Taking Steps to Meet the SECNAV's Energy Mandates

Alex R. Dzierba, PhD
Physicist
URS Federal Services Inc - WestGate Crane

TOPICS:

1. Assessment of Energy Use at NSA Crane
2. Reactivating a Hydropower Plant at Williams Dam
3. Possible deployment of Small Modular Reactor (SMR)

URS

Alex R. Dzierba, Ph.D.
alex.dzierba@urs.com

Secretary of the Navy
RAY MABUS

SECNAV's Energy Mandates

Two of the Five Energy Targets Apply to Shore Installations

Fourth: The Department of the Navy will by 2020 produce at least half of our shore-based energy requirements on our installations from alternative sources. We will boost our usage of renewable energy and in some cases we will supply power *to* the grid from solar, wind, ocean, or geothermal sources generated by the base.

Fifth: Today, about 17 percent of our total energy consumption comes from alternative sources. By 2020, half of our total energy consumption for ships, aircraft, tanks, vehicles, and shore installations will come from alternative sources.

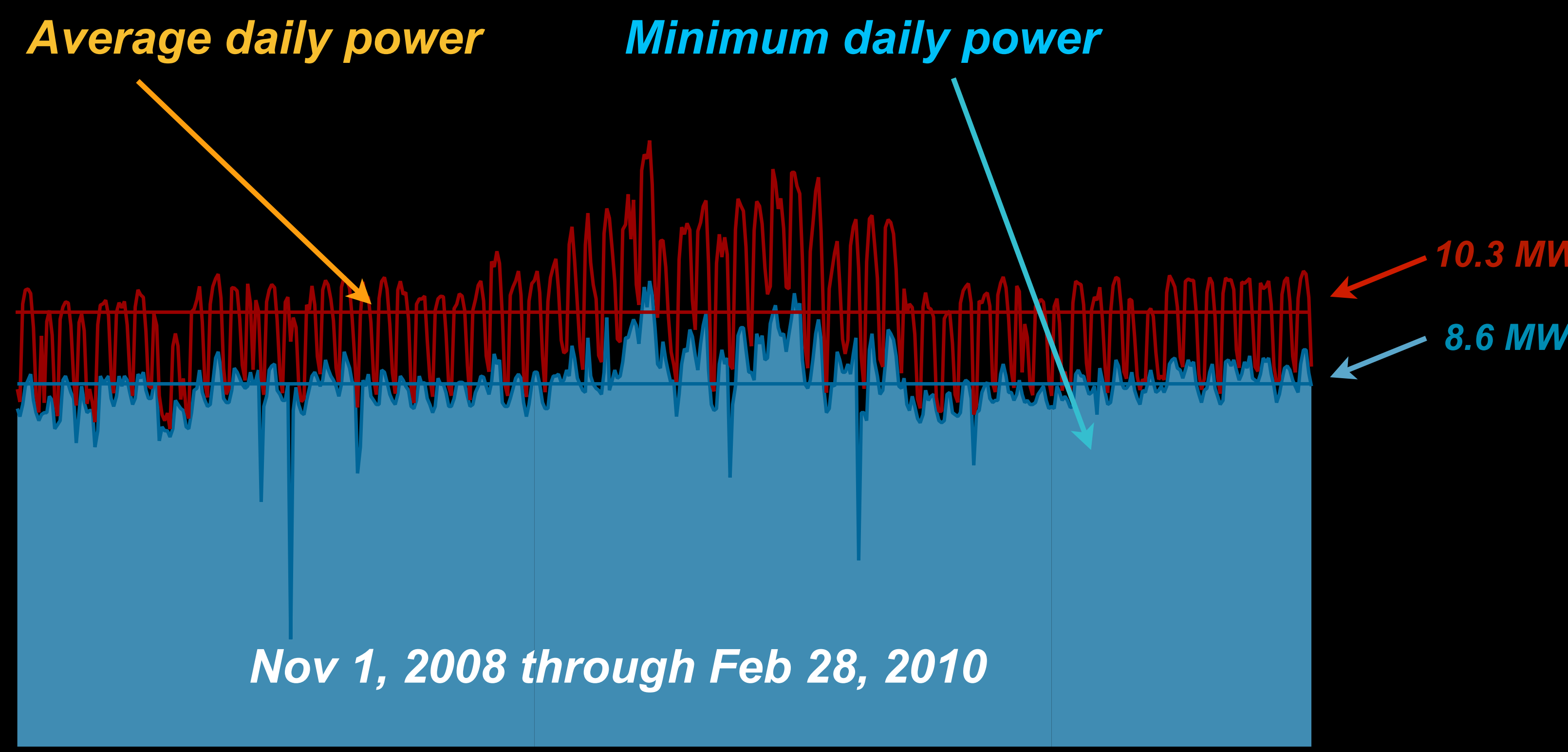
Alex R. Dzierba, Ph.D.
alex.dzierba@urs.com

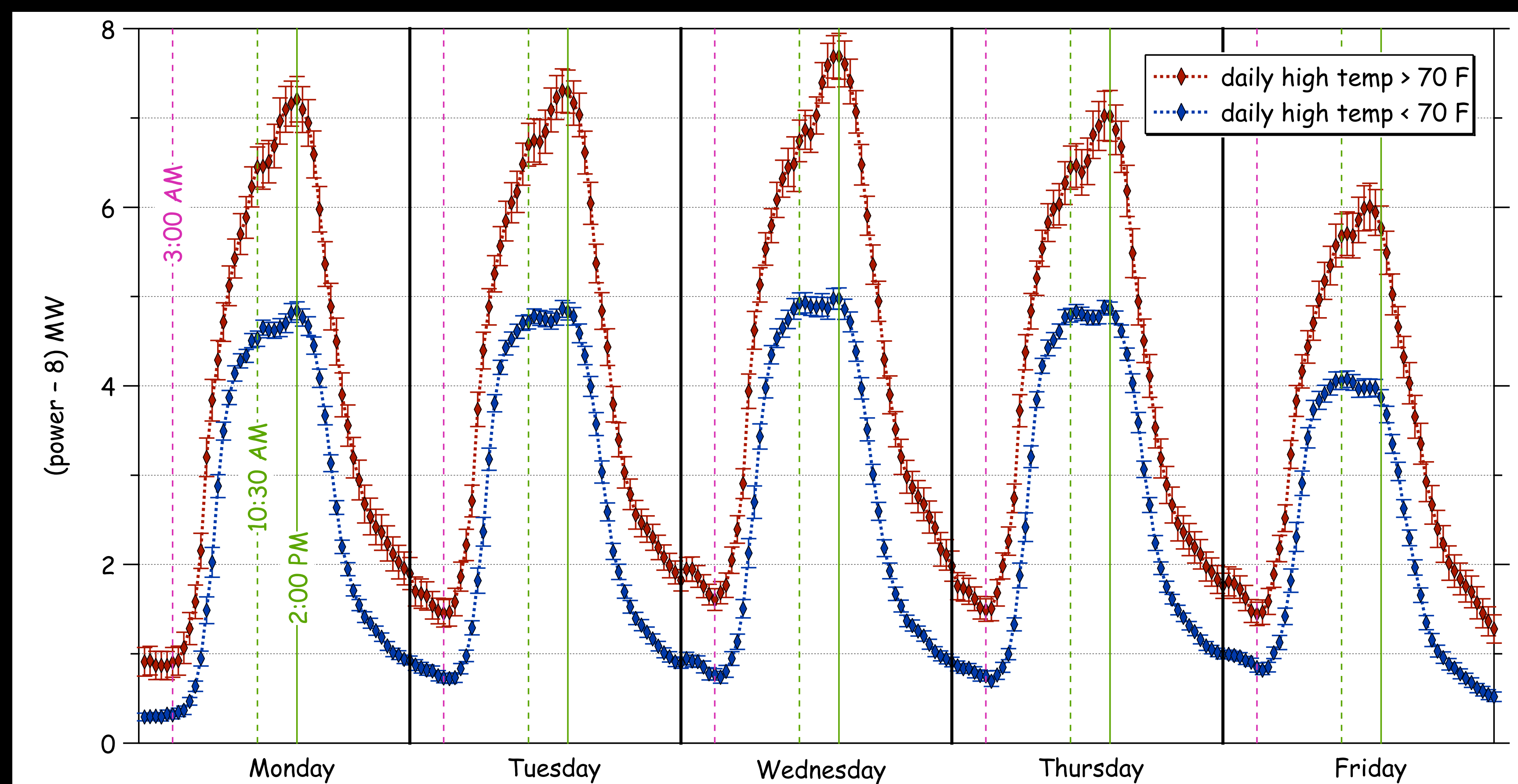
How Crane Currently Uses Electrical Power

Power in MW	Crane
Minimum	8.6
Average	10.3
Peak Winter	13
Peak Summer	18

Assuming electricity is generated by burning coal, each MW of average power results in 9,000 tons of CO_2 emitted into the atmosphere per year.

At Crane, each MW of average power costs $0.55M per year





Alex R. Dzierba, Ph.D.
alex.dzierba@urs.com

Thermal IR Flyover of NSA Crane

Goal & Methodology:
Identify buildings on the NSA Crane complex that leak energy by doing a thermal IR flyover covering the NSA Crane Campus collecting and analyzing the IR imagery data.

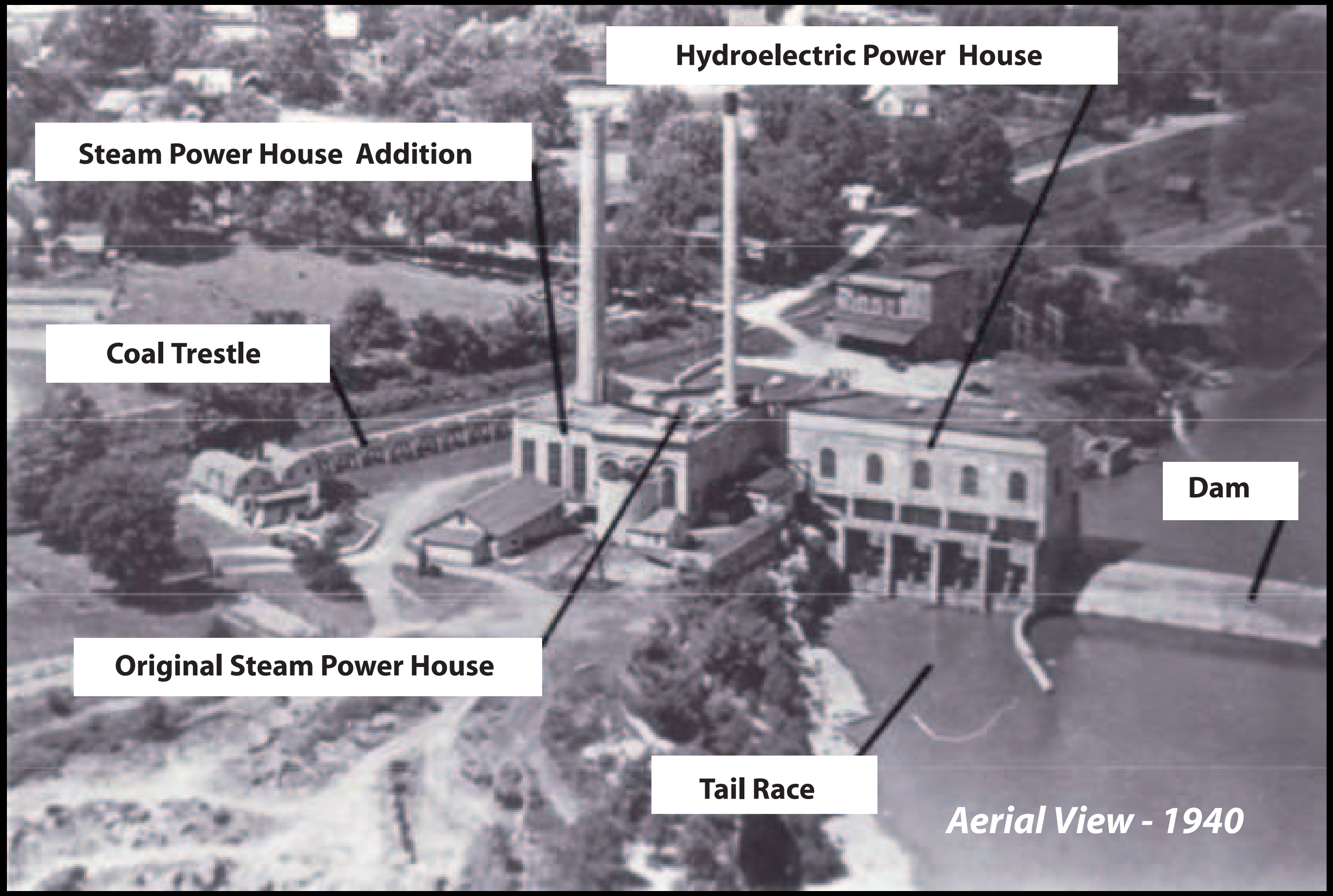
Status:
Discussions have taken place with BroadBay Group (BBG) - a veteran-owned small business that operates out of Norfolk Airport. BBG does ISR-related work at Muscatatuck and Atterbury.

Plan:
Identify equipment needed, develop a flight, data collection and analysis plan, working with EO and secure funding.

URS
Alex R. Dzierba, Ph.D.
alex.dzierba@urs.com

Reactivation of the Hydropower Facility at Williams Dam

Above photo taken September 2010



The Williams Dam and associated hydropower plant were built in 1910 through 1912. The plant had a nameplate capacity of 3 MW and supplied power through the end of the 1950's when the plant was decommissioned.

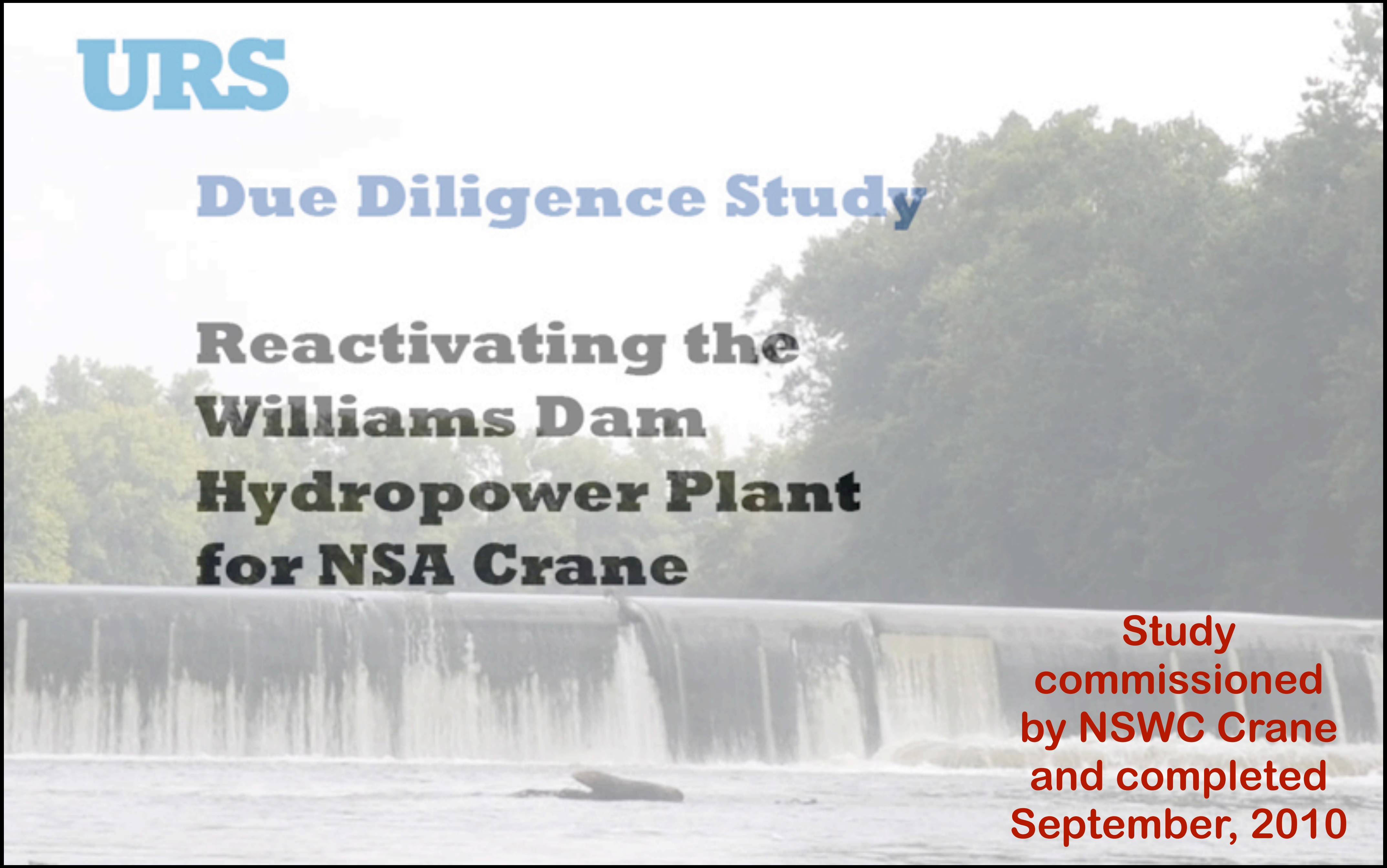
Alex R. Dzierba, Ph.D.
alex.dzierba@urs.com

Reactivation of the Hydropower Facility at Williams Dam

Located about 2 miles outside the Crane boundary

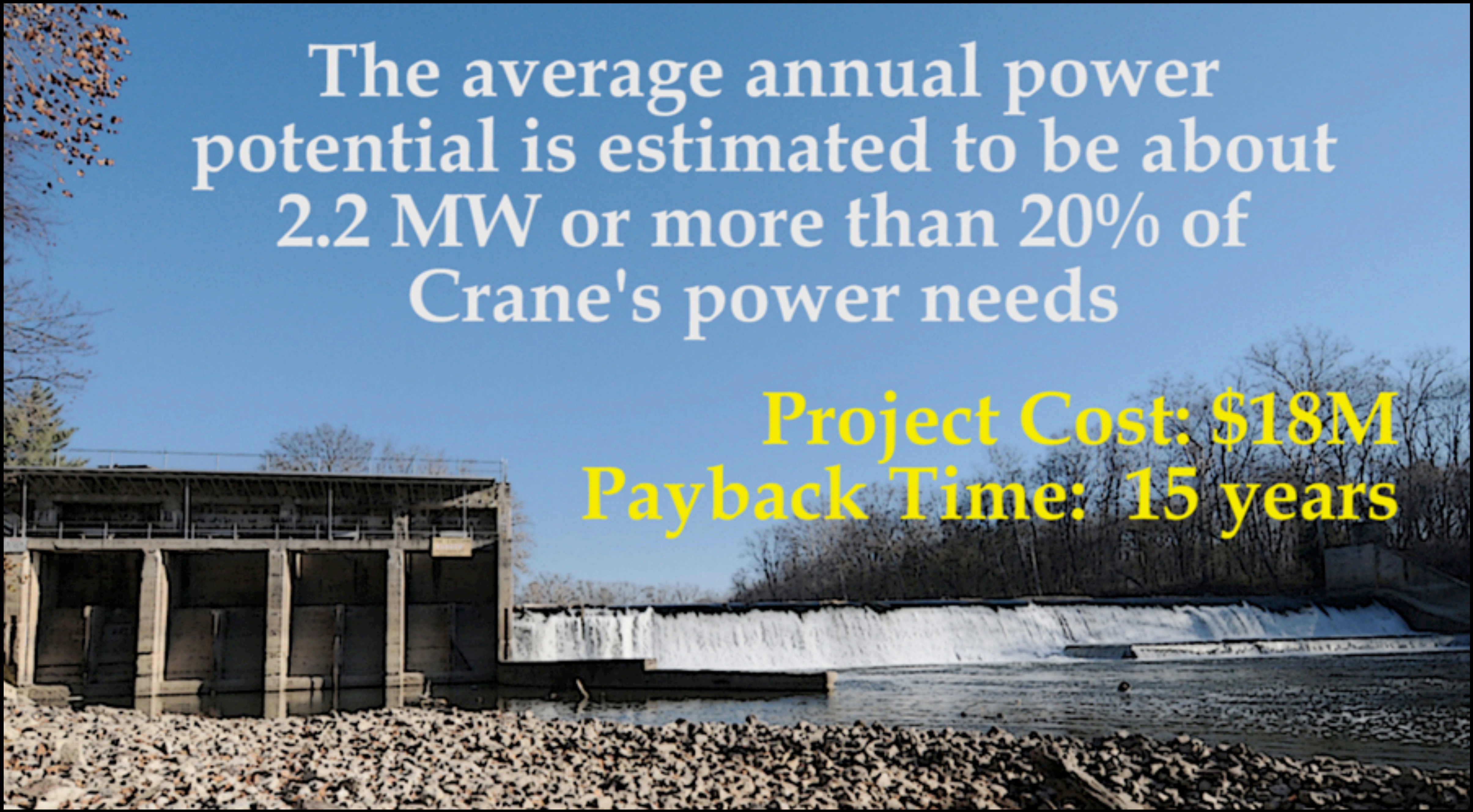
Alex R. Dzierba, Ph.D.
alex.dzierba@urs.com

Reactivation of the Hydropower Facility at Williams Dam



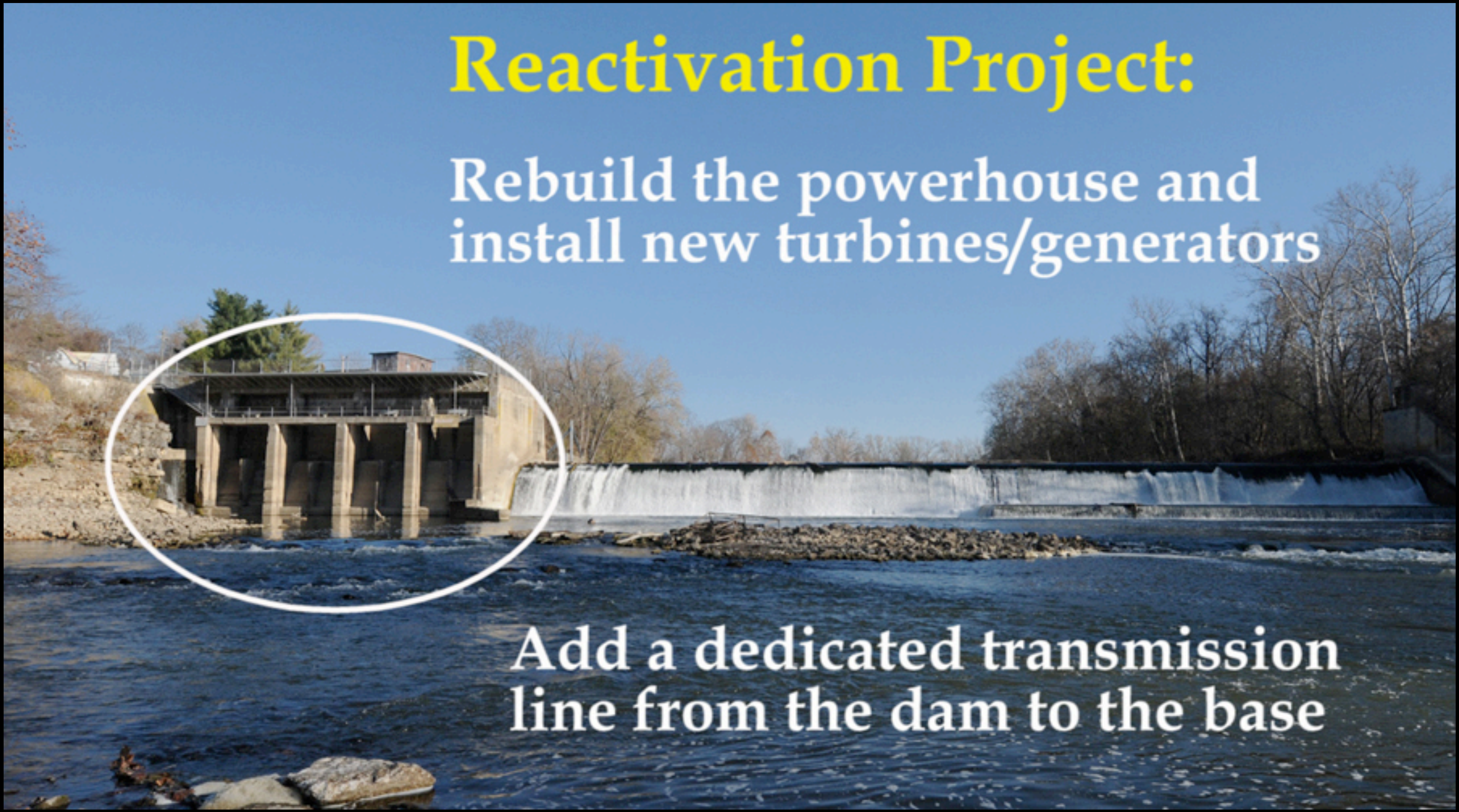
Alex R. Dzierba, Ph.D.
alex.dzierba@urs.com

Reactivation of the Hydropower Facility at Williams Dam



Alex R. Dzierba, Ph.D.
alex.dzierba@urs.com

Reactivation of the Hydropower Facility at Williams Dam



Alex R. Dzierba, Ph.D.
alex.dzierba@urs.com

Reactivation of the Hydropower Facility at Williams Dam

Environmental Benefit

Estimated annual reduction in CO_2 emissions:

18,000 tons

Alex R. Dzierba, Ph.D.
alex.dzierba@urs.com

URS Hydropower Capabilities

Alex R. Dzierba, Ph.D.
alex.dzierba@urs.com

The Possibility of Using High Temperature Superconducting Generators in Williams Dam

High temperature superconductors allow for a new family of efficient generators (for hydro and wind) and motors. The Navy is particularly interested in the latter for ship propulsion.

Williams Dam, outfitted with HTS generators, would be the first hydropower plant in the world outfitted with superconducting technology and would allow the Navy to do R&D studies.

A prototype HTS generator has been installed in a run-of-river plant in Hirschaid Germany. We are in discussions with Zenergy and CONVERTEAM to follow progress.

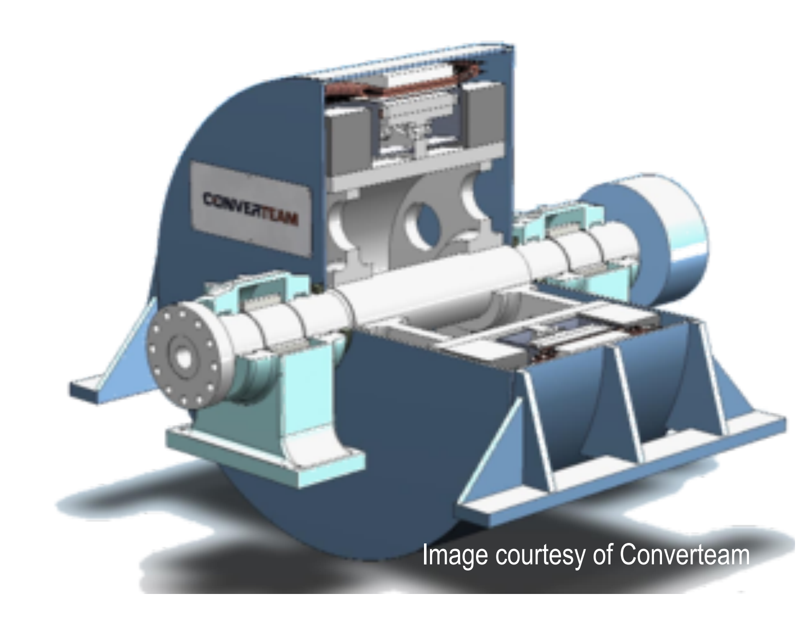


Image courtesy of Converteam

Zenergy Power GmbH
The Superconductor Energy Technology Company

CONVERTEAM
THE POWER CONVERSION COMPANY

Alex R. Dzierba, Ph.D.
alex.dzierba@urs.com

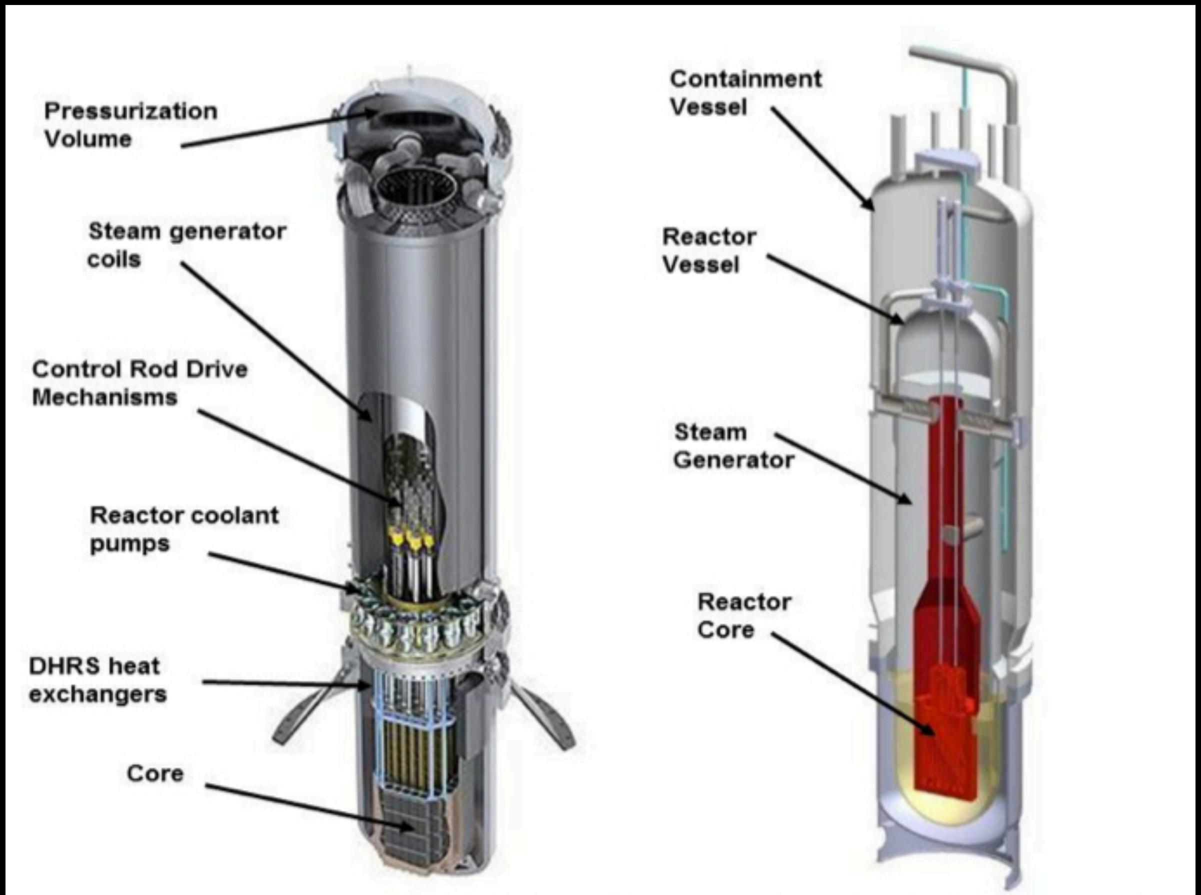
Possible Use of Small Modular Reactors to Provide Power for DOD Installations in Indiana

Briefings/Meetings at Crane, Camp Atterbury and Muscatatuck

SMRs are self-contained nuclear reactors that are sized to be smaller than conventional 1 GW nuclear power reactors by a factor of 10 to 100.

They are to be completely assembled and fueled at a factory and transported to their host site by boat, rail or truck.

At the host power generation site the SMR is buried and the output steam is used for generating electricity or process steam.



mPower (Babcock & Wilcox) 125 MWe

NuScale (NuScale) 45 MWe

Alex R. Dzierba, Ph.D.
alex.dzierba@urs.com

Electricity Generation in the U.S.

Source	% Capacity	% Generated
Natural Gas	40	22
Coal	32	47
Petroleum	6	2
Hydroelectric	10	6
Nuclear	10	20
Other	3	3

Source: U.S. Energy Information Administration

The U.S. generates twice as much electricity via nuclear energy as France

Alex R. Dzierba, Ph.D.
alex.dzierba@urs.com

Inherently Safe Reactor Modules

NuScale Power

Natural Convection for Cooling

- Inherently safe natural circulation of water over the fuel driven by gravity
- No pumps, no need for emergency generators

Seismically Robust

- System is submerged in a pool of water below ground in an earthquake resistant building
- Reactor pool attenuates ground motion and dissipates energy

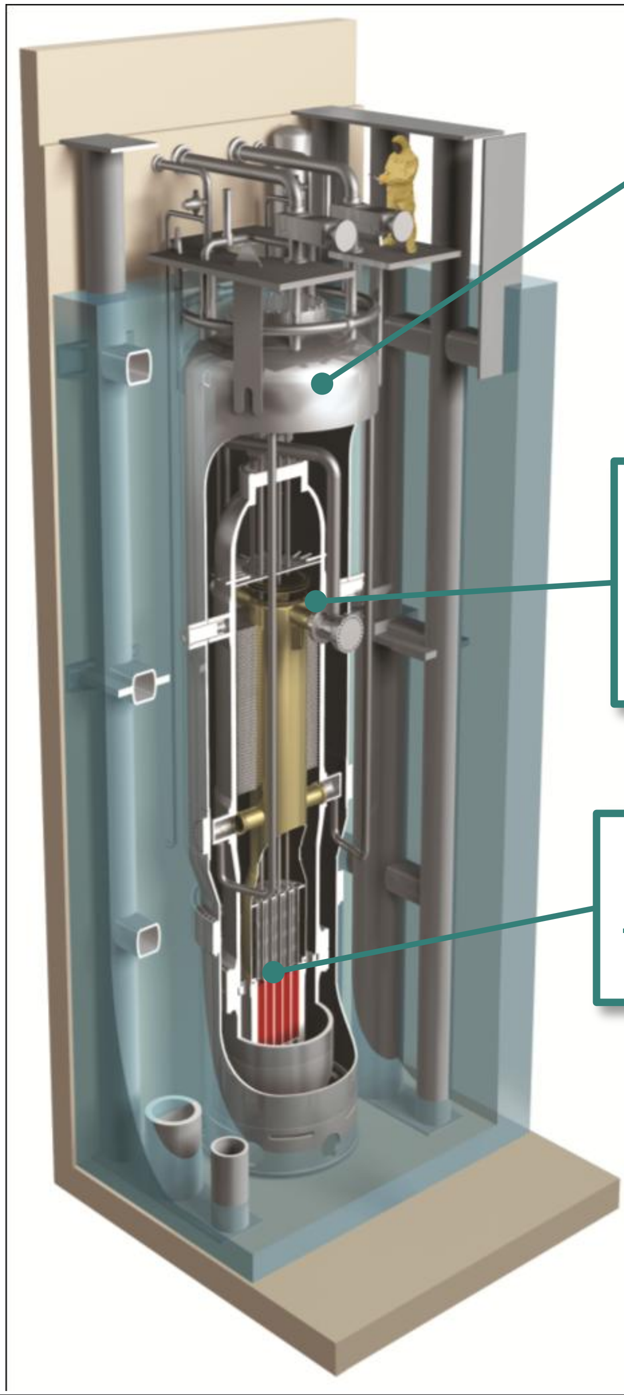
Simple and Small

- Reactor is 1/20th the size of large reactors
- Integrated reactor design, no large-break loss-of-coolant accidents

Defense-in-Depth

- Multiple additional barriers to protect against the release of radiation to the environment

45 MWe Reactor Module



High-strength stainless steel containment *10 times stronger* than typical PWR

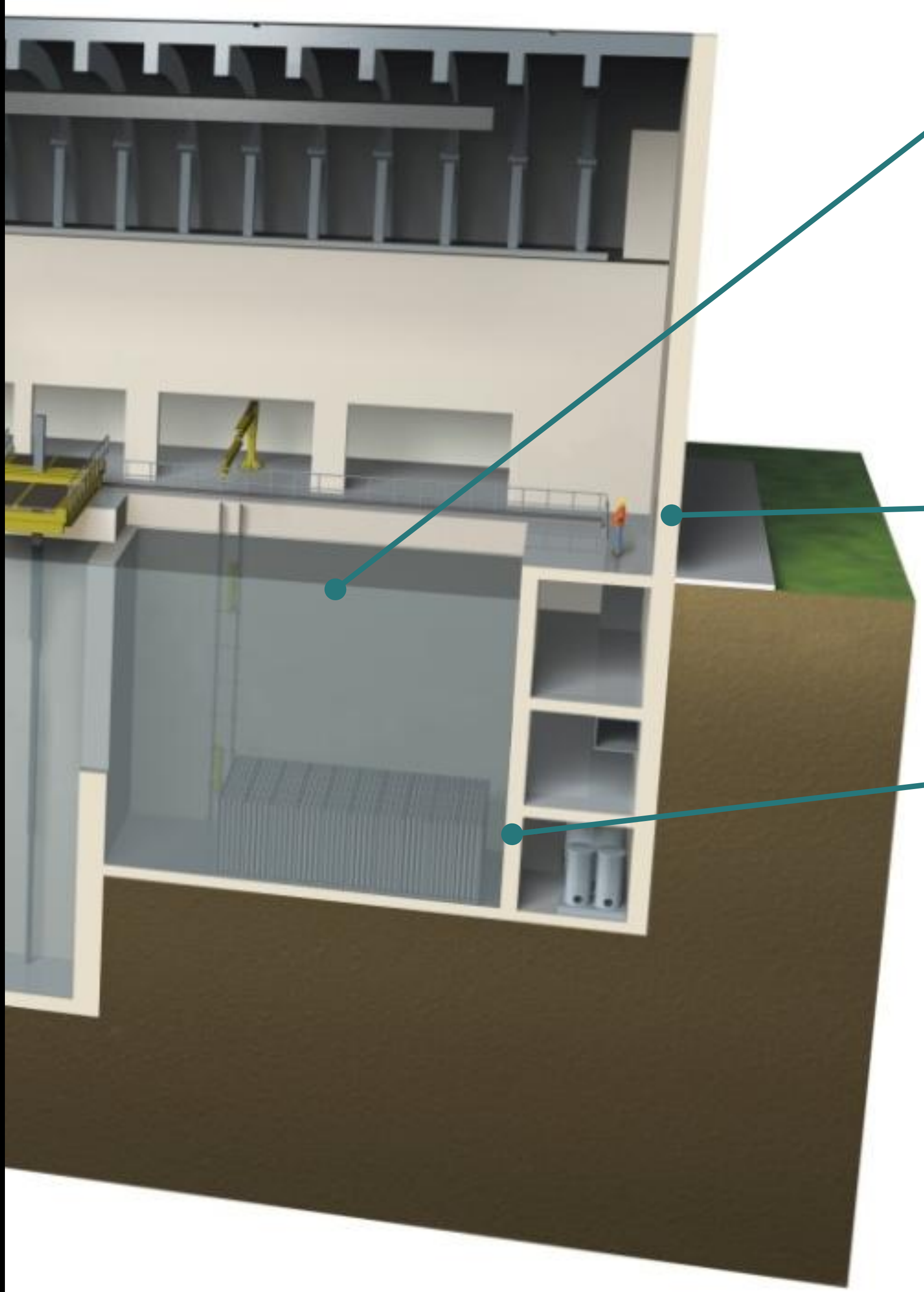
Water volume to thermal power ratio is *4 times larger resulting in better cooling*

Reactor core has *only 5% of the fuel* of a large reactor

Alex R. Dzierba, Ph.D.
alex.dzierba@urs.com

Spent Fuel Pool Safety

NUSCALE POWER



Increased Cooling Capacity

- ***More water volume for cooling per fuel assembly*** than current designs
- ***Low Density Spent Fuel Racks*** permit air cooling in the event of loss of coolant
- Redundant, cross-connected reactor and refueling pool heat exchangers provide full back-up cooling to spent fuel pool.
- Stainless steel refueling ***pool liners are independent from concrete structure to retain integrity***

External Coolant Supply Connections

- Auxiliary ***external water supply connections are easily accessible*** to plant personnel and away from potential high radiation zones

Below Ground, Robust Deep-Earth Structure.

- Below ground spent fuel pool is housed in a ***seismically robust reactor building***
- Pool wall located underground is ***shielded from tsunami wave impact and damage***
- ***Construction of structure below ground in engineered soil limits the potential for leakage***

Babcock & Wilcox

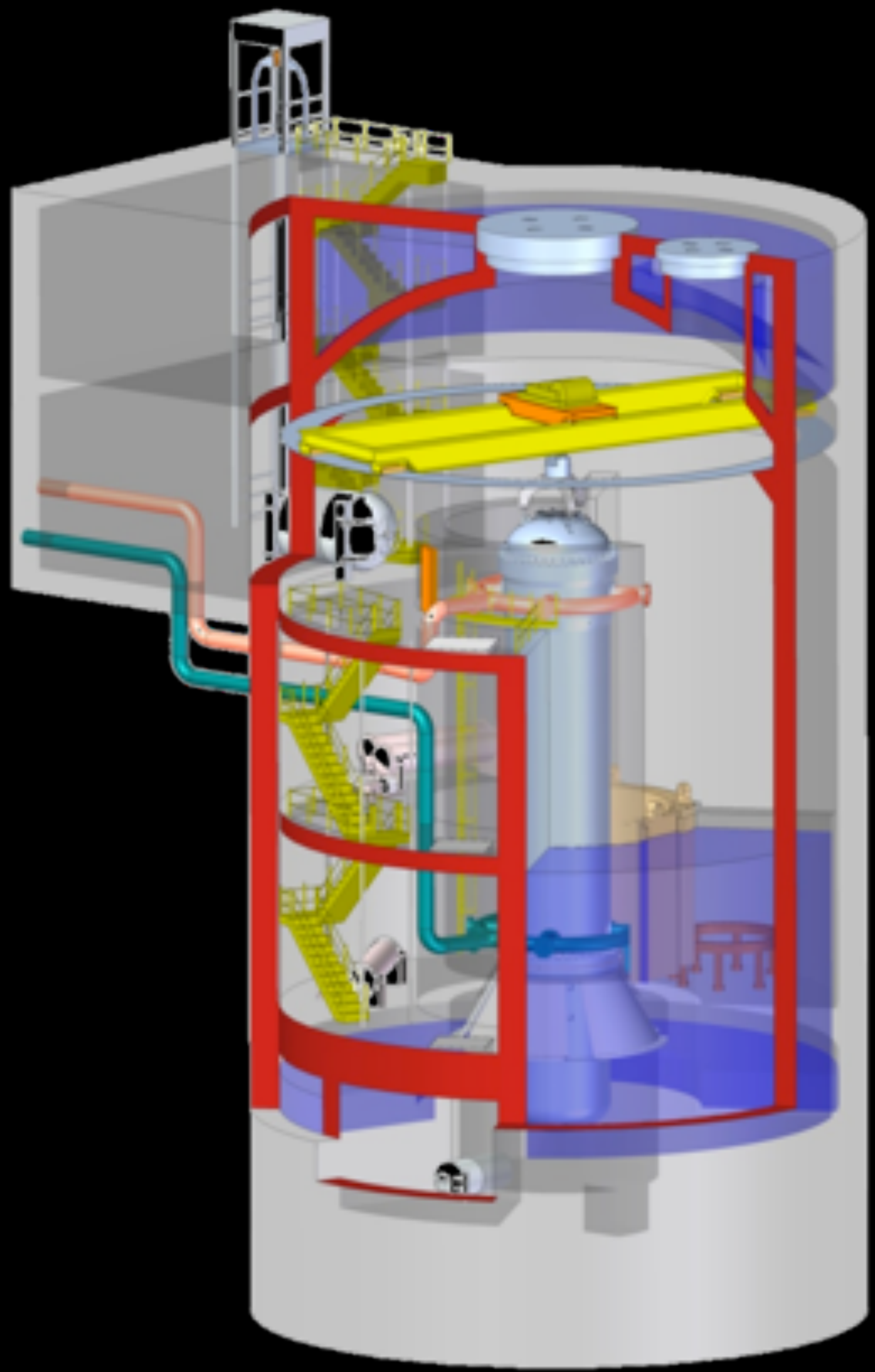
– Underground containment

– Used fuel stored in spent fuel pool for life

– Natural circulation decay heat removal system for emergency/refueling cooling

– Primary coolant treatment system within containment

– Steam generator inspection within containment



www.babcock.com/products/modular_nuclear

1. Visited B&W's Mt. Vernon facility
2. Exploratory discussions.
3. More discussions to follow.

Alex R. Dzierba, Ph.D.
alex.dzierba@urs.com

A New Approach - SMRs

Physically smaller components

- Eliminate or reduce number of large forgings
- More in-factory fabrication; less site-assembly
  - Reduce schedule uncertainty
  - Improves safety
  - Reduces cost (as much as 8-fold)
- Reduce size and weight for easier transport to site

Smaller plant footprint

- Place nuclear system further below grade to improve resistance to external events and sabotage.

Passive safety system

- Does not require active intervention

Alex R. Dzierba, Ph.D.
alex.dzierba@urs.com

SMR Study Group

First Meeting - June 13 at Camp Atterbury

Brigadier General Omer Clifton (Clif) Tooley - Commanding General Camp Atterbury and Muscatatuck

Captain Charles LaSota - Commander NSWC Crane

R. Joseph Rathz, Jr. - Assistant Master Planner Camp Atterbury

Eric Koch - State Representative

Brandon Seitz - Director of Energy & Defense Development - Lt. Governor's Office

Emmy Hildebrand - Office of Senator Richard Lugar

Dr. Ahmed Hassanein - Professor and Head of Nuclear Engineering Purdue U

Dr. David Koltick - Professor of Physics Purdue U

Dr. Roger Pynn - Professor of Physics Indiana U

Dr. J.C. Randolph - Professor School of Public and Environmental Affairs (SPEA) Indiana U

Jack Mulligan - Director of Nuclear Technologies and Programs at URS

John Clark - Adjunct Professor SPEA Indiana U

David Reece - Director of Crane Technology Inc and former Executive Director NSWC Crane

Dr. Alex Dzierba - Physicist at URS and Professor of Physics Emeritus at Indiana U

ASNE Global Deterrence & Defense Symposium 2011

Bloomington, Indiana September 13-14, 2011

Panel Discussion on Small Modular Reactors

Panelists

Dr. David Koltick (Purdue)
State Representative Eric Koch
Jack Mulligan (URS - Nuclear Technologies)

Moderator

Dr. Alex Dzierba (URS)

URS

Alex R. Dzierba, Ph.D.
alex.dzierba@urs.com