



## French Modular Impoundment

Precast alternative to reduce time, cost and risk of  
dam construction and rehabilitation

**Bill French Sr., CEO**

French Development Enterprises, LLC

[wfsr@fdpower.com](mailto:wfsr@fdpower.com) (617) 293-0153

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## The French Modular Impoundment:

- Applying proven precast technology to hydropower structures to save time, reduce cost, and reduce risk during construction

## The Challenge:

- New hydropower development is too expensive
  - High civil costs (40%–80% of Capital Expenditure)
  - Long duration, frequent cost and time overruns
  - Subject to frequent weather delays

## Partners:

- French Development Enterprises (PI)
- GEI Consultants Engineering (Engineering Lead)
- Old Castle Precast (Manufacturing Lead)
- Cleantech Analytics (R&D)
- Hydropower Consulting Specialists (Testing)
- Knight Piesold (Independent Validation)
- Willis Insurance (Consultation)
- Maine Rock Drilling and Blasting (Foundation specification)

## Next Generation Hydropower (HydroNEXT)

### Optimization

- Optimize technical, environmental, and water-use efficiency of existing fleet
- Collect and disseminate data on new and existing assets
- Facilitate interagency collaboration to increase regulatory process efficiency
- Identify revenue streams for ancillary services

### Growth

- **Lower costs of hydropower components and civil works**
- Increase power train efficiency for low-head, variable flow applications
- Facilitate mechanisms for testing and advancing new hydropower systems and components
- Reduce costs and deployment timelines of new PSH plants
- Prepare the incoming hydropower workforce

### Sustainability

- Design new hydropower systems that minimize or avoid environmental impacts
- Support development of new fish passage technologies and approaches
- Develop technologies, tools, and strategies to evaluate and address environmental impacts
- Increase resilience to climate change

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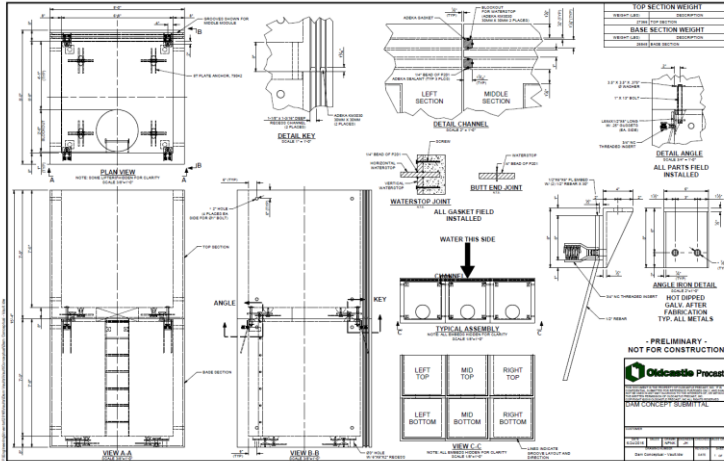
### The Impact

1. Reduce civil costs up to 60%
2. Reduce project delivery time by 43%
3. Double life expectancy of civil structures (100 years vs. CIP, which is 50 years)

- (1) Design, manufacture and test a precast modular impoundment (prototype “French Dam”)—COMPLETE
- (2) Perform full-scale feasibility analysis for precast vs. cast-in-place for actual dam site in United States—COMPLETE

## Key Questions:

- Cost – does it save money?
- Assembly Time – can it beat conventional methods?
- Permeability – does it leak?
- Safety – does it meet dam safety regulations?



## 1.) Design



## 2.) Manufacture



## 3.) Assemble



## 4.) Test

1. Successfully built and tested French Dam prototype
  - Assembled 16' x 24' dam in 3.5 hours in driving rainstorm
2. Completed precast design of an actual low-head cast-in-place dam in Rhode Island
3. Developed precast dam construction cost model

## Original Questions (and answers):

- Cost – does it save money? **YES**
- Assembly Time – can it beat conventional methods?  
**YES**
- Permeability – does it leak? **NO**
- Safety – does it meet dam safety regulations? **YES**

- Initiation Date: 12/01/2015
- Planned Completion Date: 03/01/2017
- Go/No-Go Decision successfully passed in 06/01/2016
- Each Task completed ahead of or on schedule:

Task	Task/Subtask Title	Ant. Date (Mo from start)	Actual Completion	Estimate % Complete
1	Site Selection & Criteria	3	3	100%
2	Prototype FEED	8	8	100%
3	Precast Mfg.	9	9	100%
4	Prototype Testing	11	11	100%
4	Prototype Testing	15	12	100%
5	Full-scale FEED	17	15 (est)	90%



Budget History					
FY2014		FY2015		FY2016	
DOE	Cost-share	DOE	Cost-share	DOE	Cost-share
N/A	N/A	N/A	N/A	\$960K	\$240K

- Total budget:
  - Federal: \$1,338,552
  - Cost-share: \$348,048
- Project was accelerated to be completed over the calendar 2016 year
- FDE received \$72K in financial assistance from the state of Massachusetts (MassCEC - Leveraging Federal Funding Opportunities)

## Partners, Subcontractors, and Collaborators:

GEI Consultants, Inc.  
Old Castle Precast  
Cleantech Analytics LLC  
Hydro Consulting Specialists  
Maine Rock Drilling & Blasting  
Willis Insurance

## Communications and Technology Transfer:

Exhibited at Hydrovision 2016  
(Minneapolis, MN)  
Hosted Demonstration Day on  
October 26, 2016



## FY17/Current research:

Complete Final Report and submit to DOE, which includes:

- Full-scale Front-end Engineering Design (FEED)
- Cost Comparison Model
- Test Results Report

## Proposed future research:

Full-Scale Demonstration – French Development Enterprises actively engaged in PPP discussions with municipalities to demonstrate the French Dam at existing poor/unsafe dams in the Northeast