EVERGREEN
TUG TECHNOLOGY

Presented By

Paul Jamer of Aspin Kemp & Associates
& David Irving of Atlantic Towing Limited

ASPIN KEMP & ASSOCIATES

ATLANTIC TOWING LIMITED

Agenda

- Introductions
- Green Tug Centre of Excellence
- Evergreen Tug Technology
- Methodology
- Examples
- Questions?

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J.D. Irving Ltd

- J.D. Irving Limited is a diverse, privately owned company with operations in Canada and the United States.
- It is headquartered in Saint John, New Brunswick, Canada.
- Among JDI's various interests are tug construction (East Isle Shipyard) and tug operating (Atlantic Towing) which have become well established enterprises over the last 50 years.

East Isle Shipyard

- Out of the four locations owned and operated by Irving Shipbuilding, East Isle Shipyard in PEI has been building Robert Allan Designed Z-Drive Tug boats for domestic and international clients for the last 15 years, and has become a centre of excellence for Z-Drive Tug construction.

Atlantic Towing Limited

- A primary client of East Isle Shipyard is Atlantic Towing Limited.
- ATL has been delivering quality marine services and solutions for over 50 years to customers all over the Atlantic, with a primary focus on the East Coast of Canada.
- ATL began building Z-Drive tugs in 1996 at East Isle, and today own/operate 10 of them ranging from 4,000 bhp to 5,600 bhp.

Aspin Kemp & Associates

- A Canadian based company specializing in developing, applying, managing, supporting and maintaining engineering solutions primarily in the marine and offshore oil and gas industries.
- Developers of the world's first Hybrid tug and leaders in environmental technology for marine applications.
- Operate a manufacturing facility in PEI with complete test lab and training facilities.

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Creating a "Green Tug Centre of Excellence"

- East Isle has worked with its many clients over the years to optimize tug design.
- By incorporating this feedback from the operators East Isle has become a center of excellence for Z-Drive tug construction.
- Today the focus is moving toward the future of tug technology and taking this center of excellence to the next level.

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Atlantic Towing/East Isle and Aspin Kemp & Associates have begun defining this vision under the trademark "Evergreen Tug Technology" as a basis for future green tug projects at East Isle.

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Key to Success: Balance

- With collaborative efforts from these three companies a balance of perspectives are brought to the table:
  - Operational - ATL is focused on high performance and reliability in the vessels they operate;
  - Construction - East Isle is focused on being cost competitive in the international tug building market; and
  - Technology - AKA is focused on bringing innovative technical solutions to industry.

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Ground Rules

- For Green Technology to have any significant contribution to the marine industry the end goal must be a practical one.
- Include only stable technology. (No experiments on mission critical systems)
- Must meet requirements operationally, commercially and environmentally.
- Flexibility to allow for incorporation of future technologies as they become viable. (Plug and Play)
- Understand that there can be non-monetary benefits that are valid and can drive a project.

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Scope

- Can be applied to harbour, terminal, coastal etc. applications.
- All aspects of the vessel, from hull to machinery to systems to shore-side support infrastructure can be included.
- Impact considered from cradle to grave.

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Getting Started

- On a case by case basis evaluate the requirements and constraints of a particular vessel's proposed duty cycle and operating zone.
- Identify potential green options…BUT…it is not helpful to just present a list of technologies that could make your vessel more environmentally friendly.

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The Choices!

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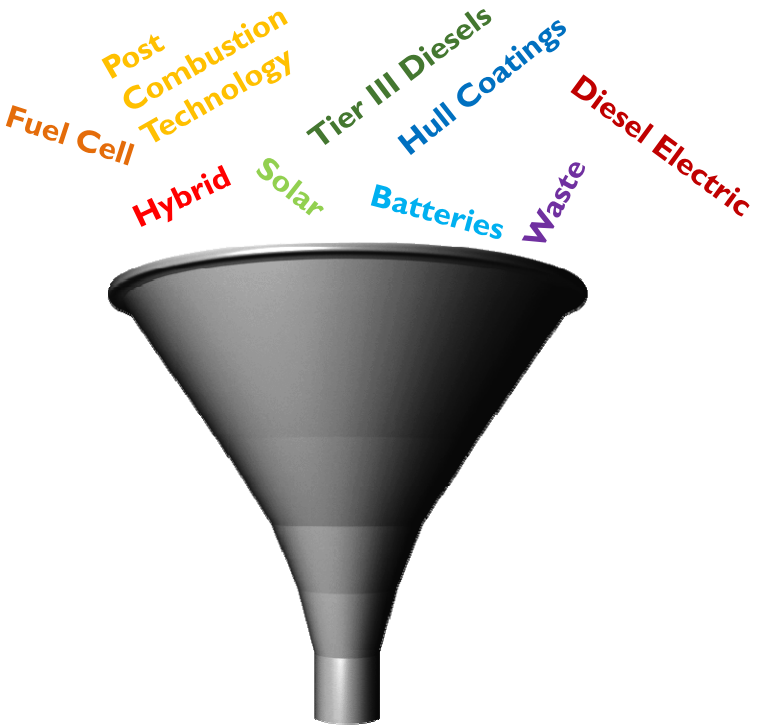
Method

- System required for sorting through the options and selecting the appropriate technologies for a project that deliver greener solutions at competitive costs, without losing sight of operational performance.



Hybrid
Hull Coatings
Tier III Diesels

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GTEA

Green Technology Effects Analysis

- What is it?
  - Formalized process for determining which technologies and propulsion configurations should be included in a green tug project;
  - Evaluates impact and viability of selections;
  - Ensures that the final configuration maximizes the benefit to all stakeholders;
  - Maintains integrity of initiatives. (Doesn't permit non-productive inclusions); and
  - Doesn't focus solely on one area of opportunity.

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Process

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Step 1: Gather Data

- Operational Requirements/Constraints;
- Budget;
- Regulatory (Class and Environmental);
- Client Expectations; and
- Available Infrastructure.

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Step 2:
Identify Potential Technologies

- Prime Movers;
- Propulsion Configurations;
- Energy Conversion/Storage;
- Hull/Propeller Design;
- Post Combustion;
- Heat Recovery;
- Regenerative Power;
- Paint/Coatings;
- Shore Power;
- Waste Management (Oil/Garbage);
- Renewable Energy;
- Lighting Systems; and
- Noise Abatement.

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Step 3: Apply Rules

- Perform GTEA;
- Include Only Stable Technology;
- Avoid Experiments (On mission critical systems);
- Meet Requirements Operationally;
- Commercially Valid; and
- Consider Non-Monetary Benefits.

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Step 4: Finalize Configuration

- Short List of Configurations and Technologies;
- Primary and Optional Selections;
- Plug and Play Analysis;
- Green Passport Plan; and
- Receive Client Approval.

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Step 5: Manufacture

- Integration of Systems and Technologies;
- Green Shipbuilding Practices - environmental guidelines met and exceeded by yard; and
- Quality assurance ensures vessel performs as expected.

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Step 6: Deployment & Operation

- Commissioning and Trials;
- Crew Training;
- Create Culture that Promotes Green Operation;
- Monitoring and Reporting; and
- In Service Support.

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Example

- Client needs:
  - Harbor tug capable of duty cycle of X;
  - Environmental restrictions in port are X; and
  - Budgetary constraints are X.
- Technology selection and design process is a collaborative effort between operator, builder and technology provider to get right mix of cost effective, performance based and environmental technology.

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Sample

System	Item/Sub-System	Potential Pollution Mode	SEV	Potential Causes	OCC	Current Process Controls	EFF	RPN
Propulsion	Main Engines	Exhaust Emissions NOx, SOx	3	Engine type	3	High Speed Diesels, EPA Tier I	9	81
	2 x Cat 3516B		3	Engine load	3	Engines sized for max output	9	81
			3	Fuel type	3	Low Sulphur Diesel	3	27
			3	Exhaust Volume	3	Fuel Metering, reduced transit speeds	3	27
		Spark Generation	9	No Spark Arrestors	1	Spark Arrestor Silencers	1	9
		Airborne Noise	3	Engine Exhaust	3	35 dBA minimum rating	3	27
		Accommodation N & V	9	Engine Vibration, Noise	3	Floating Floors in Accom	1	27
		Underwater Noise	3	Engine Vibration	3	Resilient Mounts	1	9
			3	Airborne noise inside ER	9	Insulation	3	81
		Coolant Discharge	9	Spill during fill/transfer	1	Drop Tank fitted to prevent bilge spills	1	9
								0
	ASD Units	Lube Oil Discharge	9	Seal Failure	1	Op Procedures; alarm on header tank level	3	27
			9	Spill during fill/transfer	1	Op Procedures - built-in tanks & save-alls	3	27
		Underwater Noise	3	Propeller Cavitation	3	Op Procedures - speed control	3	27
								0
Electrical	Gensets	Exhaust Emissions NOx, SOx	3	Engine type	3	High Speed Diesels, EPA Tier I	9	81
	2 x Cat C-9		3	Engine load	3	Engines sized for max output	9	81
			3	Engine load	3	Engines sized for max output	9	81
			3	Engine load	3	Engines sized for max output	9	81
			3	Fuel type	3	Low Sulphur Diesel	3	27
			3	Exhaust Volume	3	Shore power when alongside	3	27
		Spark Generation	9	No Spark Arrestors	1	Spark Arrestor Silencers	1	9
		Airborne Noise	3	Engine Exhaust	3	35 dBA minimum rating	3	27
		Accommodation N & V	9	Engine Vibration, Noise	3	Floating Floors in Accom	1	27
		Underwater Noise	3	Engine Vibration	3	Resilient Mounts	1	9
			3	Airborne noise inside ER	9	Insulation	3	81
		Coolant Discharge	9	Spill during fill/transfer	1	Drop Tank fitted to prevent bilge spills	1	9
								0
	Batteries/UPS	Acid Discharge	9	Overfill, leak of battery acid	1	GelCel sealed batteries	1	9
		Battery Disposal	3	Early wear-out of batteries	3	Op Proc - auto charge & banks sized to prolong battery life	3	27
								0
	Lighting	Light Pollution	3	Bright white lights, focus points	3	Halogen deck floods, Xenon spots	9	81

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Propulsion Opportunities

- Largest potential area for benefits:
  - Reduced Fuel Consumption;
  - Reduced Emissions;
  - Reduced Maintenance Costs; and
  - Reduce Unnecessary Idling.

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Example continued

- Plug and Play:
  - What flexibility might be required in the future of the vessel?
  - Pre-engineering for future technologies?
  - Flexibility in fuel sources for various duty cycles?

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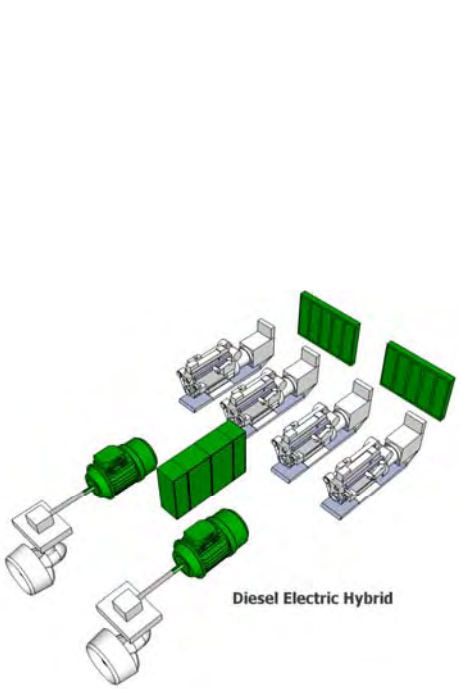
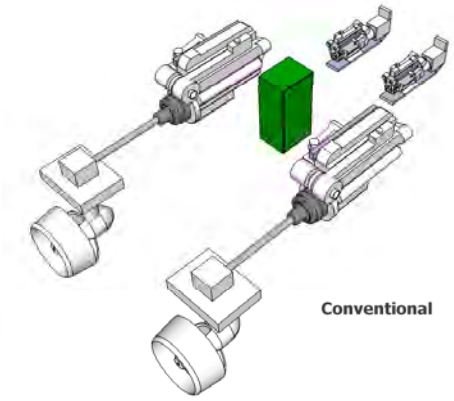
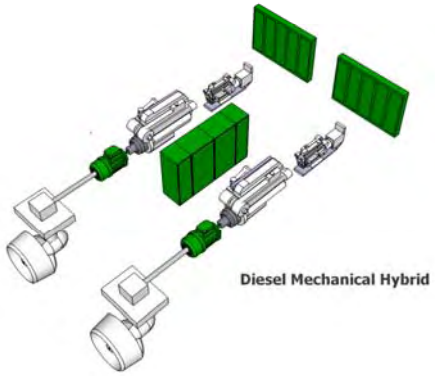
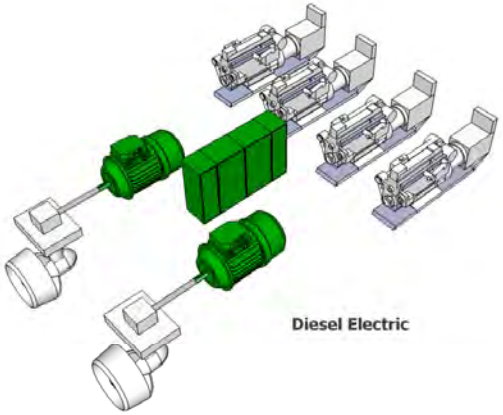
Configurations









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Plug and Play

- The Evergreen Tug Technology model is not focused on developing a system for designing a tug for only one application:
  - New technologies are emerging and maturing daily;
  - Operation profiles can change;
  - Need to provide pathway for future upgrades; and
  - Technology is moving too quickly to "lock in" now.
- Evergreen Tug Technology not only provides a framework for designing the best tug for today, it anticipates upgrades in the future.

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Conclusions

- Environmental technologies can be incorporated into tug design and manufacturing without compromising operation performance or sacrificing cost competitiveness.
- The flexibility that can be achieved has the potential to dramatically improve efficiency and life-cycle costs compared to conventional vessels.
- Best achieved by taking a balanced, pragmatic and methodical approach to selecting and incorporating the numerous options available.

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Thank You