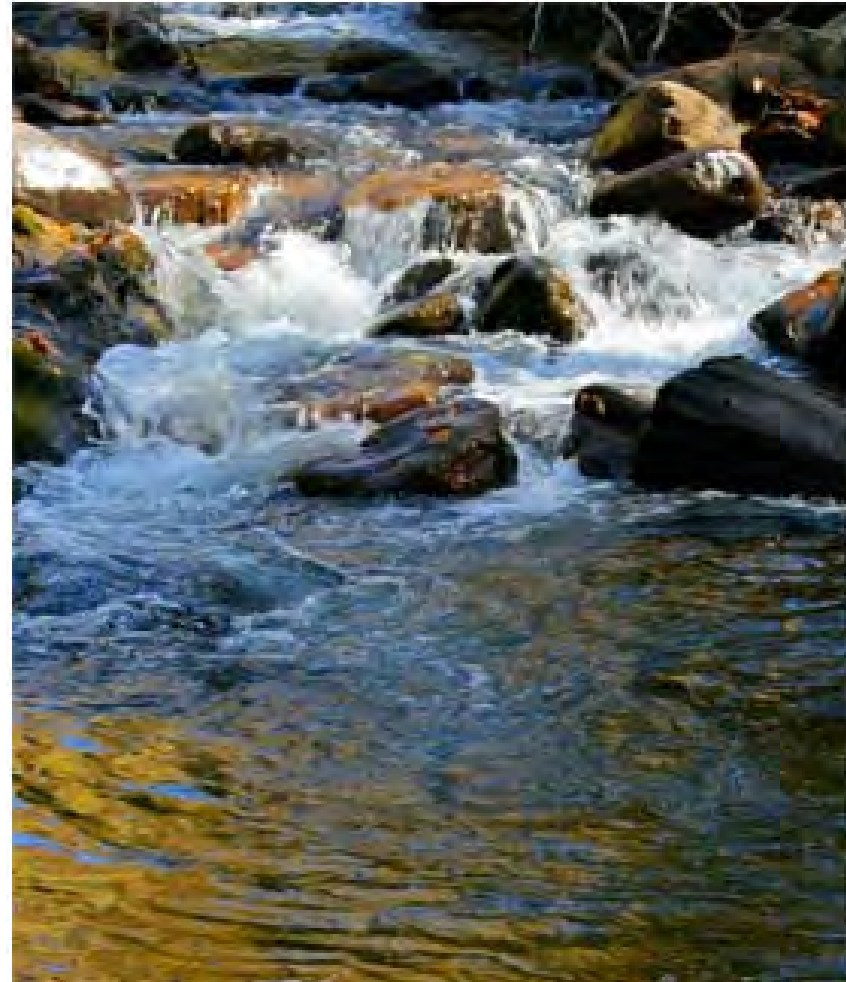


Micro-Hydropower Generation Demonstration Project for Community Education

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Environment Virginia
Symposium

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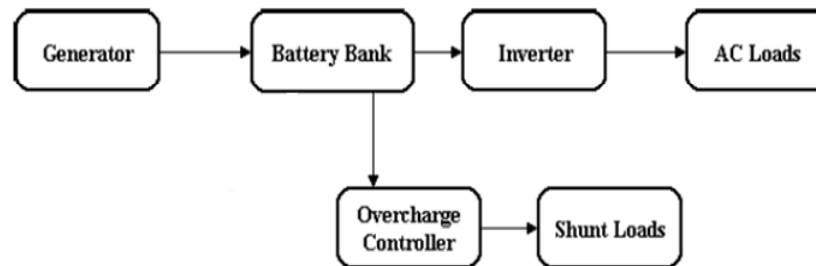


This presentation will discuss the design and installation of a micro-hydropower generation system

Background/Overview



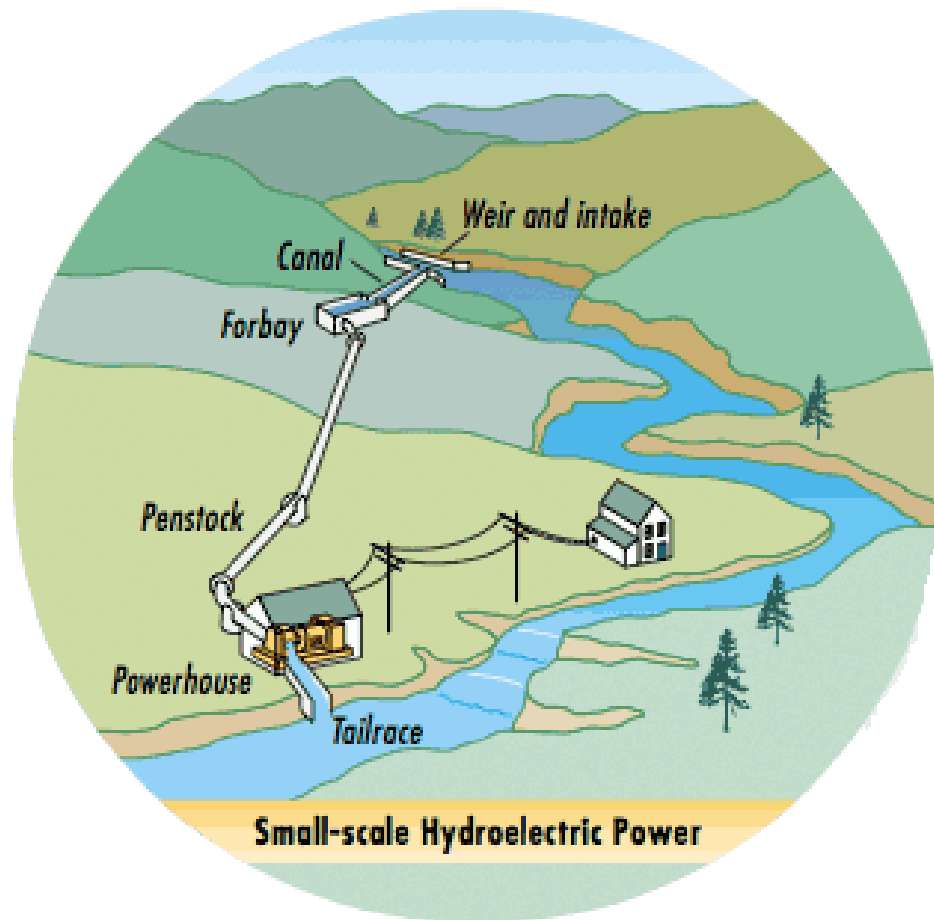
System Design



Field Installation



Hydropower is the nation's largest source of clean, domestic, renewable energy



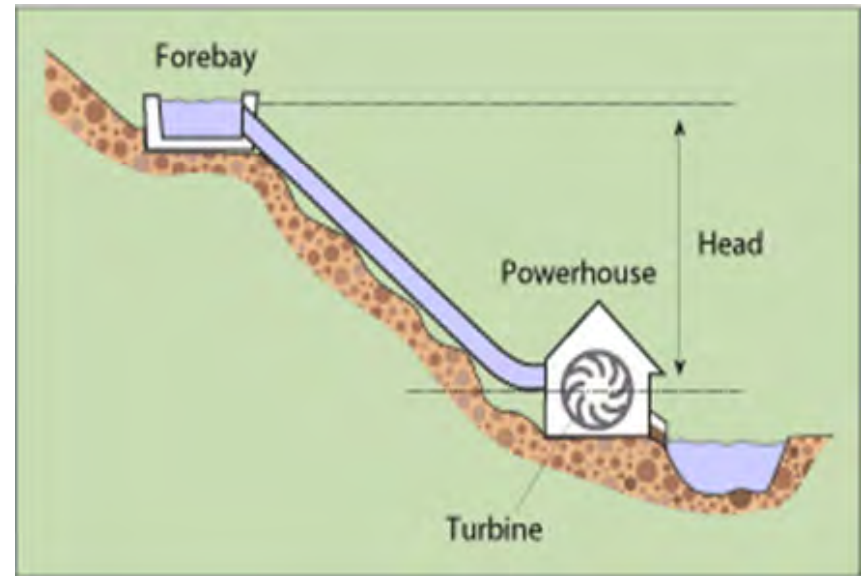
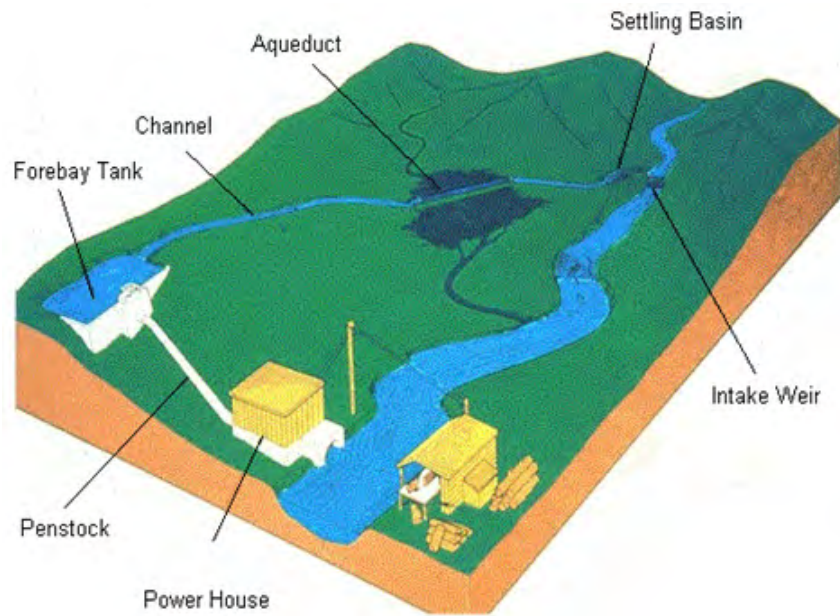
Inspiration Facts:

- Hydropower is the renewable energy source that produces the most electricity in the U.S.
- Hydropower accounted for 6% of total U.S. electricity generation in 2010

<http://energy.ltgovernors.com/microhydropower-systems-self-generation-make-your-own-power.html>



How does a micro-hydropower generation system work?



(Source: USDOE 2010)

The project site is at Glen Alton (Jefferson National Forest) where the USFS is conducting citizen educational programs



- Glen Alton is currently owned by the U.S. Forest Services
- Built in the 1930's by a wealthy banker for farming and vacation retreats
- Older model turbine has been there since 1940's



The design parameters of Glen Alton were measured using experts and proven practices

$$\text{POWER} \propto \text{HEAD} \ \& \ \text{FLOW}$$

Head- the vertical distance between the water intake and the turbine



HEAD= 21 feet

Flow- the amount (volume) of water that comes down the stream



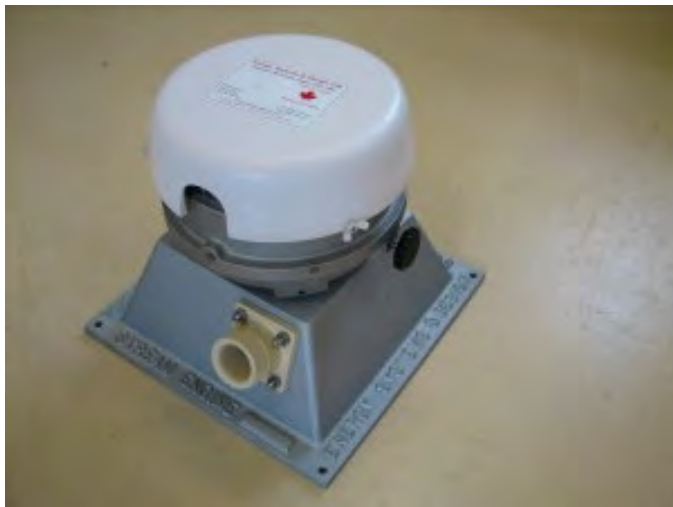
FLOW= 250gpm



The Glen Alton hydropower system is capable of generating 500 Watts (0.67 HP) continuously

Turbine Generator- Energy Systems and Design 4 Nozzle “Stream Engine”

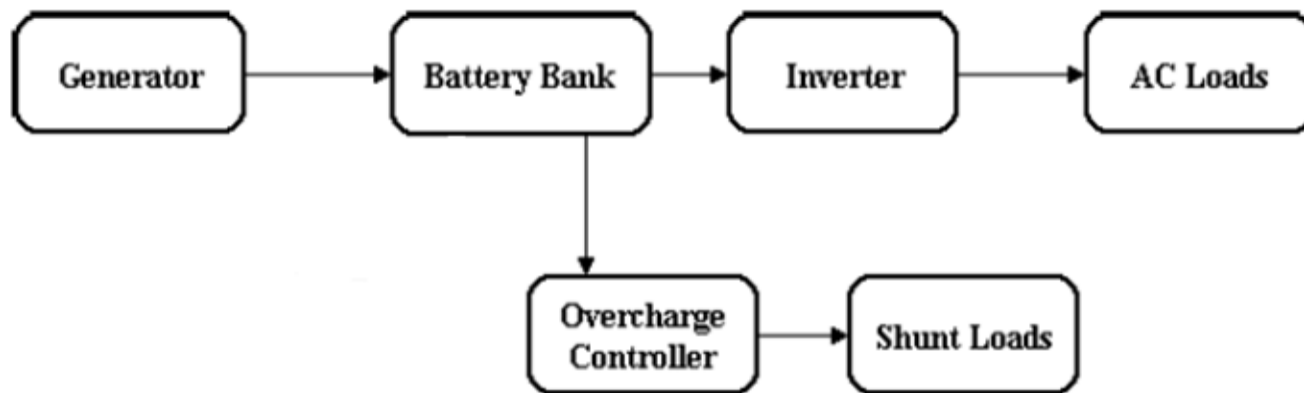
- Capable of power outputs up to 2kW
- High efficiency
- Rugged bronze *turgo wheel*
- Non-corrosive alloy parts
- Adaptable universal nozzles for wide operating range



The hydropower system is grid-tied and battery-based

Important System Design Aspects:

- 48VDC system @ 6-8 Amps
- Power use point at Glen Alton Lodge
- 200Ah battery bank (~2 days of power storage for lodge)
- Grid-tied: Virginia Net Metering Program



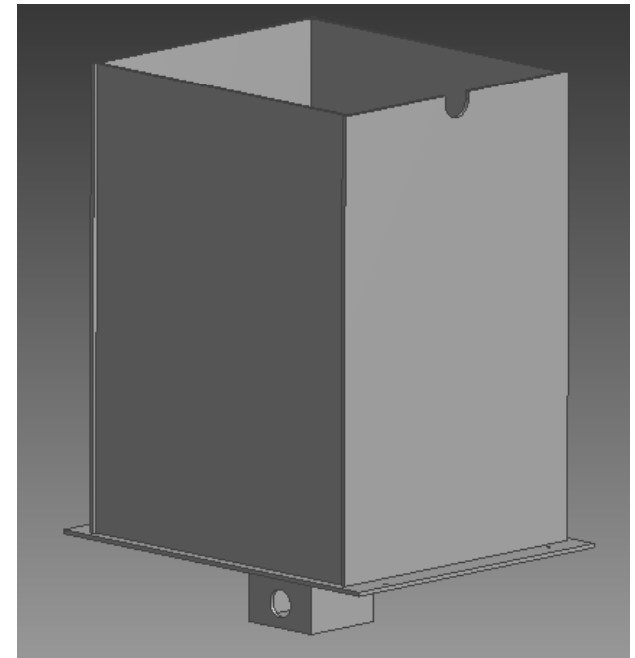
Several challenges were overcome during the design and installation phases of the project

AEP Regulations- grid-tied systems must meet *all* electrical regulations

- The DC to AC inverter must be UL 1741 compliant (signatures required)
- Labeled, lockable disconnect on AC side
- AEP engineer approval after installation is completed

Turbine Housing Issue- Creek water level frequently rises which could submerge generator unit (high water mark ~4 feet above penstock outlet)

- Option 1- Floating platform
- **Option 2- High wall watertight caisson**
- Option 3- Mount turbine above high water mark



The hydropower generation system's components are currently in the process of being installed on-site



Acknowledgments

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