Making Ferries a Viable Transit Option

The
San Francisco Bay Area Water Transit Authority

WTA

Maritime Energy and Clean Emissions

29 – 30 January 2002

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Making Ferries a Viable Transit Option

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Current Maritime Demonstration Projects

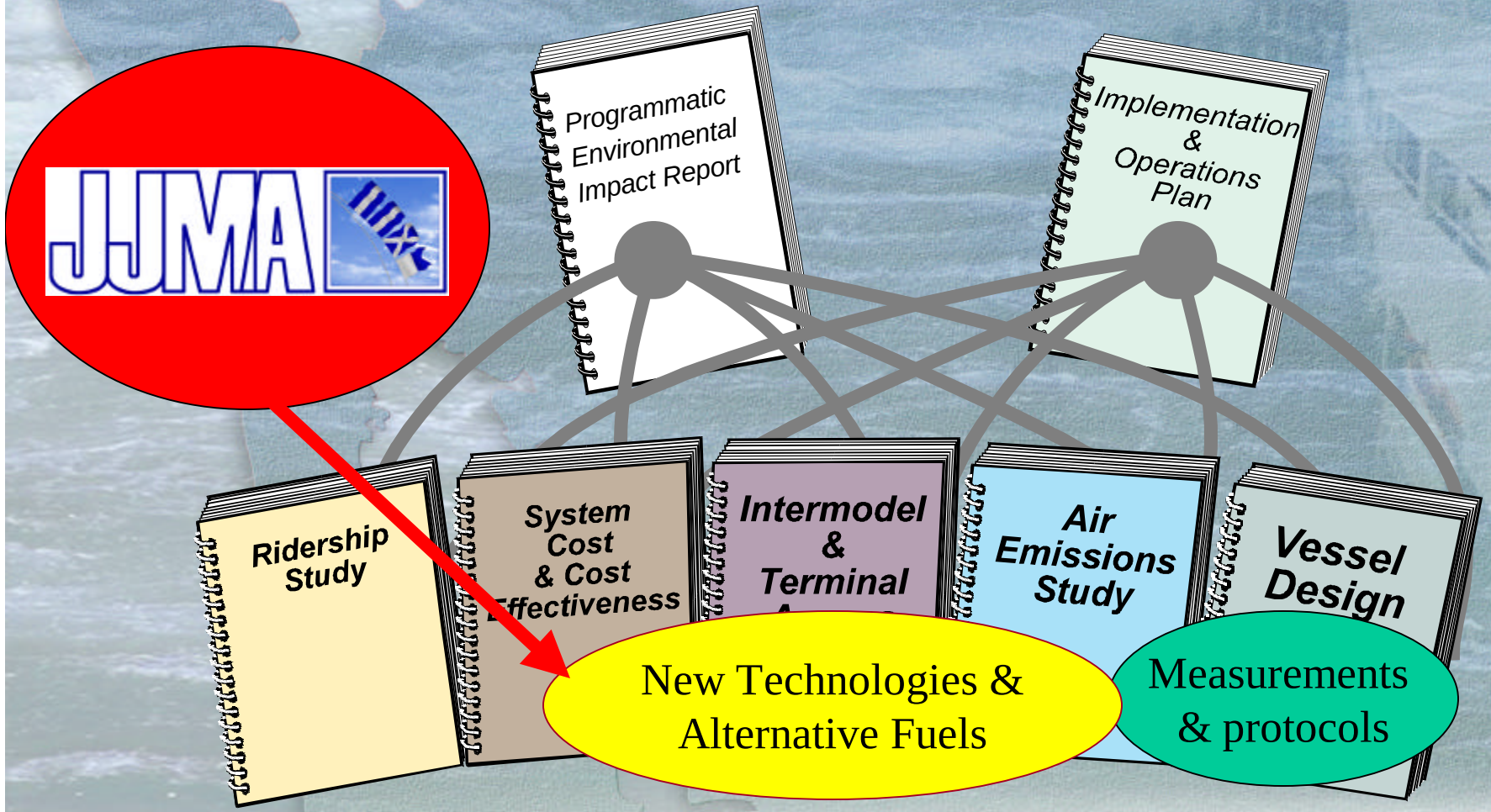
Evaluating Technologies for San Francisco Ferries

Contractor for WTA:

JJMA

29 – 30 January 2002

Technical Studies That Feed Into Both Documents



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Principles:

- The challenge isn't finding the data
- The challenge is
  - Filtering the data
  - Balancing differing agendas
  - Finding common ground

Our Process

- **Define Alternatives**
- **Characterize Alternatives**
- **Identify Desires**
- **Balance Desires with Characteristics**
- **Identify Common Ground**

Our Process

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Master List of Alternatives

Diesel Engine Modifications (Internal)

- Injection Timing Retard
- EGR
- Thermal Barrier
- Increased fuel Injection pressure
- Fuel Injector modifications
- Electronically Controlled fuel system
- Water Injection

Master List of Alternatives

Diesel Engine Modifications (External)

- Particulate Trap
- Selective Catalytic Reduction
- Oxidation Catalyst
- NOx Adsorption Catalysts
- Humidification Air Intake System
- Non-Thermal Plasma Arc

Master List of Alternatives

Fuel Alternatives

- Bio-diesel
- CNG
- LNG
- LPG
- Diesel Additives
- Diesel and Water Mixtures
- Diesel with Water Injection
- Dual Fuel (Diesel / NG)
- Fischer-Tropsch
- Methanol
- Ethanol
- Hydrogen
- Ultra Low Sulfur Diesel

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Master List of Alternatives

Alternative Propulsion Systems

- Battery Electric
- Flywheel Generator
- ICE Generator Electric
- Fuel Cell Electric / Diesel
- Fuel Cell Electric / Fischer-Tropsch
- Fuel Cell Electric / Gasoline
- Fuel Cell Electric / Hydrogen
- Fuel Cell Electric / Methanol
- Fuel Cell Electric / Natural Gas
- Gas Turbine / Diesel
- Hybrid Sail-PV-Battery-Generator
- Photovoltaic Electric
- Sail

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Attributes of Alternatives

- Maturity/Development Timeframe
- Performance of Alternatives
  - Horsepower
  - Specific fuel consumption
- Performance of Alternatives
  - Environmental Impact & Emissions
- Physicals of Alternative
- Reliability
- Safety
- Logistics
- Economic Factors
- Lessons Learned

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Matrix Sample

NEAR TERM (2007)		Economic Factors					Lessons Learned	
		Acquistion Cost	Operating Cost	Maintenance Cost	Fuel Cost	Cost Volatility	Benefits	Drawbacks
Internal to Engine Diesel Engine Modifications	Injection Timing Retard	3	2	2	2	3	2	2
Internal to Engine Diesel Engine Modifications	EGR	2	2	1	2	3	2	1
Internal to Engine Diesel Engine Modifications	Thermal Barrier	2	2	3	3	3	1	2
Internal to Engine Diesel Engine Modifications	Increased Fuel Injection Pressure	2	2	3	3	3	2	3
Internal to Engine Diesel Engine Modifications	Fuel Injector Modifications	2	2	3	3	3	2	3
Internal to Engine Diesel Engine Modifications	Electronically Controlled Fuel System	2	2	3	3	3	2	3
External to Engine Diesel Engine Modifications	Particulate Trap	2	2	2	3	3	3	2
External to Engine Diesel Engine Modifications	Selective Catalytic Reduction	1	2	2	3	3	3	2
External to Engine Diesel Engine Modifications	Oxidation Catalyst	3	3	3	3	3	3	2
External to Engine Diesel Engine Modifications	Nox Adsorption Catalysts	1	2	2	2	3	3	2

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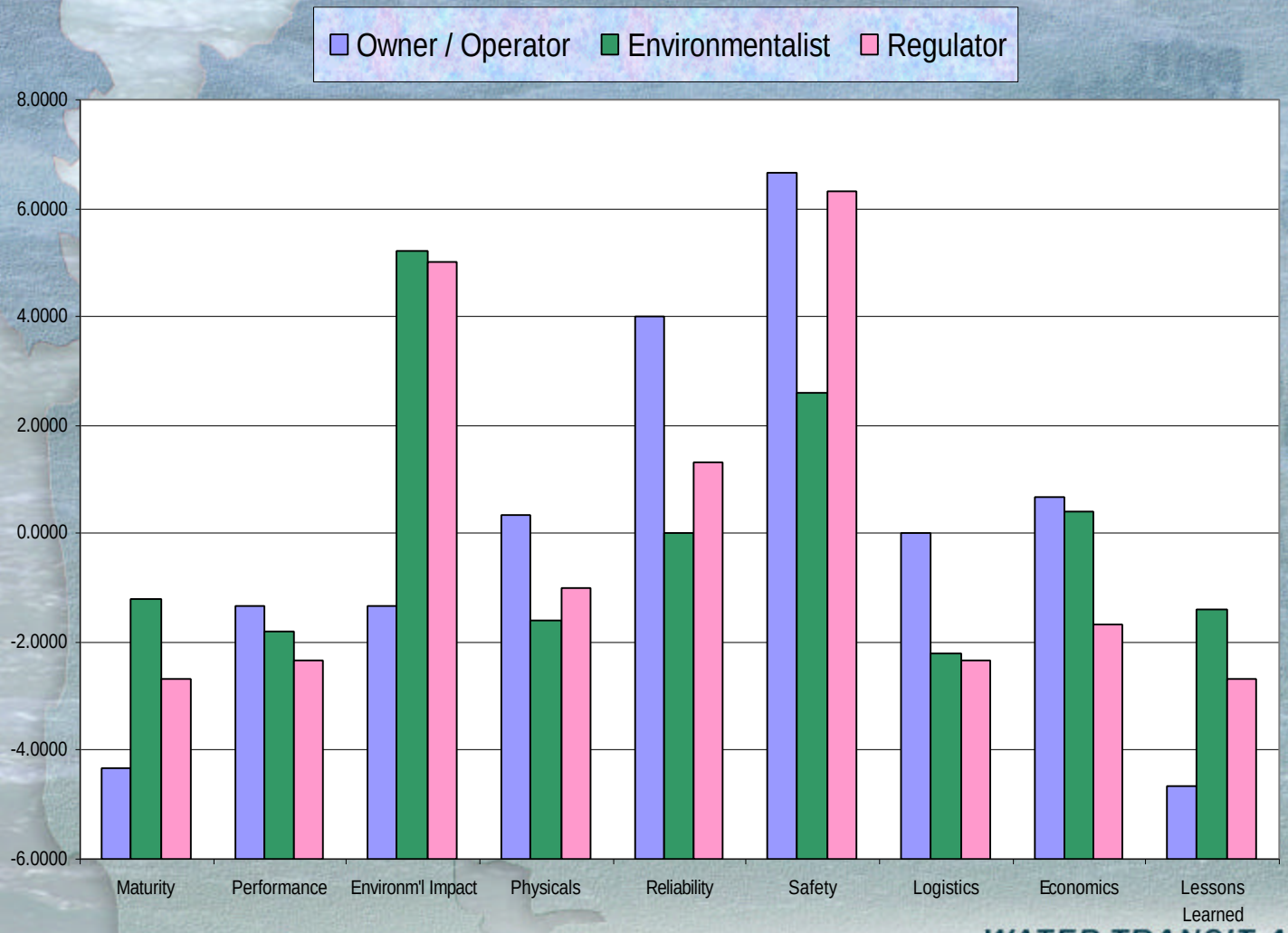
Identify Desires

- Pair-wise Comparison Surveys
- Three Communities Identified
  - Owner / Operator
  - Regulator
  - Environmentalist

Questionnaire

First Pairing		
Maturity/Development Timeframe	equal	Performance of Alternatives
Maturity/Development Timeframe	equal	Environmental Impact & Emissions
Maturity/Development Timeframe	equal	Physicals of Alternative
Maturity/Development Timeframe	equal	Reliability
Maturity/Development Timeframe	equal	Safety
Maturity/Development Timeframe	equal	Logistics
Maturity/Development Timeframe	equal	Economic Factors
Maturity/Development Timeframe	equal	Lessons Learned
Second Pairing		
Performance of Alternatives	equal	Environmental Impact & Emissions
Performance of Alternatives	equal	Physicals of Alternative
Performance of Alternatives	equal	Reliability
Performance of Alternatives	equal	S...
Performance of Alternatives	equal	
Performance of Alternati...	equal	
Performance of A...	equal	

Identify Desires



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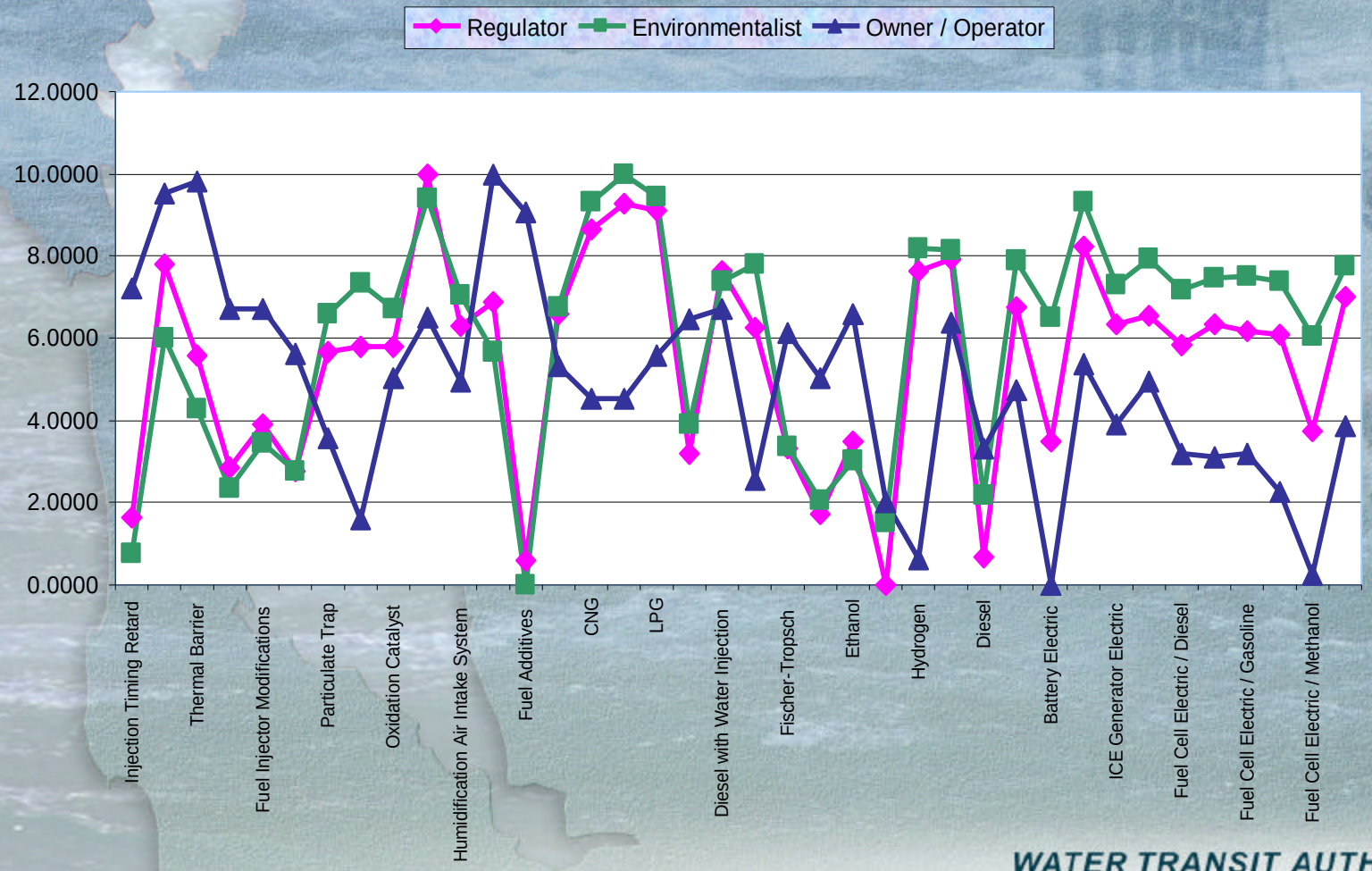
Balance Desires with Characteristics

- Evaluate each community's preference
- Compare rankings to find Common Ground

Each Community's Preference



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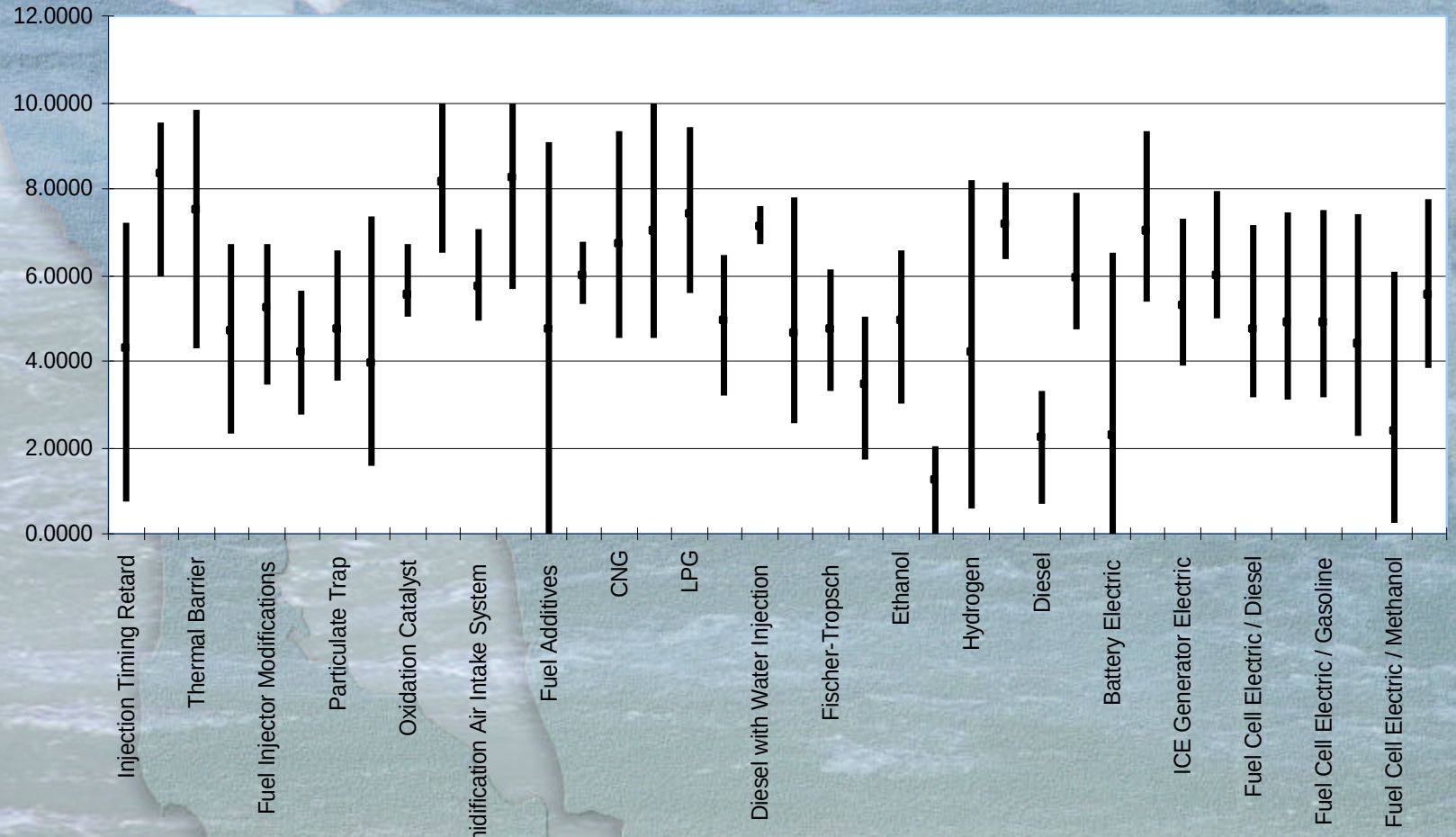
Identify Common Ground

- High – Low – Average Chart
- As “flagger” try “Average / Range”

Identify Common Ground



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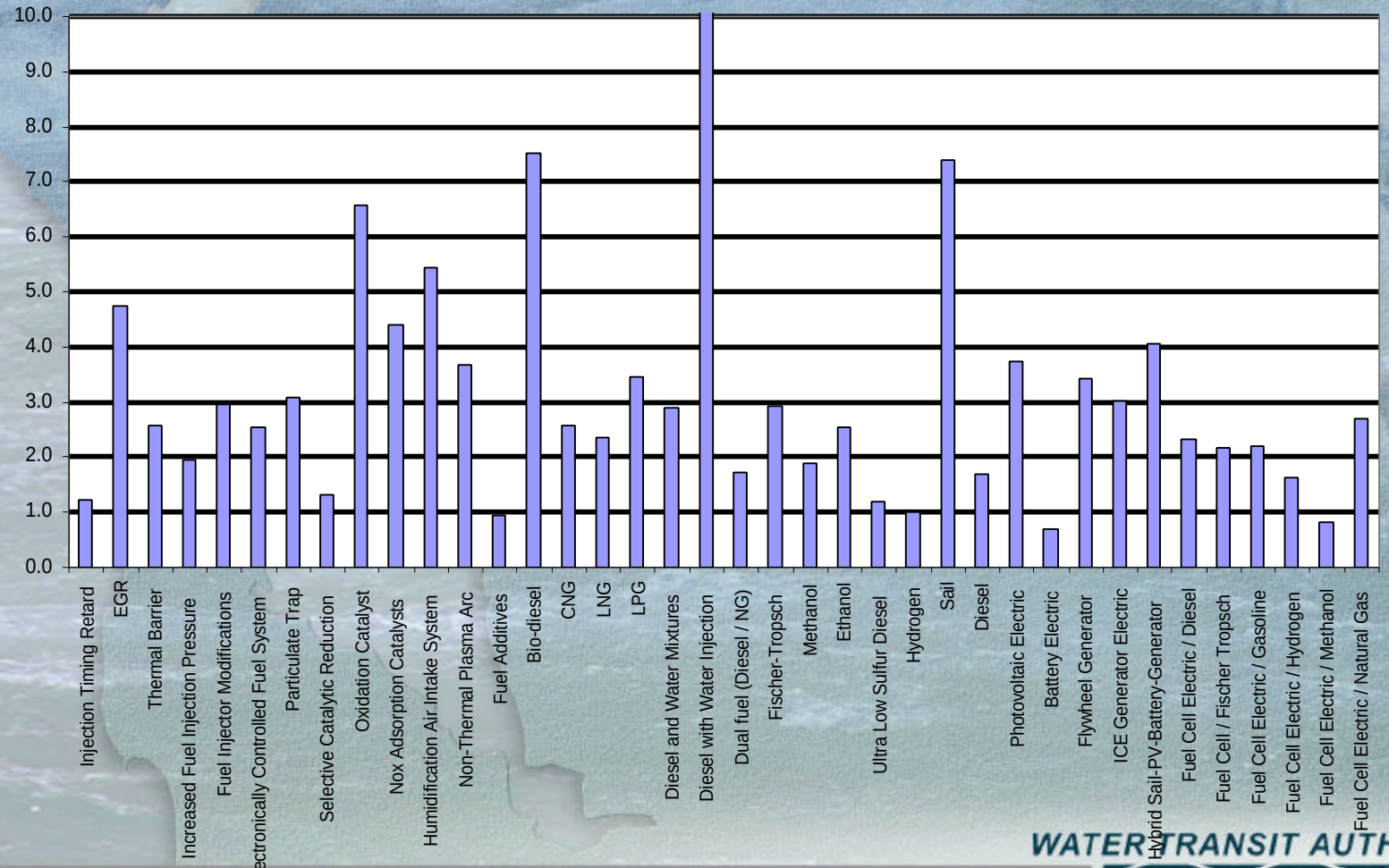
Identify Common Ground

Average / Range = Goodness



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Results from "The Process"

- ***Stay tuned...***