Conducting Analysis of Alternatives for Directed Energy Systems

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Counter-Electronics Program

Objectives:
Support the Counter-Electronics program in supporting an Analysis of Alternatives to produce the most effective CE solution

Evaluation Factors

- Functional Defeat Effectiveness
- Non-Lethal
- Assurance of Kill /BDA
- Collateral Effects
- Mission Survivability

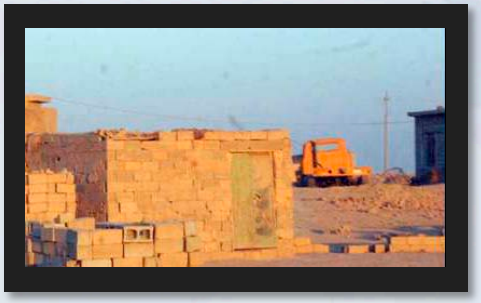
Example Study Approach

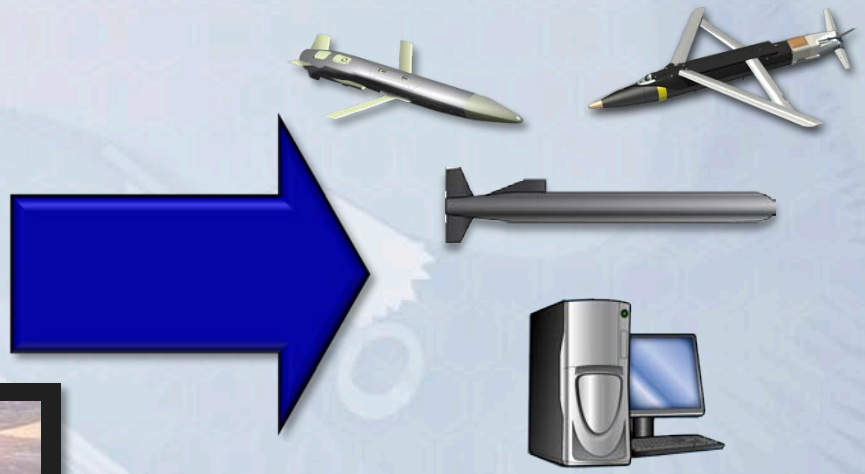
1. Define and Characterize Operational Target Set

- Buildings
- Bunkers
- WMD
- Power Distribution / Transmission
- POL Facilities
- Vehicles
- Etc…

2. Define Weapon System Concepts

- CE Missile
- CE Bomb
- CE UAS
- Kinetic Weapon Systems
- IO Technique
- Etc…





Example Study Approach

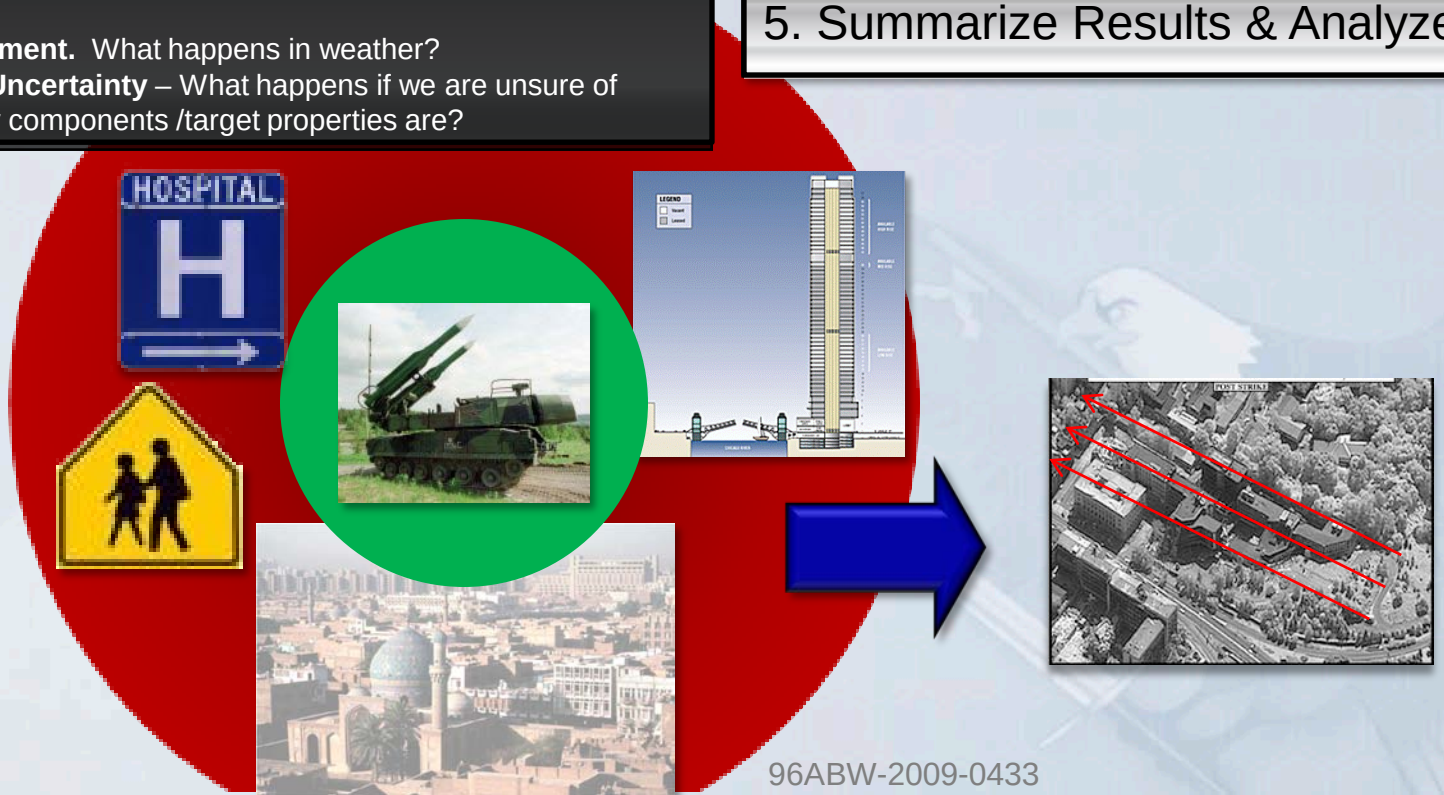
3. Define Criteria, Tactical Considerations and Measures of Effectiveness

- **Effectiveness**. What is P_K? P_{degrdn}
- **Assurance**. How do you know its dead / Damage Assessments
- **Collateral Damage**. What are effects on Schools/Hospitals – Reconstruction Costs
- **Mission Survivability**. Will the platform get to the target range?
- **Environment.** What happens in weather?
- **Target Uncertainty** – What happens if we are unsure of where key components /target properties are?

4. Sensitivity Analysis

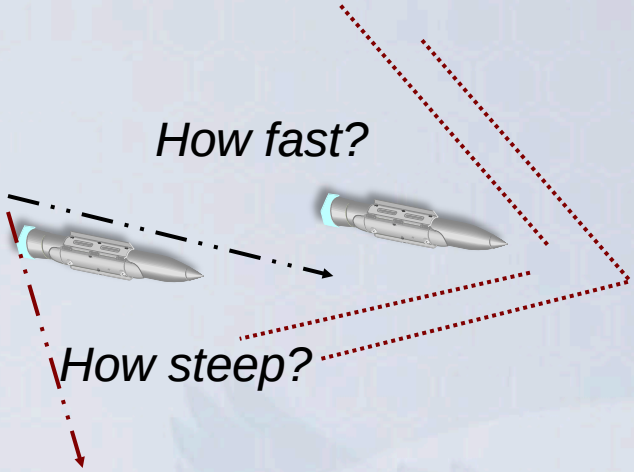
- Range to target – How close do we need to get?
- Attack geometry – Azimuth, etc
- Target Construct – Materials, Rebar,
- Target Layout – Windows, Doors, Computer, C2 , power, HVAC location
- Environment – Humidity, rain, temperature, etc

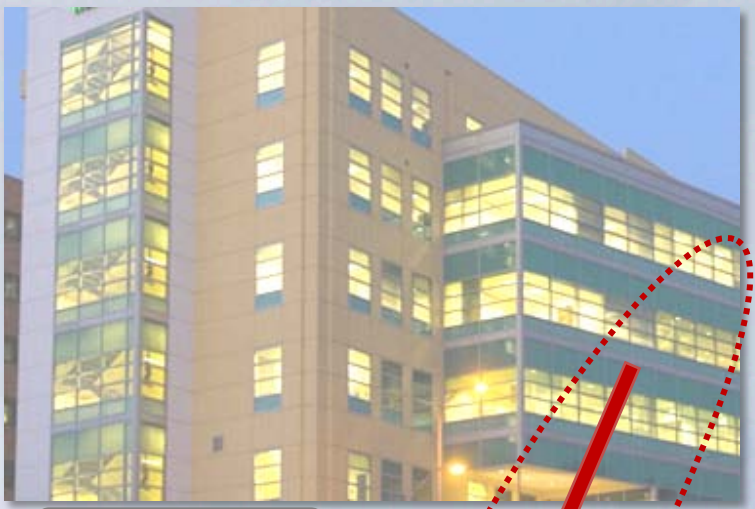
5. Summarize Results & Analyze

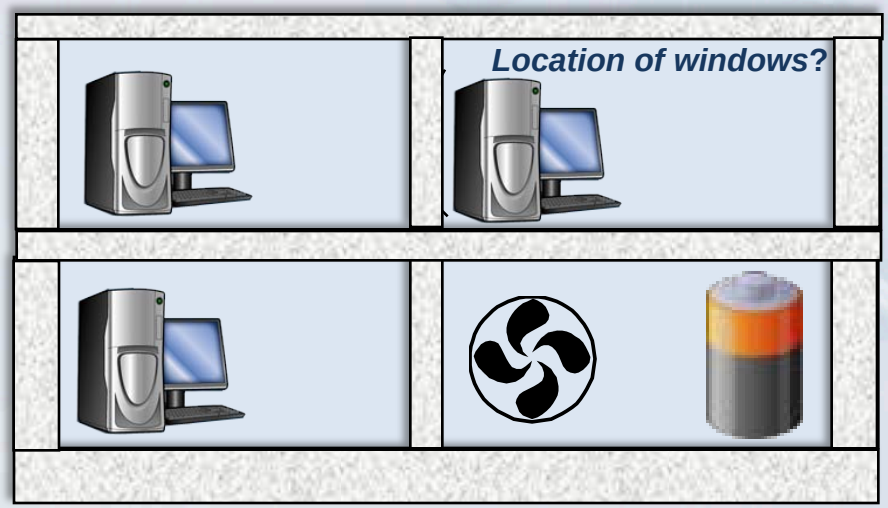


Weapon & Building Characteristics

Construction Practices

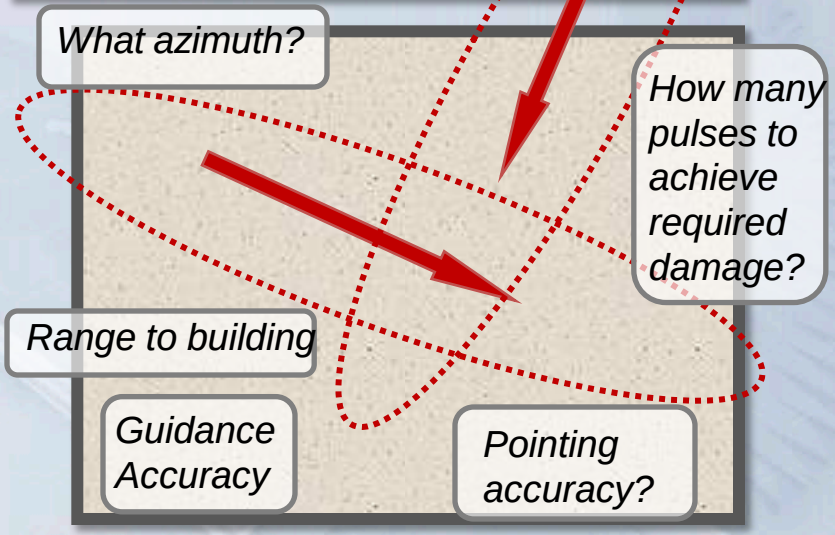






How Compartmented? Internal Structure?

Side View

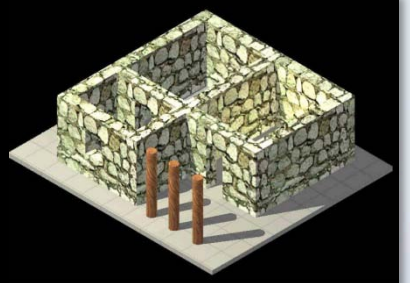


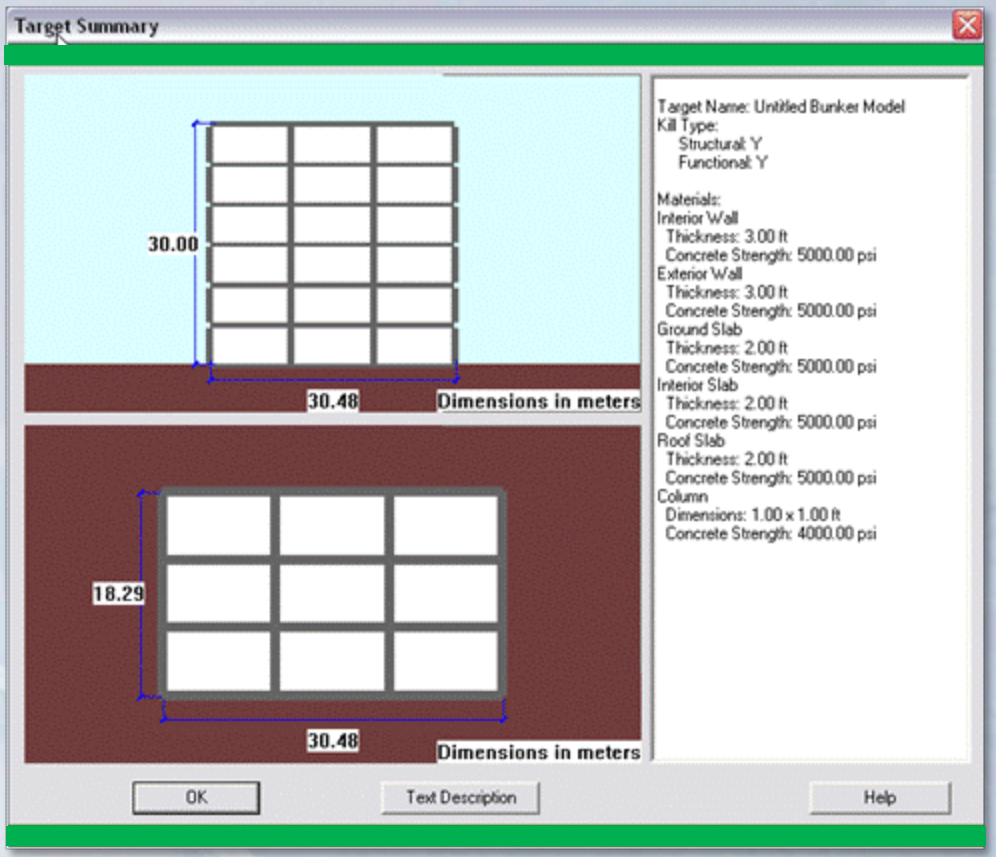
Top View

Detailed Target Information

Detailed target models :

- Window/Doors Location
- Computers Type / Layout
- Communications Type / Layout
- HVAC Type / Layout
- Power Type / Layout
- Wall Materials
- Roof Materials
- Rebar Configuration
- etc



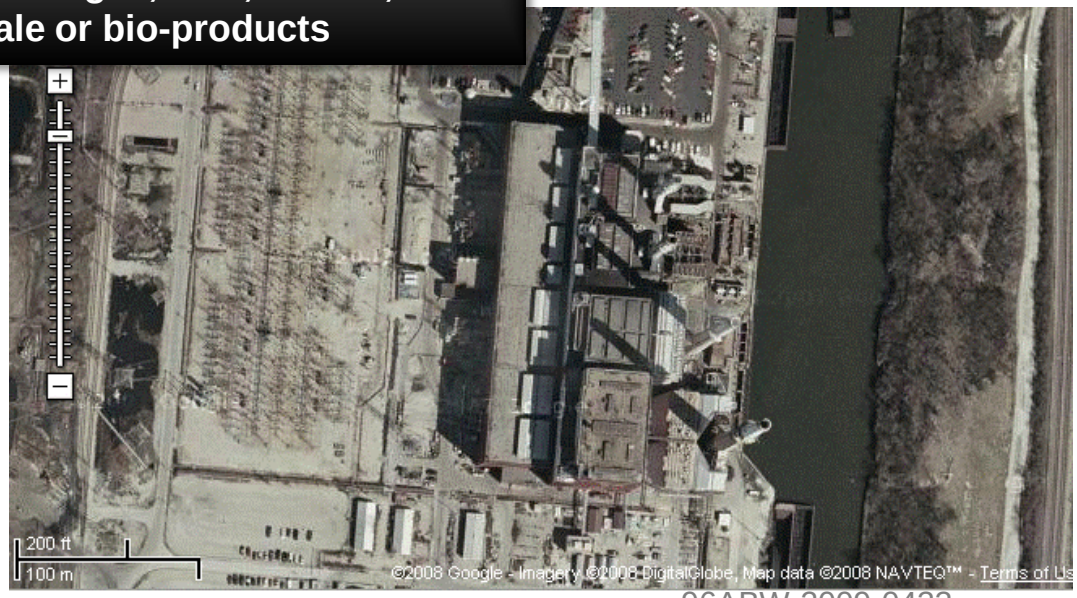


Models to Accommodate Needed Details

Example Power Plants

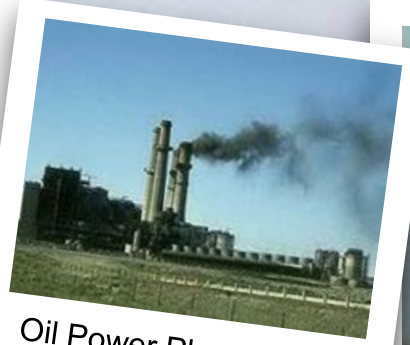
Description:

We will need to know much detail about target construction and functionality. Power plants (or power stations) such as the coal firing plant shown here are numerous. Different types of these electricity production facilities include: nuclear, natural gas, coal, fuel oil, oil shale or bio-products



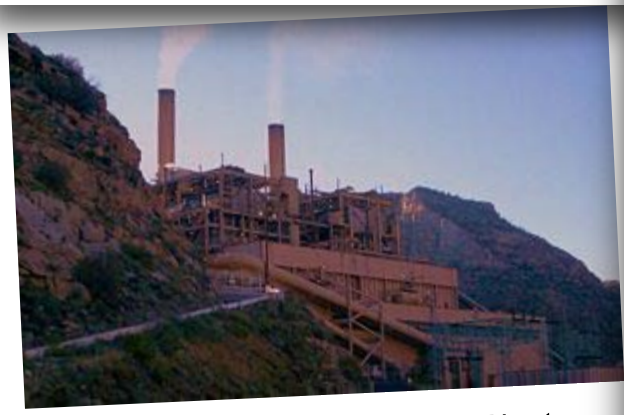
Power Plant Types

Currant Creek Power Plant near Mona, Utah is a natural gas fired combined cycle electrical plant.



Oil Power Plant in Iraq

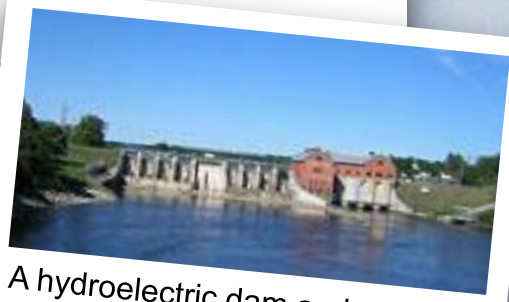
Flue gas stack at GRES-2 Power Station in Ekibastus, Kazakhstan



This is the Castle Gate Coal Plant near Helper, Utah.

Wind turbine in front of a thermal power station in Amsterdam, Netherlands

The Susquehanna Steam Electric Station, a boiling water reactor

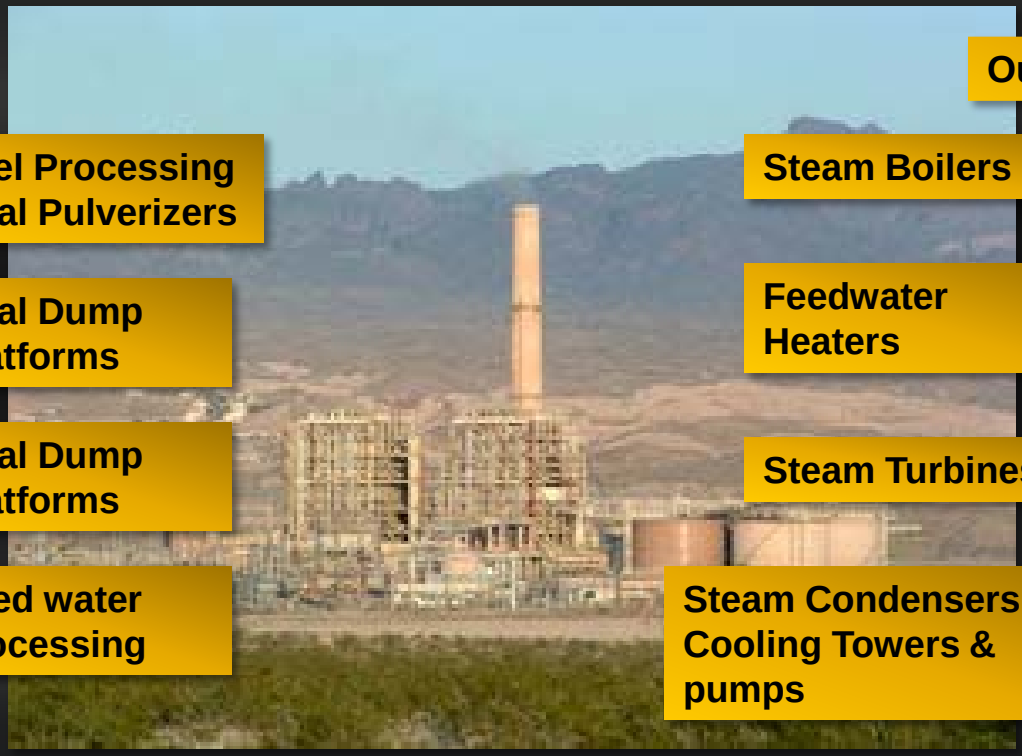


A hydroelectric dam and plant on the Muskegon river in Michigan

Coal Plant System

Inflow

Coal by:
- Rail
- Barge
- Truck
- May use Fuel Oil for start-up
- Pipe
- Truck
- Tank Cars



Fuel Processing Coal Pulverizers

Coal Dump Platforms

Coal Dump Platforms

Feed water processing

Outflow

Steam Boilers

Feedwater Heaters

Steam Turbines

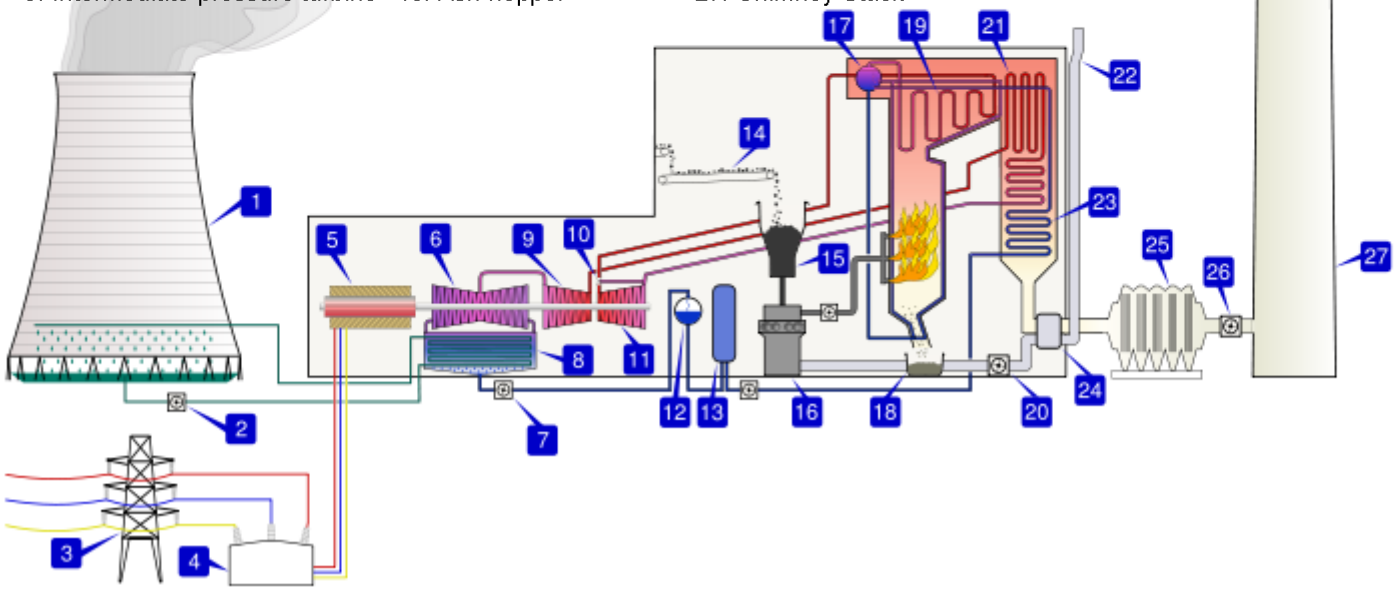
Steam Condensers, Cooling Towers & pumps

Measures of Operational Effectiveness

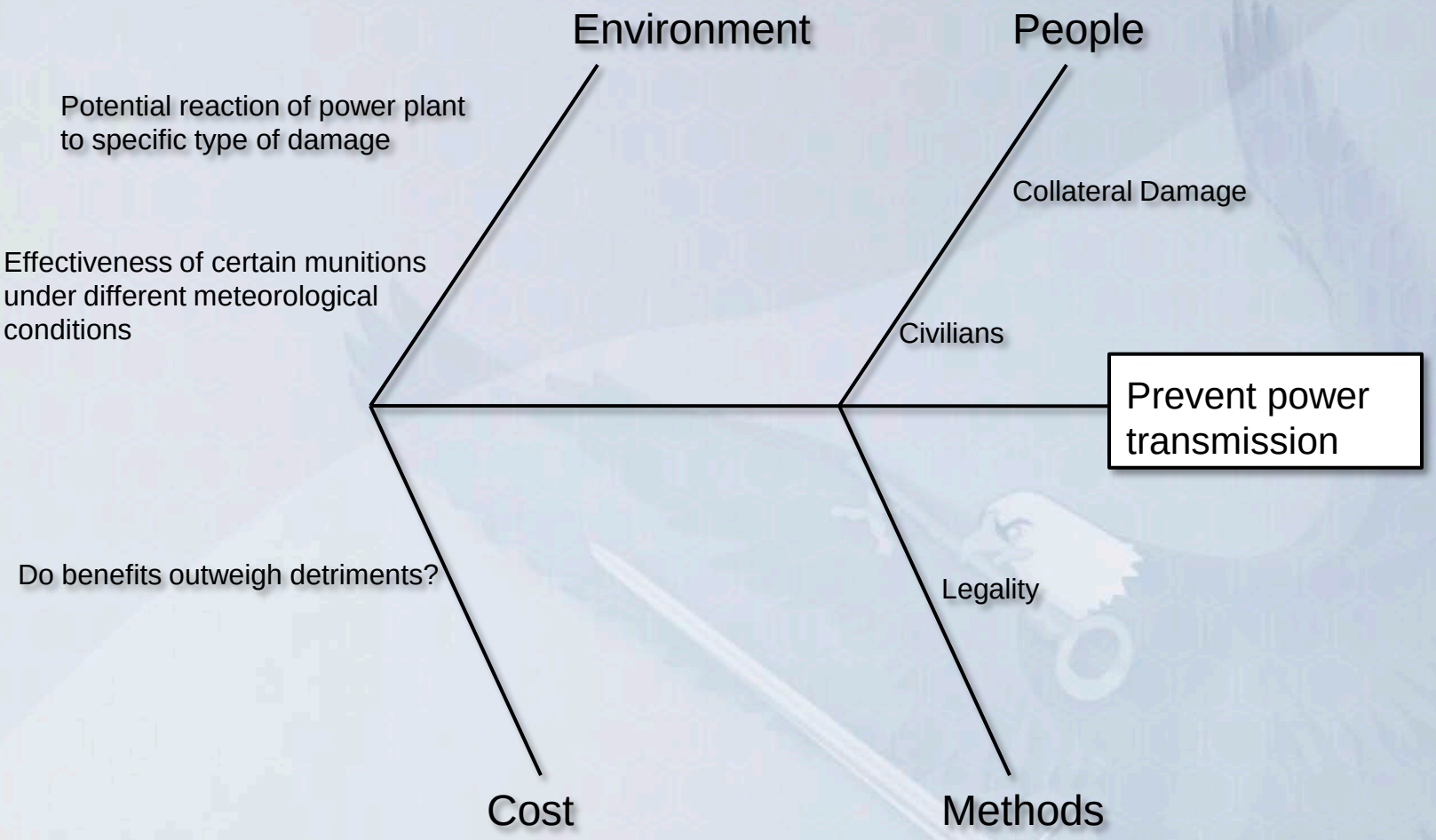
- Deny Fuel Flow for x time
- Destroy Fuel Storage for x time
- Disable output for x time
- Destroy Permanently

Key Characteristics

1. Cooling tower	10. Steam governor valve	19. Superheater
2. Cooling water pump	11. High pressure turbine	20. Forced draught fan
3. Transmission line (3-phase)	12. Deaerator	21. Reheater
4. Unit transformer (3-phase)	13. Feed heater	22. Air intake
5. Electric generator (3-phase)	14. Coal conveyor	23. Economiser
6. Low pressure turbine	15. Coal hopper	24. Air preheater
7. Condensate extraction pump	16. Pulverised fuel mill	25. Precipitator
8. Condensor	17. Boiler drum	26. Induced draught fan
9. Intermediate pressure turbine	18. Ash hopper	27. Chimney Stack



Power Transmission



Conclusions/Summary

- Targets will need to be very detailed
- Instrumentation will need to be netted across the target and non-intrusive/non-influencial
- Target Construction will require Homework