topography and existing water distribution networks, California is a leading state for in-conduit hydropower growth.

The CEC's guidebook estimates that costs are typically between $5,000-$15,000 kw with a payback period of 15 years. However, the report also notes that costs vary widely from project to project:

> "The financial feasibility of the project depends on initial project capital investment, annual (O&M) costs, and project benefits calculated on average annual energy generation and the price of the generated electricity… costs can vary widely between projects and should not be generalized."

The breakdown of costs is as follows:

**Figure ES-1: Example of Capital-Cost Breakdown of In-Conduit Hydropower Project Using a Francis Turbine With 500 kW Capacity**




Source: Stantec, 2019

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[1] DOE Hydropower Market Report 2017 and 2019. Available at https://www.energy.gov/sites/prod/files/2018/04/f51/Hydropower%20Market%20Report.pdf

In addition, the regulatory process for in-conduit development is more streamlined than other technologies, due to its limited to non-existent environmental impact, and projects can often receive an exemption from the FERC licensing process.

There are many examples of successful in-conduit projects in California and nearby states. For example, the Fontana Water Company Sandhill WTP project commissioned in 2013 had a total cost of $1.6 million, annual revenue of $100,000, annual generation of 1,936,000 kwh, a payback of 8 years, and a 30-year savings of $4.2 million. Similar examples are included in the NLine presentation included in the appendix of these comments.

Other examples, though out of state, worth highlighting for comparison are the Juniper Ridge and Ponderosa projects in Bend, Oregon. These projects have capacities of 5 MWs and 0.75 MWs, respectively, and are the result of a coordination between renewable energy developers, irrigation districts, environmentalists and Oregon state government financing programs.[2] This kind of partnership could be formed in California.

**2. Non-powered dams in California:**

In the last ten years, several non-powered dams in the U.S. were retrofitted to include power generation capabilities. Non-powered dams are attractive resources for new renewable development because the majority of the civil works is already in place, which reduces both costs and environmental impacts. While most non-powered dams in California have power potential less than 30 MWs, any larger projects could still be eligible as a non-emitting resource under S.B. 100.

Some examples of recent non-powered dam developments include American Municipal Power's four new projects on the Ohio River with more than 300 MWs of combined capacity[3] and Eagle Creek's projects in the Northeast. In addition, Missouri Energy Services' Red Rock facility in Iowa was put into service this summer with a total capacity of 36.4 MWs[4]. Dozens of other projects around the country have received licenses from FERC and are candidates for development.

The federal government has invested substantial resources into non-powered dam development. In 2018, Congress directed FERC to establish an expedited licensing process for adding power generation to non-powered dams, with the goal of completing the licensing process in less than two years.[5] In

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[2] See DOE Hydrovision Report on page 149. Available at: https://www.energy.gov/eere/water/downloads/hydropower-vision-report-full-report
[3]AMP Hydroelectric Power: https://www.amppartners.org/generation/hydro
[4] Red Rock Project Overview: https://www.redrockhydroproject.com/project-overview/
[5] FERC News Release: "FERC Finalizes Expedited Hydro Licensing Process" (2019). Available at: https://www.ferc.gov/news-events/news/ferc-finalizes-expedited-hydro-licensing-process

addition, the DOE[6], FERC[7], the Army Corps of Engineers[8], and the Bureau of Reclamation (BOR)[9] have all conducted resource assessments of power potential at federal non-powered dams. Estimates for in-state California non-powered dam energy potential are as high as 195 MWs.

The BOR study is especially relevant in this proceeding because the BOR uses Boca Dam, a non-powered dam in California, as a case study for cost and resource availability. BOR estimates that Boca Dam has a potential installed capacity of 1.1 MWs, an annual production of 4,370 MWh, a capacity factor of 0.43, and requires a 1.14 mile transmission interconnection. Tables 3-6 and 3-7 provides key cost metrics, but the full case study can be found on Chapter 3 of the [BOR report: Hydropower Resource Assessment at Existing Reclamation Facilities (2011)](https://www.usbr.gov/power/AssessmentReport/USBRHydroAssessmentFinalReportMarch2011.pdf)

**Table 3-6 Example Costs for Boca Dam Site**

| **Cost Component** | **Cost ($)** |
|---|---|
| **Total Direct Construction Cost** | **3,020,666** |
| Civil Works | 413,583 |
| Turbine(s) | 651,112 |
| Generator(s) | 382,846 |
| Balance of Plant Mechanical | 130,222 |
| Balance of Plant Electrical | 133,996 |
| Transformer | 48,109 |
| Transmission-Line | 262,200 |
| Contingency (20%) | 404,414 |
| Sales Taxes | 200,185 |
| Engineering and CM (15%) | 394,000 |
| | |
| **Total Development Costs** | **4,393,028** |
| Licensing Cost | 0 |
| Total Direct Construction Cost | 877,844 |
| T-Line Right-of-Way | 3,020,666 |
| Fish & Wildlife Mitigation | 41,455 |
| Recreation Mitigation | 0 |
| Historical & Archeological | 306,261 |
| Water Quality Monitoring | 146,802 |
| Fish Passage | 0 |
| | |
| **Annual O&M Expense** | **144,379** |
| Fixed Annual O&M | 29,509 |
| Annual Variable O&M | 29,760 |
| FERC Charges | 1,676 |
| Transmission / Interconnection | 10,000 |
| Insurance | 9,062 |
| Taxes | 36,248 |
| Management / Office / Overhead | 15,103 |
| Major Repairs Fund | 3,021 |
| Reclamation / Federal Administration | 10,000 |

**Table 3-7 Boca Dam Site Benefit Cost Ratio and IRR Summary**

| | |
|---|---|
| Present Worth of Costs[1] (million) | $6.5 |
| Present Worth of Benefits[1] (with Green Incentive) (million ) | $11.0 |
| Present Worth of Benefits[1] (w/o Green Incentive) (million ) | $5.9 |
| Benefit Cost Ratio (with Green) | 1.68 |
| IRR (with Green) | 11.3% |
| Benefit Cost Ratio (w/o Green) | 0.89 |
| IRR (w/o Green) | 3.4% |

Note:

All costs in 2010 dollars

1 - Total and Present Value Costs Calculated over 50-year Period of Analysis at 4.375% discount rate

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6 DOE "An Assessment of Energy Potential at Non-Powered Dams in the United States" (2012). Available at https://hydrosource.ornl.gov/sites/default/files/NHAAP_NPD_FY11_Final_Report.pdf

7 FERC "Non-powered Federal Dams with Potential for Non-federal Hydropower Development" (2019). Available at: https://www.ferc.gov/news-events/news/ferc-issues-guidance-hydro-development

8 U.S. Army Corps of Engineers "Hydropower Resource Assessment at Non-powered USACE Sites" (2013). Available at: https://www.hydro.org/wp-content/uploads/2014/01/Army-Corps-NPD-Assessment.pdf

9 Bureau of Reclamation "Hydropower Resource Assessment at Existing Reclamation Facilities" (2011). Available at: https://www.usbr.gov/power/AssessmentReport/USBRHydroAssessmentFinalReportMarch2011.pdf

DOE “An Assessment of Energy Potential at Non-Powered Dams in the United States”

| State | Name of Non-Powered Dam | River | Potential Capacity MWs |
|---|---|---|---|
| CA | Palo Verde Diversion | Colorado River | 54.3 |
| CA | Fish Barrier Dam (Oroville Facilities) | Feather River | 35.2 |
| CA | Morelos Diversion | Colorado | 25.2 |

FERC “Nonpowered Federal Dams with Potential for Non-federal Hydropower Development”

| State | Name of Non-powered Dam | River | Potential Capacity MWs |
|---|---|---|---|
| CA | Morelos Diversion | Colorado River | 25.2 |
| CA | North Fork Dam | North Fork American River | 6.2 |
| CA | Hidden Dam | Fresno River | 2.6 |
| CA | Boca Dam | Little Truckee River | 1.2 |
| CA | Imperial Dam | Colorado River | 1.1 |
| CA | Casitas Dam | Coyote Creek | 1.0 |

Additional information can be found in the appendix of these comments, which includes presentations from AMP, Eagle Creek, and French Development on how they finance and develop non-powered dams.

**Conclusion:**

There is substantial opportunity for small hydropower growth in California, through both in-conduits and non-powered dams. Both of these resources rely on existing infrastructure and are located in-state. Inclusion of small hydropower in future CEC, CPUC, and CARB reports and models can help California achieve the goals of S.B. 100 as quickly and cost effectively as possible.

To the extent CEC, CPUC, and CARB need additional information beyond the CEC report on in-conduits and the DOE, FERC, Army Corp, and BOR reports on non-powered dams, NHA members are ready and willing to assist.

Thank you again for consideration of these comments.

Sincerely,

Dennis Cakert
Manager of Regulatory Affairs and Market Policy
National Hydropower Association
601 New Jersey Ave NW
Washington, D.C. 20001
Email: Dennis@hydro.org
(202) 697-2404

**Appendix:**

1. NLine Energy Small Hydro Overview
2. American Municipal Power Case Study: Tax Advantaged Financing for Hydroelectric Facilities
3. Eagle Creek Renewable Energy: Financing a Small Hydro Portfolio
4. French Development Enterprises

**Small Hydroelectric**
renewable power generation

NLINE ENERGY™

# Small Hydropower Overview

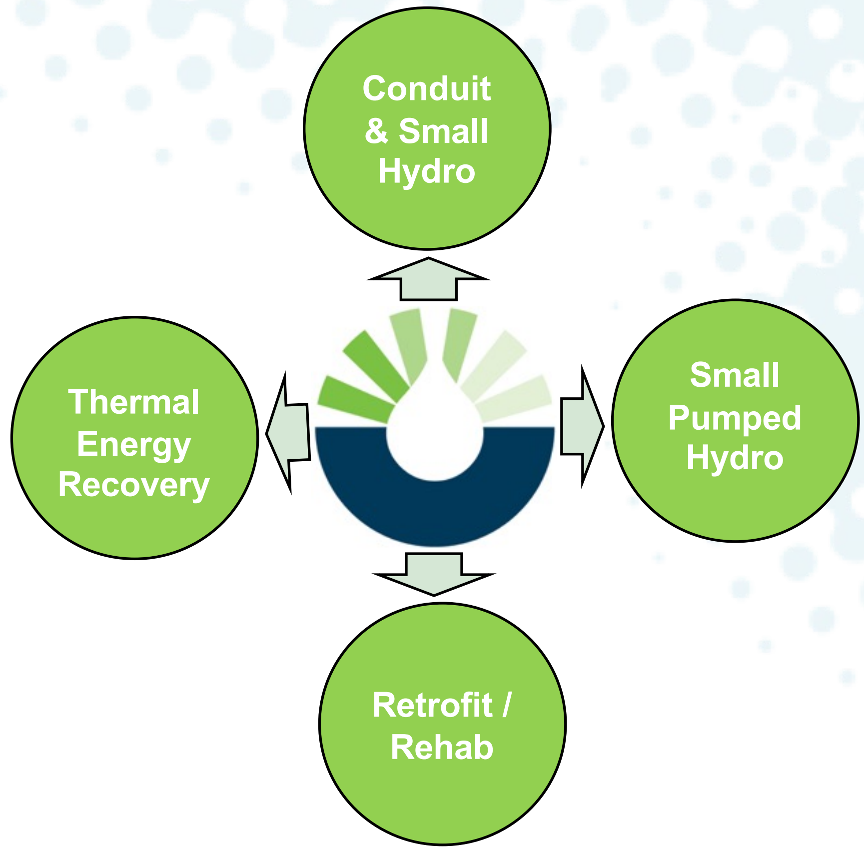
January 2020

# NLine Energy: What We Do

NLINE ENERGY
EVERY DROP OF ENERGY

## Mission

- Harness **wasted energy** in existing infrastructure
- Create cost-effective **renewable electricity**
- Provide immediate **financial benefit** to customers

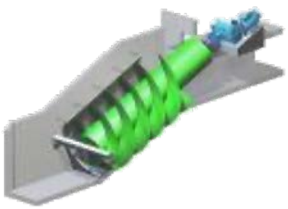



## Overview

- 91% of Small Conduit Hydro Development in CA*
- 31% of Small Conduit Hydro Development in US*
- Association of California Water Agencies (ACWA) Approved Preferred Provider**
- Offices in CA, OR, and NH

*2013-pres. Approved FERC NOI Conduit Exemption filings by MW
**Competitive RFQ process (2010-2018)

# Value of Small Hydro



**Technology**

- 50-100 year asset life
- New models @ 1/3 cost of old hydro

**Financing/ Economics**

- Economic payback and financial returns
- Net-energy metering and feed-in-tariffs

**Regulations**

- FERC Notice of Intent (Exemption)
- Qualified renewable energy for RPS, AB 32

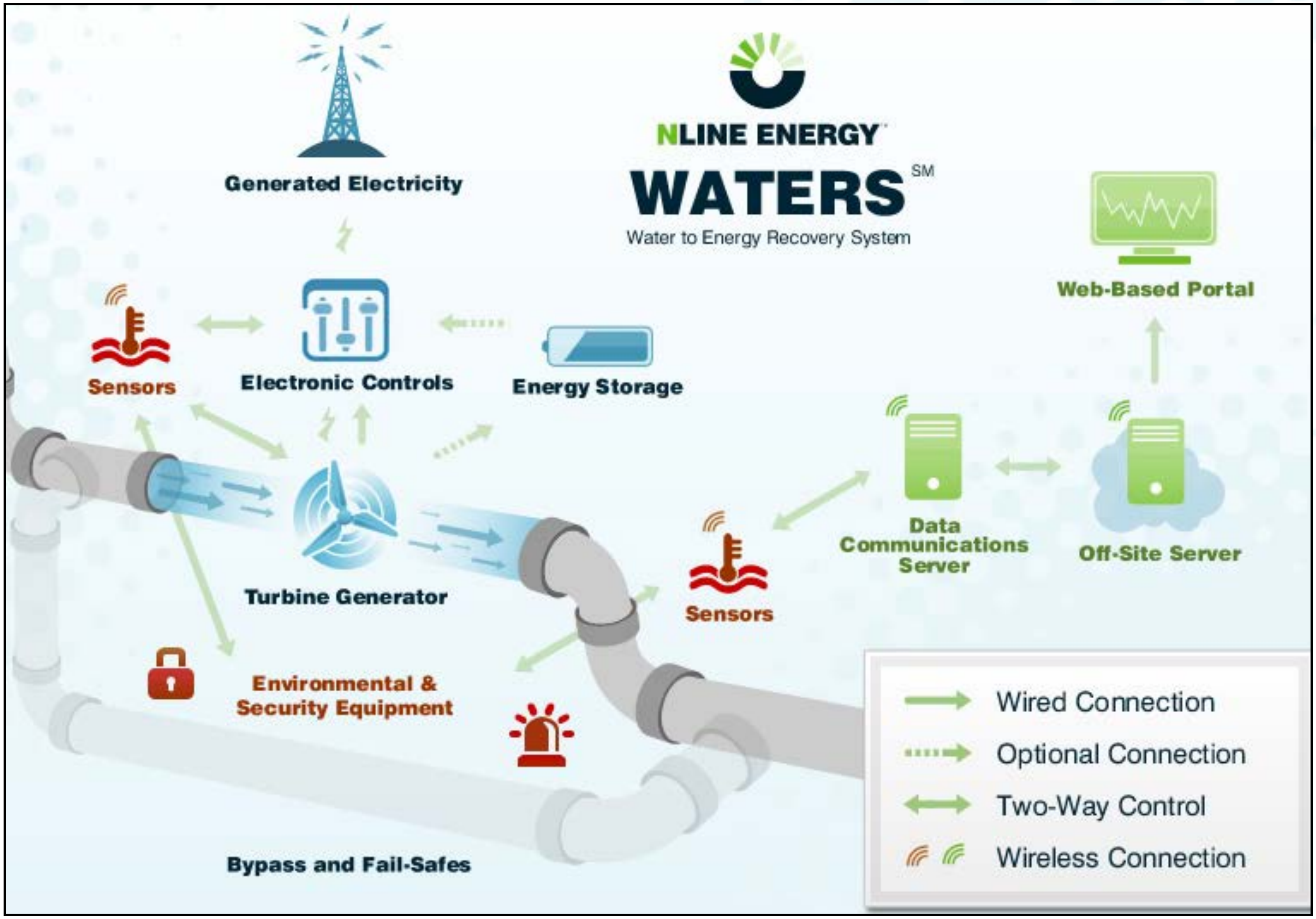
**Environmental**

- Pre-Disturbed Earth Categorical Exemption
- Negligible footprint v. other renewables

**Operations & Maintenance**

- “Pump in reverse”
- Minimal training required

# Our Solution:
# Water to Energy Recovery



# Our Solution:
# Water to Energy Recovery

# Experience Across the Small Hydro Spectrum

## NLine Energy Experience

| | | | |
|---|---|---|---|
| **Water System** | ✓ Raw | ✓ Potable | ✓ Recharge |
| **Hydro Sites** | ✓ Pipes | ✓ Canals | ✓ Dams |
| **Civil Construction** | ✓ New build | ✓ Additions | ✓ Retrofit |
| **Technologies** | ✓ Impulse | ✓ Reaction | ✓ Hydrokinetic |
| **Pressure Range** | ✓ High head | ✓ Low head | ✓ Variable |
| **Districts** | ✓ Water | ✓ Irrigation | ✓ Flood Control |
| **Financing** | ✓ Owner | ✓ Third-party | ✓ PPA/Lease |

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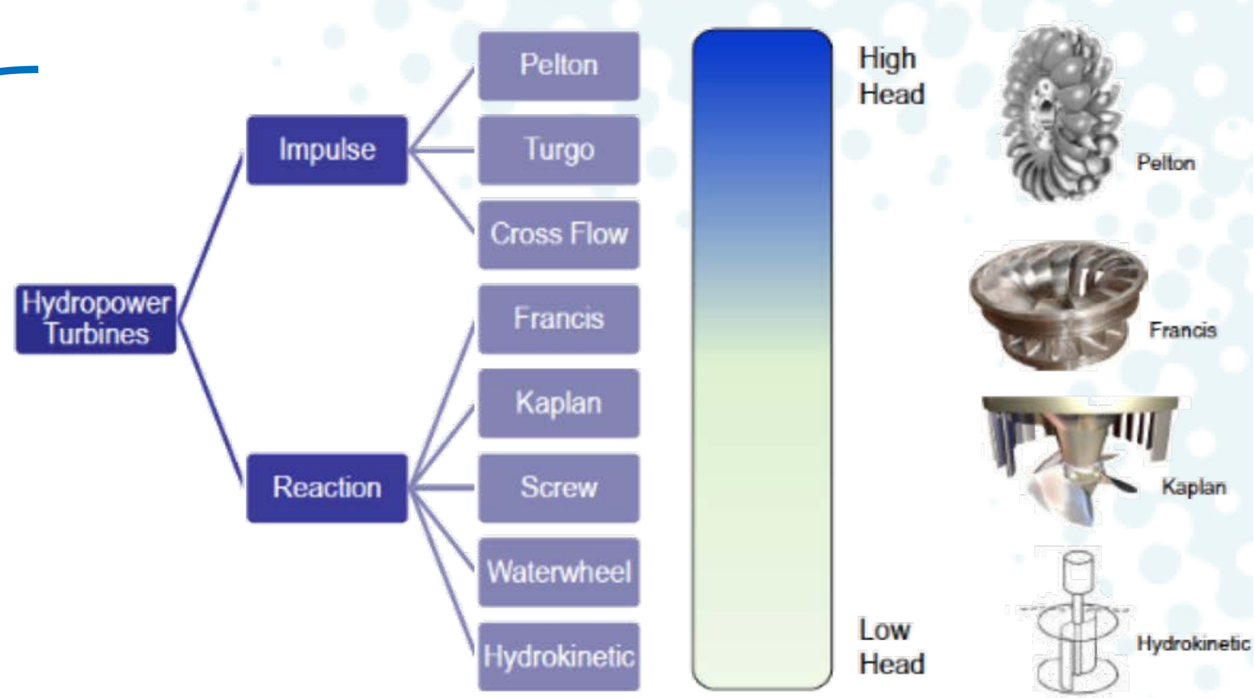
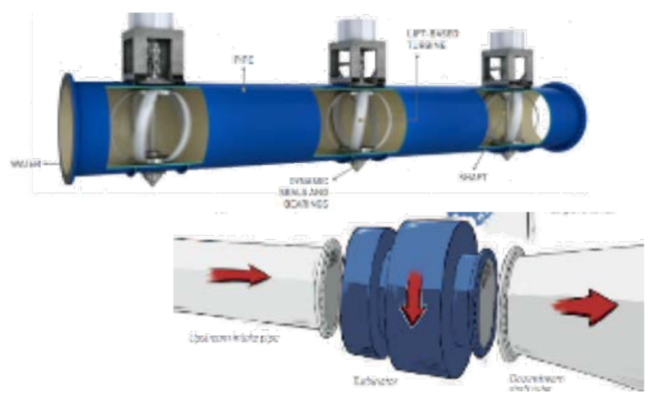
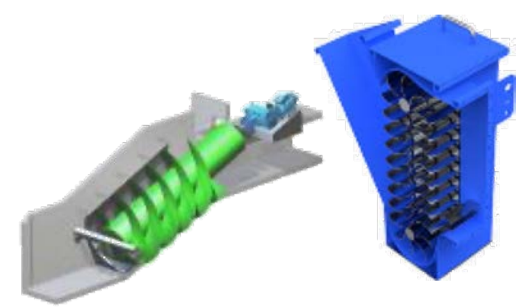
# Hydro Technologies

*NLine Energy uses site-specific technology, with proprietary software for selection and modeling*

**Deep expertise in classic hydro technologies**

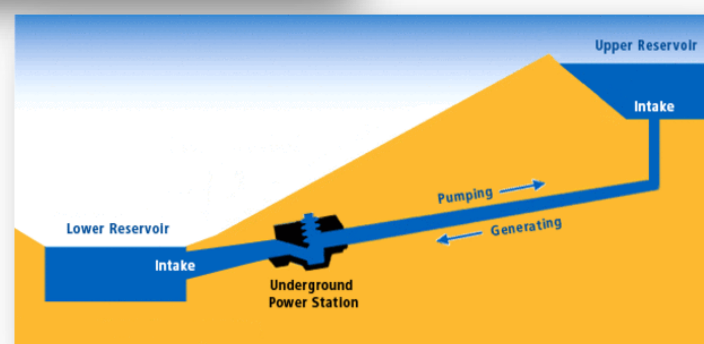



**Ear-to-the-ground for emerging hydro tech**

# Small Hydro Sites

- High Head, Low Flow
  - Pressure reducing valves/vaults.
  - Energy dissipation devices
- Low Head, High Flow
  - Canals, WWTP effluent outfall,
  - Large diameter transmission lines
- Existing Hydro Plants
  - Conditions assessments
  - Capacity amendments for enviro flows
- Small Pumped Storage
  - Utility-scale energy storage
  - Off-peak or renewable energy storage



# Site Selection:
# High Head, Low Flow

- Eligible Sites:
  - Pressure reducing valves/vaults
  - Energy dissipation devices
  - Sleeve valves
  - Turnouts

- Minimum average flow >**4.5 cfs (~3 mgd)**
- Minimum head differential >**100 feet (43 psid)**

- Short distance to 3-Phase Power

# Site Selection:
## Low-Head, High-Flow Sites

- Eligible Sites:
  - WWTP effluent outfalls,
  - Canal drops,
  - Large diameter transmission lines

- Minimum average flow >**30 cfs (~20 MGD)**
- Minimum head **>10 feet (4.3 PSI), but <100 feet (43 PSI)**

- Short distance to 3-Phase Power

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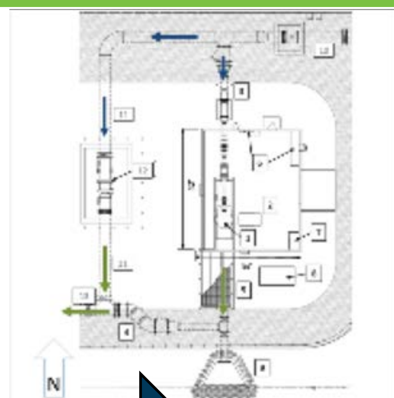
# Development Steps


## Feasibility Assessment

- No-Cost
- 10-point fatal flaw analysis of financial, technical, regulatory hurdles
- Go / No-Go recommendation

## Preliminary Analysis

- Investment-grade analysis
- Financial, technical, regulatory features of site
- 40+ page report

## Design

- Competitive technology bid
- Electrical, environmental, interconnection, geo-tech/survey, surge analysis

## Construct & Commission

- Construction and project management
- Commissioning and grid-synching
- Marketing, messaging

## Maintain

- Operator training
- Operations and maintenance support
- Compliance and performance analysis

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# Our Clients

- Amador Water Agency
- East Valley Water District
- San Gabriel Valley Water Company
- El Dorado Irrigation District
- Imperial Irrigation District
- Kaweah River Power Authority
- Mojave Water Agency
- Nevada Irrigation District
- Placer County Water Agency
- San Bernardino Valley MWD
- San Diego County Water Agency
- Sonoma County Water Agency
- Sweetwater Authority
- Three Valleys Municipal Water District
- City of Tacoma
- Metro Parks in Tacoma
- West Valley Water District
- City of Hood River
- East Fork Irrigation District
- Lost & Boulder Ditch Improvement Company

# Fontana Water Company: Sandhill WTP Project

| Site Name | Sandhill WTP |
|---|---|
| Head | 277-347 ft |
| Flow | 4-13 cfs |
| Technology | Pump-as-Turbine |
| Turbine(s) rating | 310 kW |
| Annual generation | 1,936,000 kWh |
| Annual revenue | $100,000 |
| Project cost | $1,675,000 |
| Subsidies | $848,000 |
| Payback | 8 years |
| 30-yr net savings | $4,200,000 |
| Status | Commissioned (2013) |

# Three Valleys MWD: Miramar Hydro Project

| Site Name | Miramar WTP |
|---|---|
| Head | 50 - 250 ft |
| Flow | 3-20 cfs |
| Technology | Pump-as-Turbine coupled with 525 kW Francis |
| Turbine(s) rating | 435 kW |
| Annual generation | 621,000 kWh |
| Annual revenue | $67,000 |
| Project cost | $1,575,000 |
| Subsidies | $125,000 |
| Payback | 14.6 years |
| Status | Commissioned (2015) |

# Amador Water Agency: Tanner WTP Project

| Site Name | Tanner WTP |
|---|---|
| Head | 170-230 ft |
| Flow | 2-10 cfs |
| Technology | Pump-as-Turbine |
| Turbine(s) rating | 118 kW |
| Annual generation | 580,000 kWh |
| Annual revenue | $79,000 |
| Project cost | $1,595,000 |
| Subsidies | $140,000 |
| Payback | 17.7 years |
| 30 yr net savings | $2,620,000 |
| Status | Commissioned (2016) |

# Sweetwater Authority: Perdue WTP Project

| Site Name | Perdue WTP |
|---|---|
| Head | 300-312 ft |
| Flow | 7-29 cfs |
| Technology | Pump-as-Turbine |
| Turbine(s) rating | 590 kW |
| Annual generation | 3,716,000 kWh |
| Annual revenue | $362,000 |
| Project cost | $2,850,000 |
| Subsidies | $552,000 |
| Payback | 14.1 years |
| 30 yr net savings | $6,000,000 |
| Status | Commissioned (2017) |

# East Valley Water District: Plant 134 Project

| Site Name | Plant 134 WTP |
|---|---|
| Head | 255 ft |
| Flow | 3-11 cfs |
| Technology | Pump-as-Turbine |
| Turbine(s) rating | 180 kW |
| Annual generation | 807,000 kWh |
| Annual revenue | $76,000 |
| Project cost | $1,560,000 |
| Subsidies | $150,000 |
| Payback | 14 years |
| 30-year net savings | $3,105,000 |
| Status | Commissioned (2018) |

# West Valley Water District: Roemer Project

| Site Name | Roemer WTP |
|---|---|
| Head | 235 – 295 ft |
| Flow | 4 – 25 cfs |
| Technology | Pump-as-Turbine |
| Turbine(s) rating | 440 kW |
| Annual generation | 2,020,000 kWh |
| Annual revenue | $202,000 |
| Project cost | $2,227,000 |
| Subsidies | $270,000 |
| Payback | 10 years |
| 30-yr net savings | $8,700,000 |
| Status | Commissioned (2018) |

# El Dorado Irrigation District: Reservoir 7 Project

| Site Name | Res 7 |
|---|---|
| Head | 178 – 208 ft |
| Flow | 3 – 25 cfs |
| Technology | Pump-as-Turbine |
| Turbine(s) rating | 485 kW |
| Annual generation | 1,853,000 kWh |
| Annual revenue | $180,000 |
| Project cost | $2,600,000 |
| Subsidies | $0 |
| Payback | 15.5-17 years |
| 30 yr net savings | $4,217,000 |
| Status | Commissioned (2018) |

# Mojave Water Agency: Deep Creek Recharge Project

| Site Name | Deep Creek |
|---|---|
| Net Head | 460-500ft |
| Flow | 29 cfs |
| Technology | Pelton |
| Turbine rating | 840 kW |
| Annual generation | 3,700,000 kWh |
| Annual Revenue | $330,000 |
| Project cost | $4,900,000 |
| Payback | 10-15 years |
| Status | Commissioned (2019) |

# San Gabriel Valley Water Company: B24 Project

| Site Name | B24 |
|---|---|
| Head | 110-170 ft |
| Flow | 5-8 cfs |
| Technology | Pump-as-Turbine |
| Turbine(s) rating | 72 kW |
| Annual generation | 430,000 kWh |
| Annual revenue | $56,000 |
| Project cost | $1,300,000 |
| Subsidies | $760,000 |
| Payback | 8.9 years |
| 30-yr net savings | $2,325,000 |
| Status | Commissioned (2019) |

# Amador Water Agency: Ione Reservoir Project

| Site Name | Ione Reservoir |
|---|---|
| Net Head | 460-500ft |
| Flow | 1-6 cfs |
| Technology | Pelton |
| Turbine rating | 450 kW |
| Annual generation | 1,383,000 kWh |
| Annual Revenue | $216,000 |
| Project cost | $2,970,000 |
| Subsidies | $750,000 |
| Payback | 11.6 years |
| Status | Commissioning (Q1 2020) |

# San Bernardino Valley MWD: Waterman Recharge Project

| Site Name | Waterman |
| --- | --- |
| Head | 435 ft |
| Flow | 28 cfs |
| Technology | Pelton |
| Turbine(s) rating | 1,050 kW |
| Annual generation | 3,575,000 kWh |
| Annual revenue | $326,000 |
| Project cost | $3,701,000 |
| Subsidies | $0 |
| Payback | 12.3 years |
| 30-yr net savings | $4,992,000 |
| Status | Construction Bidding (Commissioning Q3 2020) |

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# Summary

## Small Hydro

- ✓ Recover wasted energy
- ✓ Use existing infrastructure
- ✓ High capacity factor & efficiencies
- ✓ Long asset life
- ✓ Favorable payback and cash flow

## NLINE ENERGY™

- ✓ Owner's Representative: integrator, developer, financier
- ✓ Niche small hydro focus
- ✓ Experience across site types
- ✓ Site-specific technologies


NLine Energy, Inc.

5170 Golden Foothill Parkway

El Dorado Hills, CA 95762

o: 916.235.6852 | f: 866.444.4320

www.nlineenergy.com

NLINE ENERGY™

EVERY DROP OF ENERGY

# Tax-Advantaged Financing for Hydroelectric Facilities

## American Municipal Power, Inc. Case Study

June 3, 2013

Edward P. Meyers
Managing Director
BMO Capital Markets

NHA National Hydropower Association

BMO Capital Markets

# Project Profile

- **American Municipal Power, Inc. completed Financing for three "run-of-the-river" hydroelectric facilities on the Ohio River**
  - Cannelton – 88 MW
  - Smithland – 76 MW
  - Willow Island – 44 MW

- **Current Estimated commercial operation dates for the three facilities**
  - Cannelton – Third Quarter 2014
  - Smithland – Second Quarter 2015
  - Willow Island – Fourth Quarter 2014

- **FERC licenses are owned by AMP and all permits are in hand for all three facilities**

# Contractual Obligations and Investor Protections

- **Power Sales Contract with 79 Project Participants**
  - Take-or-pay "come hell or high water" commitments
  - 25% "step-up" provision
  - Contracts extend beyond the final maturity of the bonds
  - Top six participants account for 47% of allocated capacity and all have credit ratings in at least the "A" category
  - Participants provide geographic diversity
  - Most Participants set their own electric rates and exercise local control

- **Authority to enter take-or-pay Power Sales Contract**
  - Home Rule Powers of Ohio Participants; successfully validated in the Franklin County Court of Common Pleas
  - Statutory authority of non-Ohio Participants

# Contractual Obligations and Investor Protections con't

- **Unqualified Legal Opinions as to validity and enforceability**
  - Opinions were unqualified as to the validity of Power Sales Contract and take-or-pay provisions

- **Master and Supplemental Trust Indentures**
  - 1.10X rate covenant
  - 1.10X additional bonds test 2 years after Commercial Operation
  - A fully funded Debt Service Reserve Fund
  - These tests are net of the BABs interest subsidy

# Overview of Combined Hydroelectric Phase 1 Financing

- **First permanent financing in November 2009 - $666,435,000**
  - All-In TIC 4.221%
  - Comprised of four series of debt:
    - $24,425,000 Series A (Federally Taxable) All-In TIC 4.401%
    - $497,005,000 Series B (Federally Taxable – Build America Bonds) All-In TIC 4.218%
    - $122,405,000 Series C (Federally Tax-exempt) All-In TIC 4.228%
    - $22,600,000 Series D (Tax-Credit CREBs ) Private Placement
- **Final permanent financing in December 2010 - $1,378,990,000**
  - All-In TIC 5.332%
  - Comprised of three series of debt:
    - $152,995,000 Series A (Federally Taxable) All-In TIC 7.498%
    - $1,109,995,000 Series B (Federally Taxable – Build America Bonds) All-In TIC 5.265%
    - $116,000,000 Series C (Tax Credit CREBs) All-In TIC 3.191%
- **Total Financing $2,045,425,000**
  - All In TIC 4.978%
  - Final Maturity Date February 2050
  - Expected to receive $1,308,129,639.16 in BABs subsidy over the term of the bonds
    - Sequestration reduced August 2013 subsidy payment by $1,832,540
  - Expected to receive $69,118,252 in CREBs subsidy over the term of the bonds
    - Sequestration reduced August 2013 subsidy payment by $204,867

# Rating Agency Strategy

- In order to obtain financing at reasonable interest rates, presentations were made to rating agencies and bond investors demonstrating that:
  - The project was sound
  - AMP had a viable plan of finance and bond security provisions in place
  - The project would be well-managed after COD

# The Project is Sound

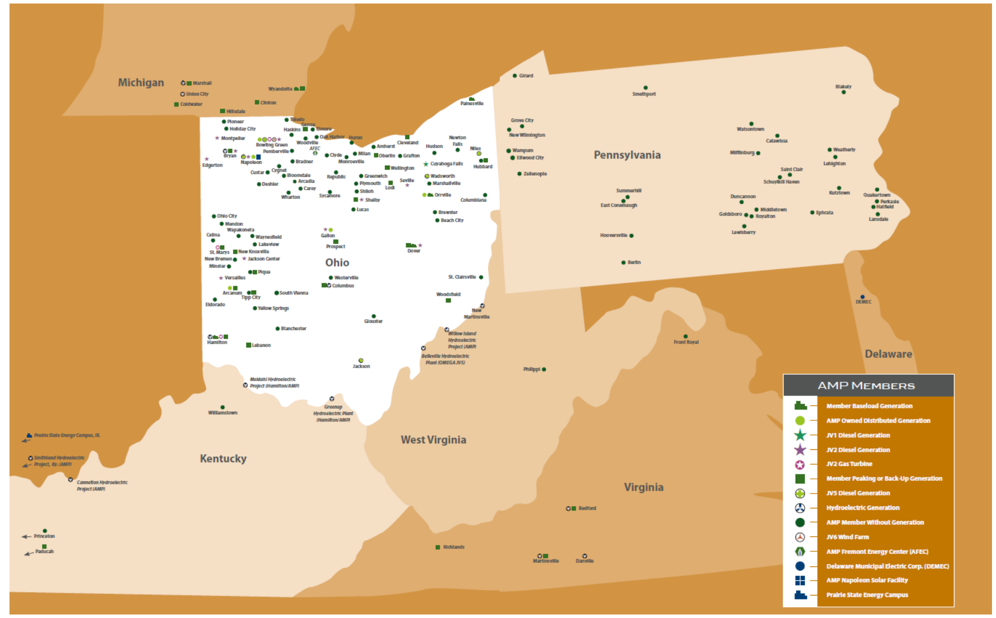
- Sawvel and Associates retained to perform feasibility study
- MWH Americas, Inc. (MWH) retained as Project Engineer
  - AMP chose three of the top five hydroelectric development sites on the Ohio River, as identified by MWH.
  - FERC licenses already in hand for all three sites
  - Each project is being constructed using bulb type turbine-generating
  - The physical life of each project is expected to exceed the life of all debt issued
- AMP employed experienced consultants and vendors

# A Viable Plan of Finance

- AMP has substantial liquidity through a revolving $750 million line of credit expandable to $1 billion with a syndicate of banks
- AMP employed a multi-pronged financing structure, utilizing several tax-advantaged financing instruments
  - Taxable bonds
  - Tax-exempt bonds
  - Build America Bonds
  - Clean Renewable Energy Bonds

# The Project will be Well-Managed after Commercial Operation Date

- AMP has relevant hydroelectric generation experience from constructing and operating a similar hydroelectric plant located on the Ohio River that has been in operation since 1999
- AMP monitors Participant credit quality on an ongoing basis
  - Financial strength must be demonstrated prior to becoming an AMP member
  - Members undergo annual review and credit scoring upon release of their annual audit
  - Credit scores were shared with Rating Agencies for initial rating as well as on an ongoing for rate reviews






NHA National Hydropower Association

BMO Capital Markets

# Case Study: American Municipal Power, Inc.

**In adverse market conditions, AMP was successful in pricing its entire $2.045 billion bond issue at levels producing an all-in total interest cost of 4.978%**

- **Underlying credit ratings of A3/A/A (Moody's/S&P/Fitch)**
  - **Moody's rating of A3 due to multiple projects under construction**
  - **Moody's affirmed A3 rating May 20, 2013**
- **Transaction marketing plan included internet roadshows as well as numerous one-on-one investor conference calls**
- **Bonds were distributed to both institutional and retail investors,**
  - **Including 30 who had never owned AMP bonds previously and one international investor**
  - **For Series 2010 BMO carved out retail maturities in 2029 and 2030 which, when combined with other retail priority orders, enabled AMP to achieve a $56 million retail participation level**
- **Series 2010 bonds strategically utilized bond insurance to save 8bps, net of the upfront premium, on $27.3 million bonds**
- **Solid investor demand resulted in 1.5x oversubscription and allowed us to tighten credit spreads 15bps on $324 million bonds (accounting for 24% of aggregate par) from initial to final pricing**

# Financing a Small Hydro Portfolio

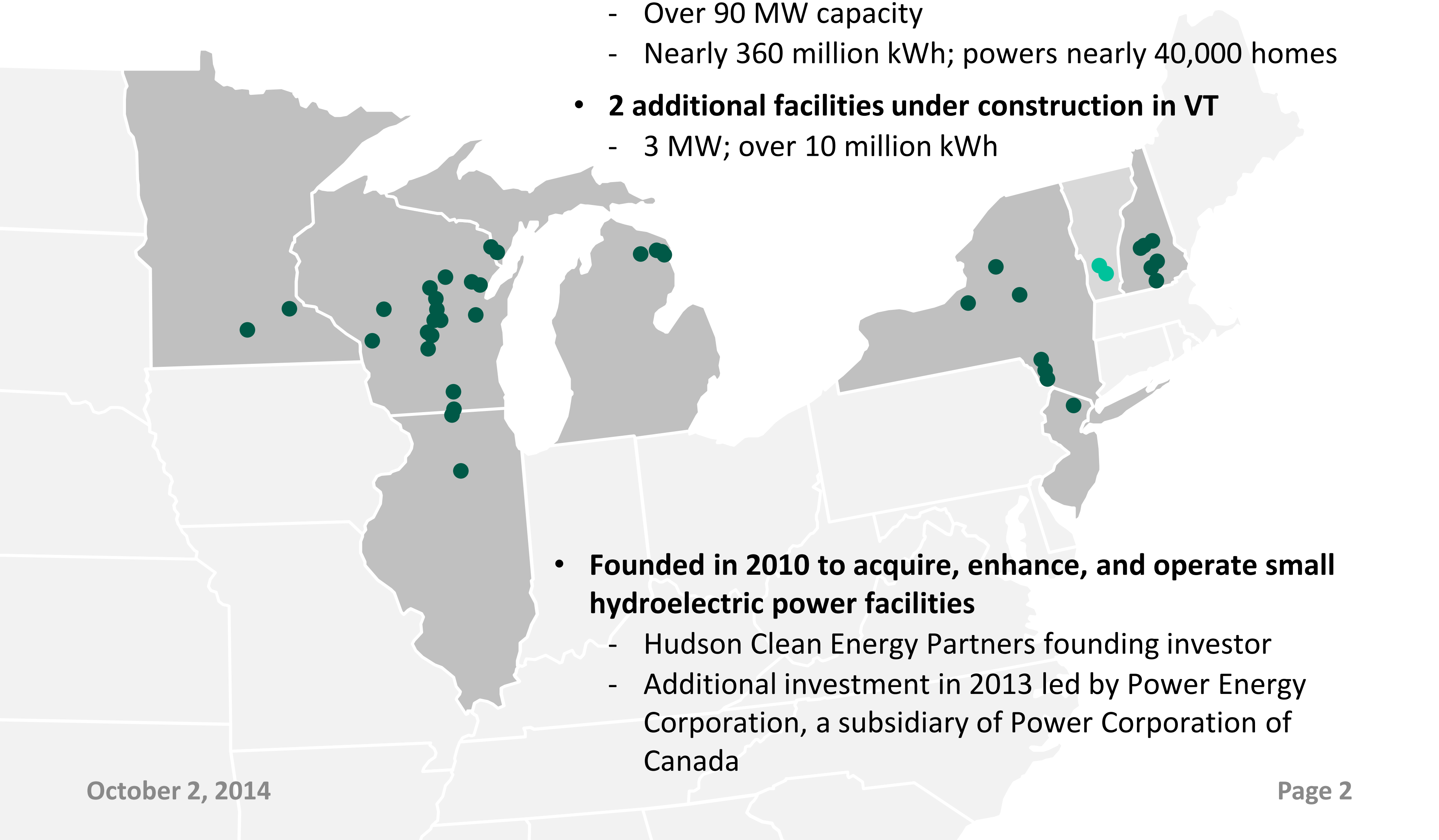
*NHA Finance Summit*
*October 2, 2014*

*Matthew Ocwieja*
*Director of Finance, Eagle Creek Renewable Energy, LLC*

# About Eagle Creek Renewable Energy

***Eagle Creek Renewable Energy owns, operates, and develops hydroelectric power projects***

- **41 operating facilities in 7 states**
  - Over 90 MW capacity
  - Nearly 360 million kWh; powers nearly 40,000 homes
- **2 additional facilities under construction in VT**
  - 3 MW; over 10 million kWh



- **Founded in 2010 to acquire, enhance, and operate small hydroelectric power facilities**
  - Hudson Clean Energy Partners founding investor
  - Additional investment in 2013 led by Power Energy Corporation, a subsidiary of Power Corporation of Canada

# A Portfolio Approach to Financing

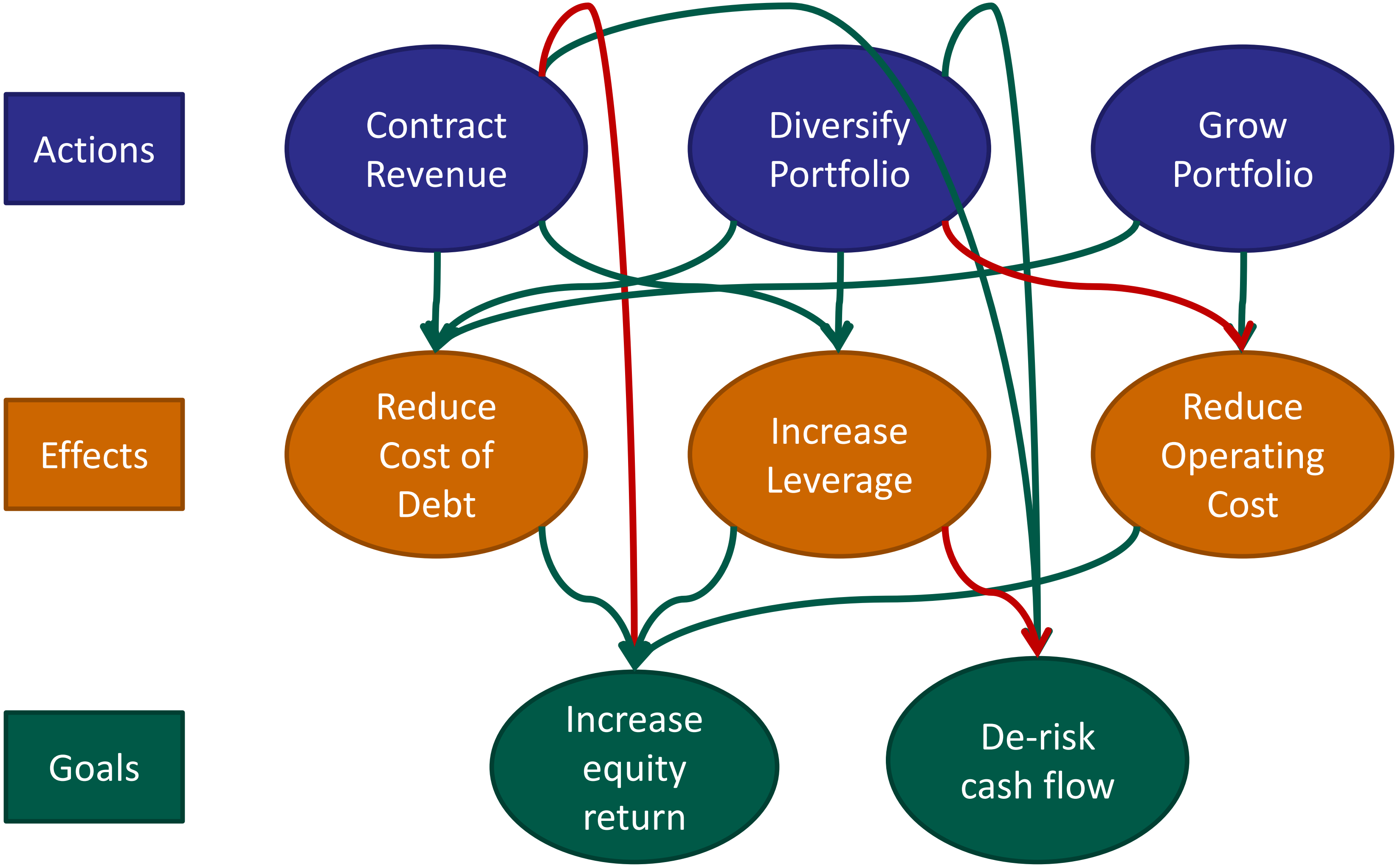
***Financing a small hydro facility requires overcoming a number of challenges:***

| | |
|---|---|
| **Transaction size** | • Small financing transactions attract less interest from banks and/or require more expensive non-project debt. |
| **Transaction cost** | • A small financing carries nearly the same internal and external cost as a larger one and therefore provides less benefit from financing. |
| **Market Risk** | • A single small hydro asset is generally either fully contracted or fully merchant.<br>• Merchant assets support only small amounts of high-cost debt. |
| **Hydrology Risk** | • A single hydro asset, while much more consistent on an intra-day or inter-day timescale than other renewable generation, can have significant year-to-year production variability. |

***A portfolio approach can overcome these challenges***

# Focus on Risk-Adjusted Return to Equity

***The goal for Eagle Creek management is to maximize the risk-adjusted return to equity holders***



# Revenue Contracting

***Contracting revenue reduces portfolio risk and allows for improved financing but at a cost***

| Benefits | Drawbacks |
|---|---|
| • Reduced risk to equity investors<br>• Contract above downside projection allows for greater debt capacity<br>• Reduced volatility allows for lower cost of debt | • New contracts likely to be at below-forecast rates<br>  • Supply-demand imbalance in long-term market favors buyers; in some markets no buyers longer than 3 years<br>  • Small projects have little market power and often don't receive fair contract rates<br>  • Run-of-river hydro contracts are unit contingent; off taker may apply a significant discount<br>• Acquisition of already-contracted assets is competitive and lower-risk/lower-return for equity investors |

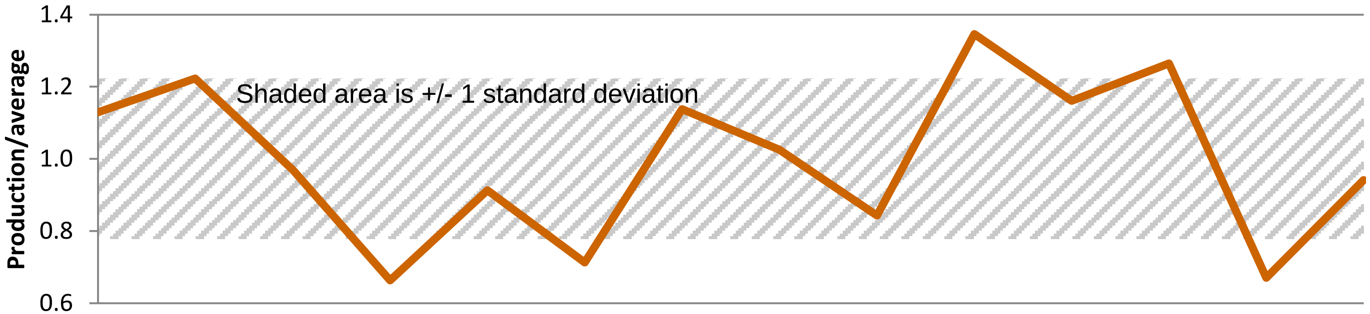
***A balance of contracted and uncontracted assets allows greatest flexibility and opportunity***

- In a highly-contracted portfolio, revenue contracts may not be limiting factor on debt sizing
- More leverage results in higher cost of debt (lower marginal benefit) and risk to equity
- Balanced approach allows for acquisition of facilities where fair contracts are unlikely

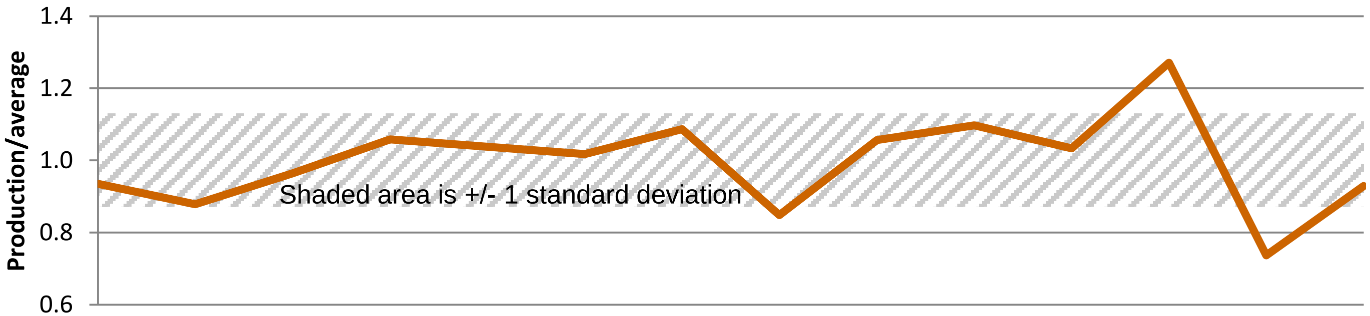
# Diversification of Hydrology Risk

***Beyond power pricing, the other major risk in hydro is water availability***

- Among hydro plants Eagle Creek has studied, coefficient of variation (standard deviation divided by average) of annual production varies from 9% to 40%
- Representative plant shown below has coefficient of variation = 22% over 14 years




- A representative portfolio has significantly lower coefficient of variation = 13%
  - Includes plant above; approx. 17x the annual average production of the single plant




***Diversification of hydrology reduces risk to equity holders, firms up financing case permitting greater leverage, and reduces credit support requirements resulting in lower cost of debt.***

# Other Benefits of a Portfolio

***A larger portfolio of facilities further improves returns and reduces risk through:***

| | |
|---|---|
| Reduced operating expense | • Synergies among plants can result in a lower overall cost/MWh. |
| Larger financing transaction size | • Attracts interest from more financing sources; competition results in lower cost. |
| Smaller relative expenses | • Fixed costs related to financing (legal, technical, market study) do not scale with portfolio size. |

***Eagle Creek's approach is to create value through an optimized portfolio of small hydroelectric power plants.***

## Capital/Project Cost Examples for Small Hydro

| | | |
|---|---|---|
| Mid-West 1 | 4.5 MW | $5.6M/MW |
| Mid-West 2 | 1.0 MW | $6.5M/MW |
| Lakes Region | 23 MW | $4.3M/MW |
| South Central | 14 MW | $2.7M/MW |
| NE Canada | 19 MW | $2.6M/MW |

Note…these project costs vary with - type of project, coffer dam construction, site work, rock removal and blasting, water depth and flow, labor rates, etc.

## Fixed and Variable Operating Costs

Industry average of O&M = 1% to 3% of total project cost…assume 2%

## Future Cost Changes…see modular French Dam

Industry move to modular vs. conventional hydro construction

Growth of modular pumped storage hydro

Further reduction in component pricing…including batteries

**Interconnection Costs** (unknown, see location, state, utility for needs)

**Resource Availability**

Per the ASCE, CA currently has 1,580 permitted dams with an average age of 70 years.  Only 24% are powered and 74% are rated as High Hazard…and CA is in dire need of improved water controls.

Retrofits (adding new power) or rehabs (adding more power) from the existing dam inventory is a quick way to jump start renewable resources.

Creating additional pumped storage facilities and site-select hydro Micro Grids with "blackstart capabilities" is essential to resource development and utilization.

Energy storage/output and minimum flow is project or location specific.

For further information, see www.fdepower.com or call Bill French directly at 617-293-0193.