Galena Nuclear Project

MY:T Solutions LLC

- 2003
  Initial contact with Toshiba

- 2004
  DOE report recommended evaluation of 4S as the Galena Energy source (Situational Analysis)
  City Counsel passed resolution to pursue siting a 4S based facility in Galena.

- 2005
  Galena's meeting with NRC
  Request funding for white papers

Galena Continued

- 2006

  White papers funding authorized by State of Alaska

  White papers completed

- 2007

  Toshiba meets with the Nuclear Energy Authority to discuss licensing the Toshiba 4S Reactor

Nuclear Energy

MY:T Solutions LLC

Questions:

1. What about 3 mile Island

3. What about Terrorists

5. What happens to the waste

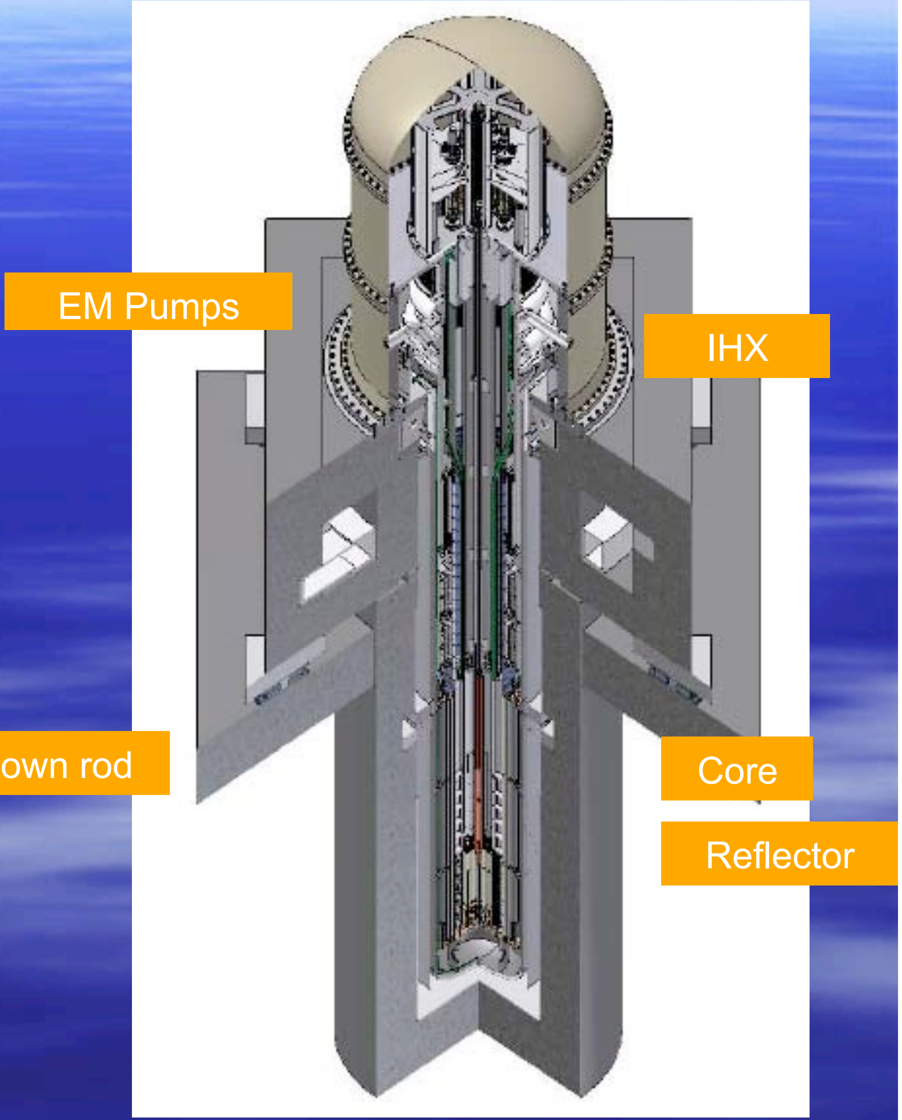
7. How do you handle an emergency

Nuclear Battery

- Battery

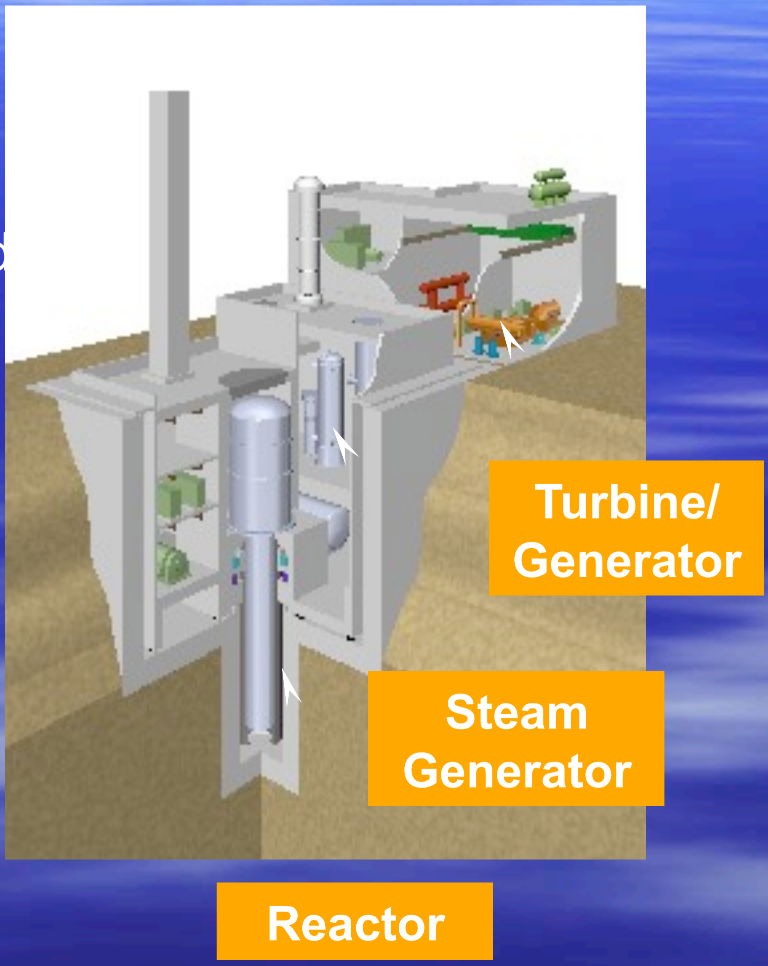
Plant Description

- **Reactor**
  - Core
    Metallic fuel core (U-10%Zr)
  - Reactivity control
    Movable reflectors
  - Shutdown system
    Shutdown rod and reflectors
  - Primary heat transport system
    - Pumps: Annular type
      Electro-magnetic (EM) pumps
    - IHX: Annular type
      intermediate heat exchanger



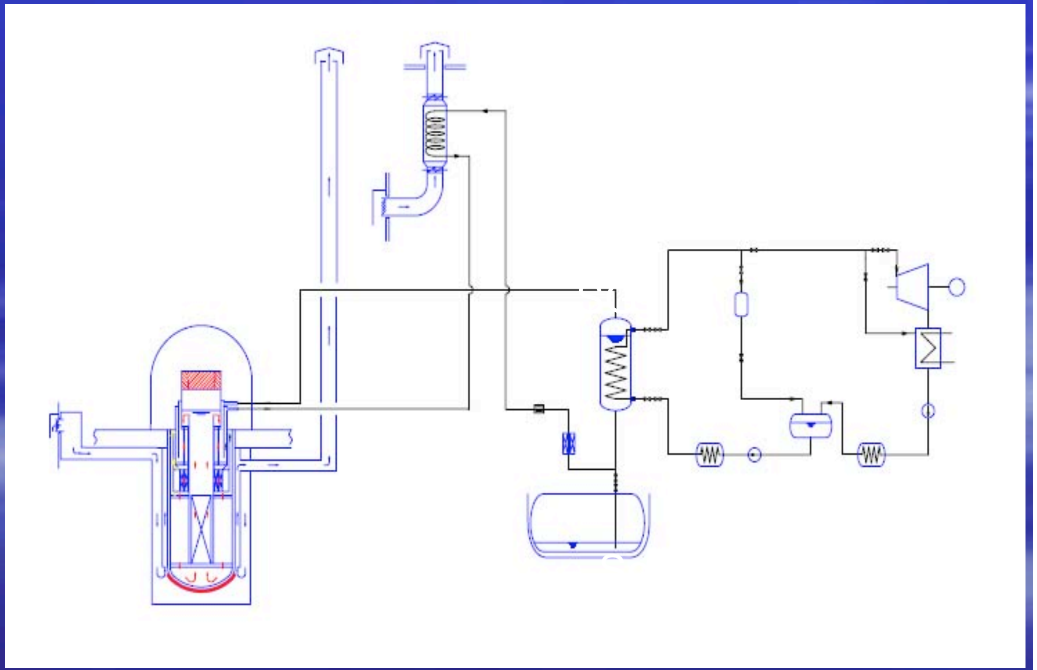
Overview

- **Sodium cooled fast reactor**
- **30 MWt (10MWe)**
- **Application**
  – Remote areas of small power demand (e.g., Galena Alaska)
  – Considered a candidate for GNEP grid-appropriate small and medium reactor design
- **Main features**
  – Passive safety
  – No onsite refueling for 30 years
  – Low maintenance requirement
  – High inherent security



Plant Description

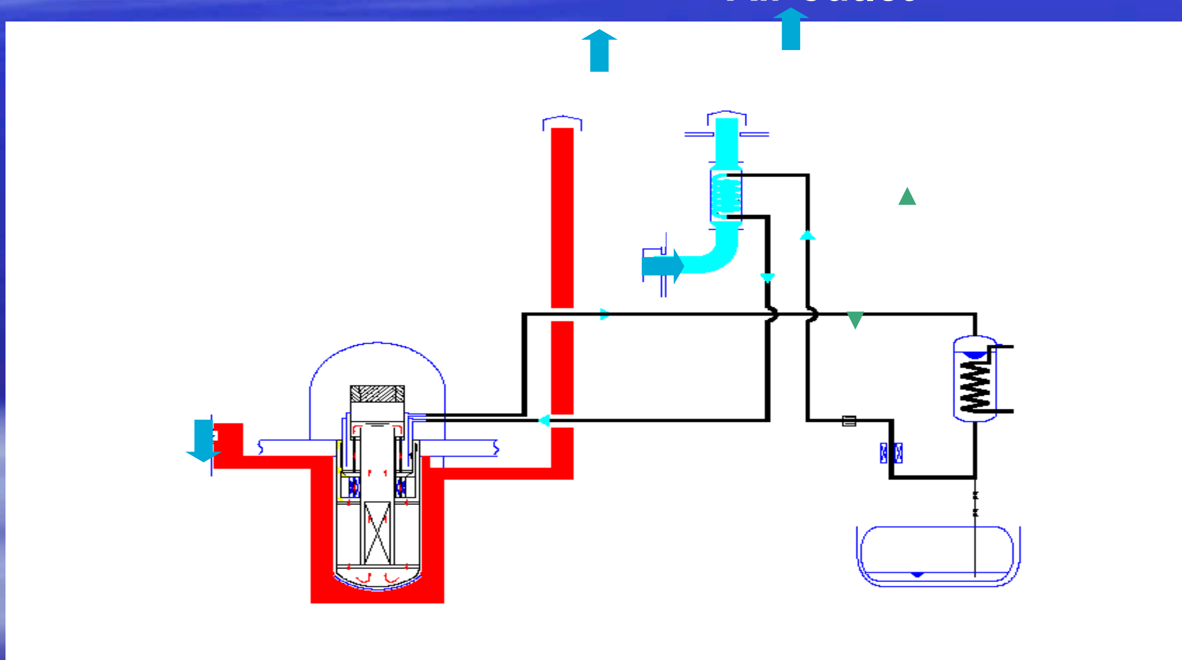
- **Heat transport systems**
  - Primary heat transport system: Inside the reactor
  - Intermediate heat transport system
    - Steam generator
    - EM pump
    - Air cooler
    - Dump tank
  - Water & steam system
    - Turbine Generator



Passive Decay Heat Removal

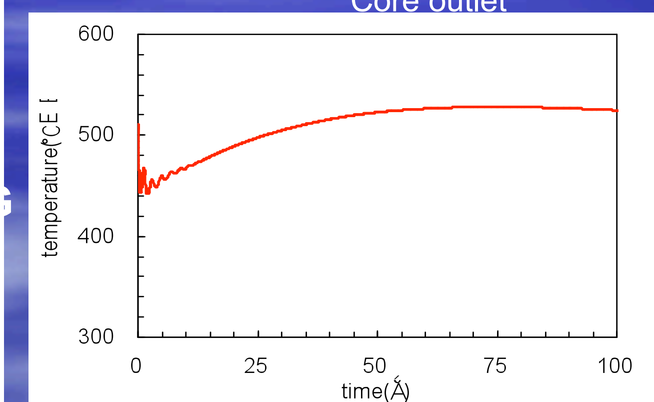
- **Heat removal by natural circulation & natural air draft**
  - RVACS: Natural air draft outside the guard vessel
    - Sufficient cooling capacity by only RVACS
  - IRACS: Natural circulation of sodium and air draft of air cooler

Air outlet **Air outlet**



r)

Core outlet



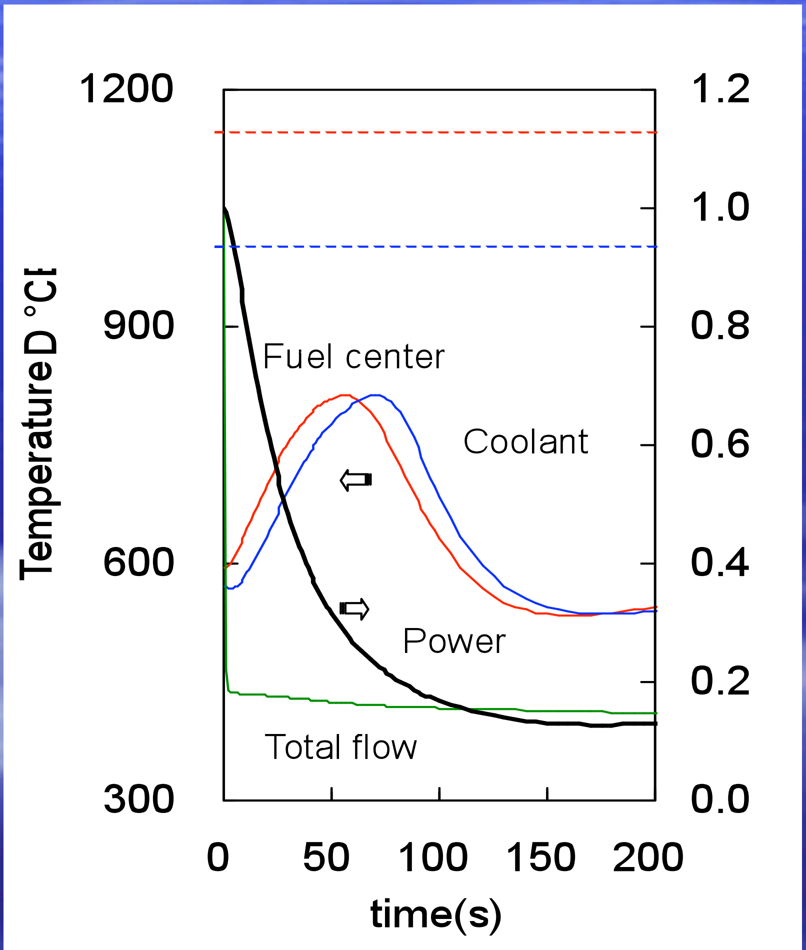
RVACS

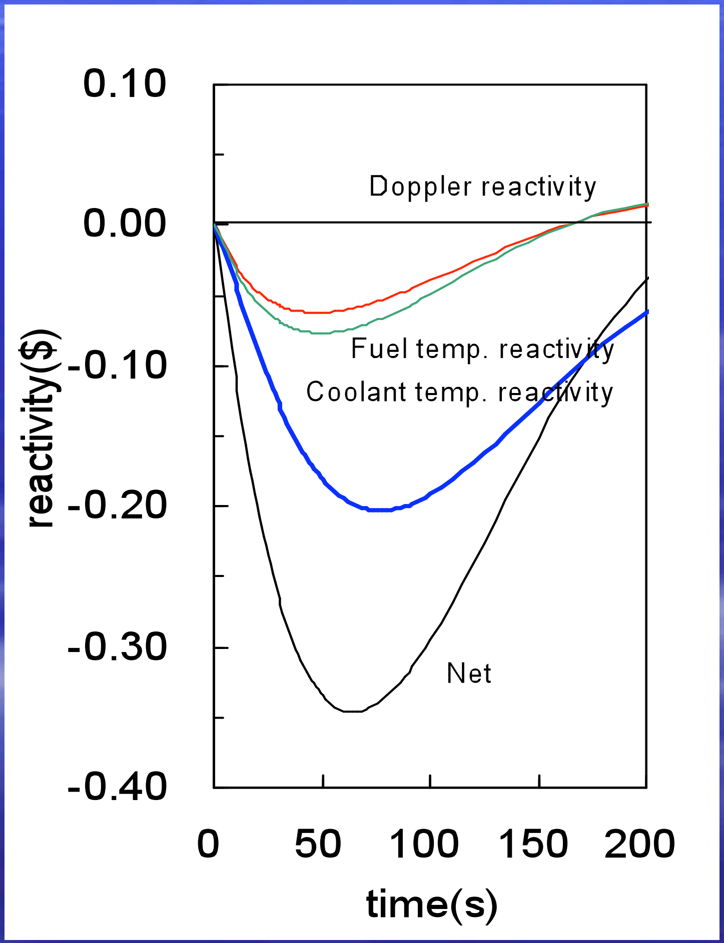
Air flow pass

Loss of offsite power
Assumption : Heat removal by only RVACS

Passive Shutdown for Unprotected Events

- Safety Analysis of Unprotected sudden loss of flow
  Large margin to coolant boiling and fuel melting





Main Design Features

- Safety Features
- Key Features of 4S
  - Passive safety
  - No onsite refueling for 30 years
  - Low maintenance requirement
  - High inherent security

Safety Features

- Low pressure system with pool design and guard vessel
- Negative coolant temperature coefficient promotes safe, stable operation.
- Large margin to coolant boiling or cladding failure
- Reliable, redundant and diverse scram systems
- Smaller excess reactivity with metallic fuel core design – limited potential for reactivity insertion accident
- Passive, reliable, and diverse shutdown heat removal systems

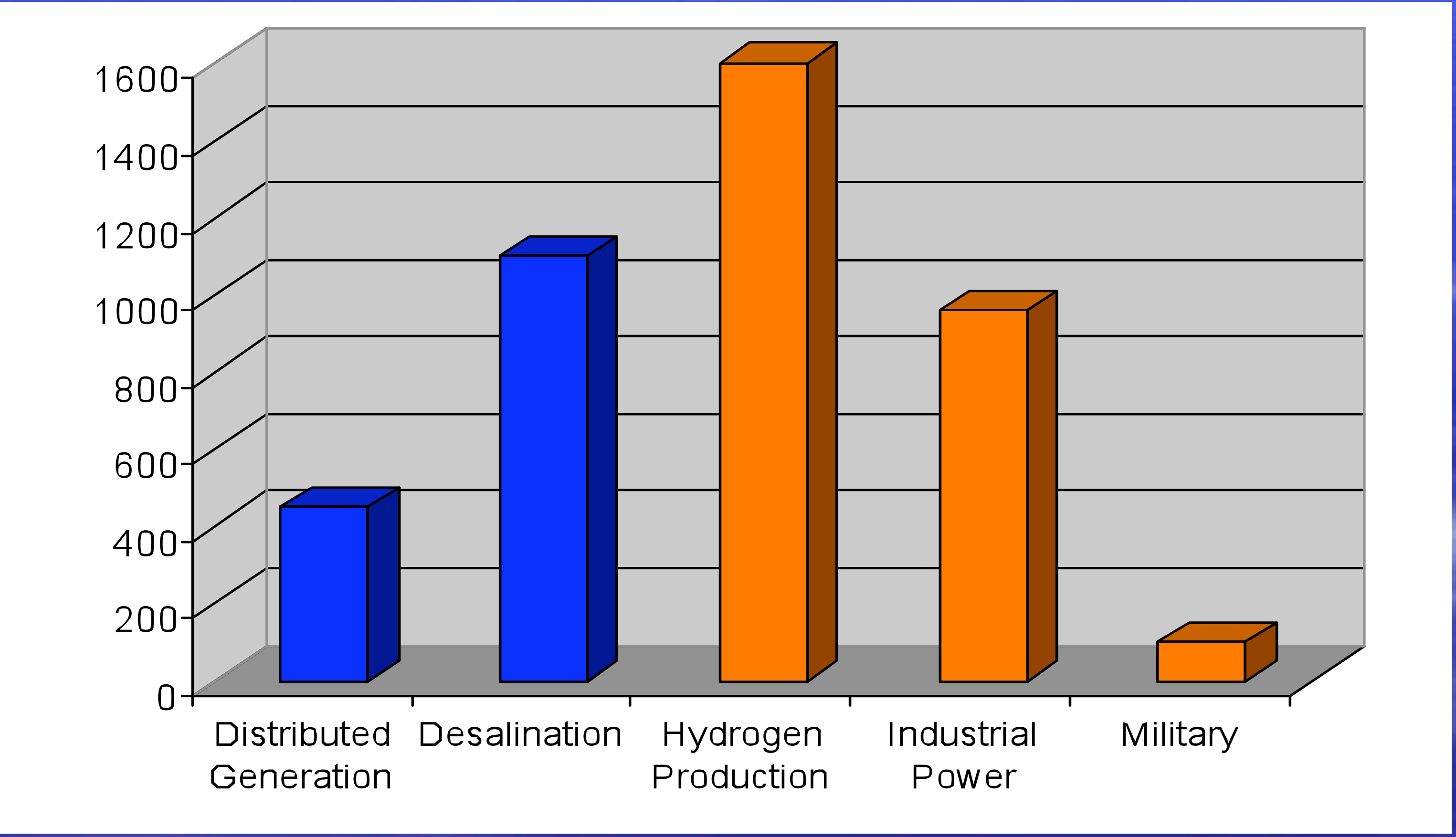
Tests to Support 4S Design

Design Feature	Verification Item	Required Testing	Status
Long cylindrical core with small diameter Reflector controlled core	Nuclear design method of reflector control core with metallic fuel	Critical experiment	Done
High volume fraction metallic fuel core	Confirmation of pressure drop in fuel subassembly	Fuel hydraulic test	Done
Reflector	Reflector drive mechanism with fine movement	Test of reflector drive mechanism	Done
RVACS	Heat transfer characteristic between vessel and air	Heat transfer test of RVACS	Done
EM pump	Structural integrity Stable characteristics	Sodium test of EM pump	Done and Planned
Steam generator (Double wall tubes)	Structural integrity Heat transfer characteristic Leak detection	Sodium test of steam generator Leak detection test	Done and Planned
Seismic isolation	Applicability to nuclear plant	Test of seismic isolator	Done

Proposed Licensing Approach

- **Submit Design Approval application in 2009**
  - **Phase 1:** Complete a series meetings with NRC to identify issues to be addressed before Design Approval application
  - **Phase 2:** Submit technical reports and obtain NRC feedbacks to address the issues identified in phase 1
  - **Phase 3:** Submit Design Approval application and obtain FSER
- **Application referencing Design Approval application Toshiba expects U.S. customer will submit a COL**

Small Reactor Market Niche Program Plan



Sample Commodity Costs – 10 Megawatts of Electricity Equivalent

Commodity	Production Rate	10 MWe Yields:	Comments
Electricity	10 MW	240,000 KW/day	
Oxygen	567 scf/ min	817,071 scf/day	Assume electrolysis process using Teledyne Titan HP generator
Hydrogen	1134 scf/ min	1,634,143 scf/day	Assumes electrolysis process using Teledyne Titan HP generator
Desalinated Water	6,381 gpm	9,188,522 gpd	Assumes Salt Water Reverse Osmosis process with 35,000 ppm TDS input and producing 350 ppm TDS output

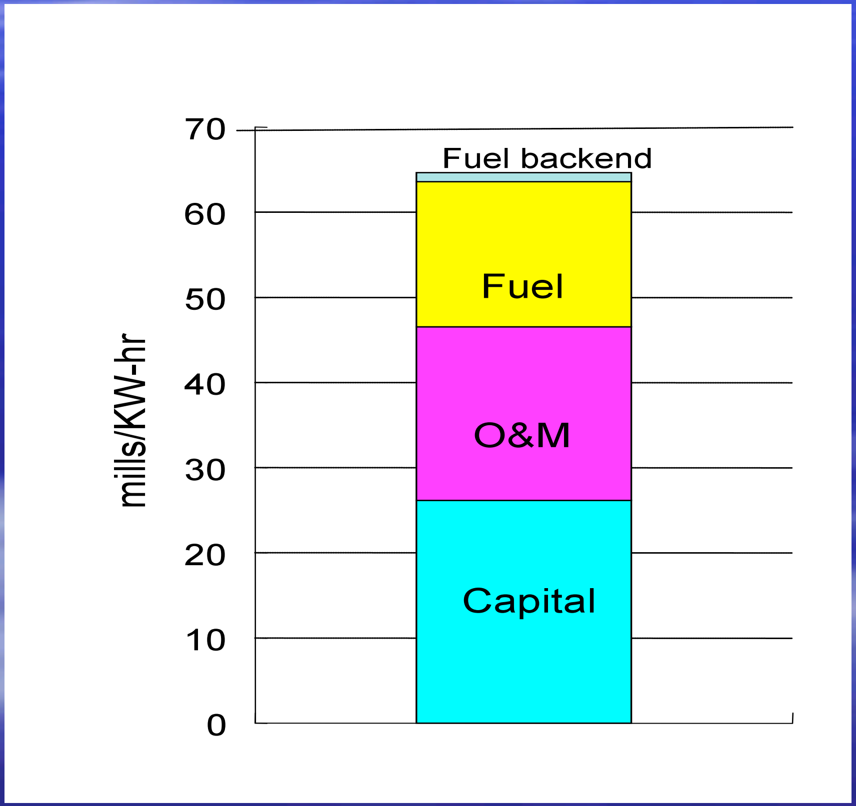
Galena Electric Power –a Situational Analysis

MY:T Solutions LLC

Nuclear: Possible Uses of Extra Power

- **Hydrogen Production**
- **Greenhouses**
- **Aquaculture**
- **Galena as a test-bed**
- **Transmission to Neighboring Villages**
- **Increased use by consumers**
- **District Heat**

4S Preliminary Cost Estimate



- 50MWe (135MWt) :
  10 MWE variant
- Commercial plant
  (mass production phase)
- Plant Construction:
  $ 2,500 $3,000/KWe

  Busbar Cost:
  $.065 mills-$.070 /KW-hr*

MY:T Solutions LLC

GNEP

The Global Nuclear Energy Partnership

Greater Energy Security in a Cleaner, Safer World

President George Bush

GNEP Reprocessing

- Spent fuel rods

GNEP Element Demonstrate Small Scale Reactors

MY:T Solutions LLC

- In order to expand the use of nuclear energy in these small electricity markets, a small reactor is preferred for small electricity grids. These reactors will be safe, simple to operate, more proliferation-resistant, and highly secure.

  How the reactors would work

  Small, more proliferation-resistant reactors could incorporate features that would … include fuel designs that offer very long-life fuel loads (that last the entire life of the reactor); effective… safeguards … to promote non-proliferation; potential for district heating and potable water production; fully passive safety systems; simple operation that requires minimal in-country nuclear infrastructure; use of as much existing licensed or certified technology as possible; and use of advanced manufacturing techniques.

Mohamed ElBaradei

One potential strategy is to construct hundreds of mini-nuclear power plants that would each serve a single village, said ElBaradei. These plants would be less expensive than their full-size counterparts and could be set up without a need for an extensive power grid. In addition, the small-scale plants could be made with sufficient safety features to prevent meltdown and theft. This includes a passive cooling system that works even if power is shut down, said researchers this summer at Argonne National Laboratory. The reactors could also run for 30 years without the need to refuel, and any theft would require the use of large and conspicuous gear that could be visible by satellite, according to Argonne's senor technical advisor David Wade.

Nobel laureate Mohamed ElBaradei, director general of the International Atomic Energy Agency, gave this year's David J. Rose Lecture on "Nuclear Technology in a Changing World: Have We Reached a Turning Point?" Photo / Donna Coveney

Why Nuclear??

MY:T Solutions LLC

Remember the 1970's??

- Long gas lines
- High Gas prices
- Emphasize Alternative energy
- Domestic vs Oil Imports
- Global Cooling

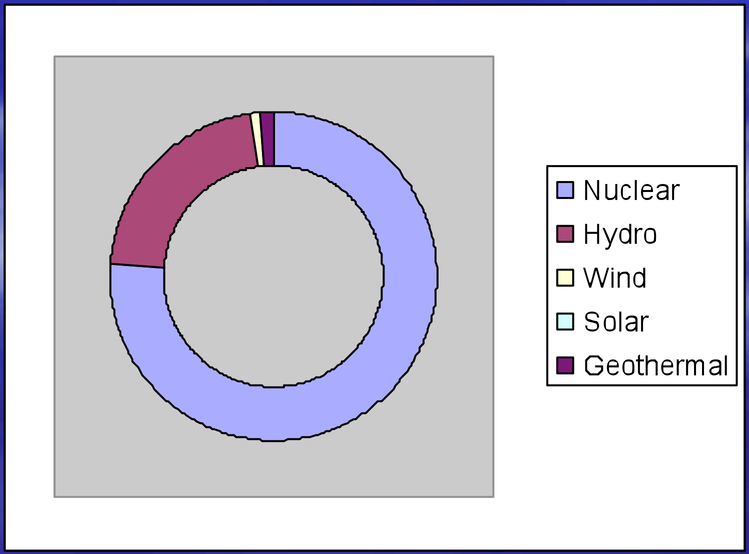
Where Will the Hydrogen Come From?

MY:T Solutions LLC

	Natural Gas	Nuclear	Solar	Wind	Biomass	Coal
Facilities	777,000	2,000 x 600mgw	113 mil x 40kw	1 mil x 2mgw	1.5 bil tons	1 bil tons
Cost	$I Trillion	$840 Billion	$22 Trillion	$3 Trillion	$565 Billion	$500 Billion
CO_2 Emissions	300 Million tons	0	0	0	500 million tons	500 million tons
Cost per Gal Gasoline Equivalent	$3.00	$2.50	$9.50	$3.00	$1.90	$1.00

Emission Free Energy in the United States

Nuclear	Hydro	Wind	Solar	Geothermal
76.20%	21.60%	0.70%	0.10%	1.40%



Vision for the future

MY:T Solutions LLC

- The natural gas pipeline,
- Geothermal development at Mt Spurr,
- Hydroelectric projects,
- Wind projects,
- Nuclear power
- Coal to liquid project

Conclusions

- Nuclear Power -50 years without a fatality
- Secure 19% enrichment -non weapons grade
- Burner Reactor -uses reprocessed fuel
- Auto shut down -no operator error

Toshiba 4S Project

- Thank you

Marvin Yoder

907 227-7158

marviny59@gmail.net