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Energy Efficiency in Sustainable Port Development and Operations

AAPA Facilities Engineering Seminar and Expo

November 07, 2013

Clear Communications



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Oneway[®]
to zero harm

Zero harm to people and assets
Zero environmental incidents

- ▶ A new fuel tanker arrives on location at a site in the middle east
- ▶ The HSE manager tells the fleet supervisor to ensure that the tanker is clearly labelled “Diesel Fuel” and “No Smoking” in Arabic

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- ▶ A new fuel tanker arrives on location at a site in the middle east
- ▶ The HSE manager tells the fleet supervisor to ensure that the tanker is clearly labelled “Diesel Fuel” and “No Smoking” in Arabic
- ▶ The result...



Agenda



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- ▶ Port Development, Operations, and Modernization
- ▶ Growth Factors
- ▶ Energy Review and Savings Potential
- ▶ Understanding the Existing Port's Energy Infrastructure
- ▶ Future Energy Demand
- ▶ Sustainability and Non-Technical Risk Management
- ▶ Strategy and Energy Policy

Port Development



► Development Factors

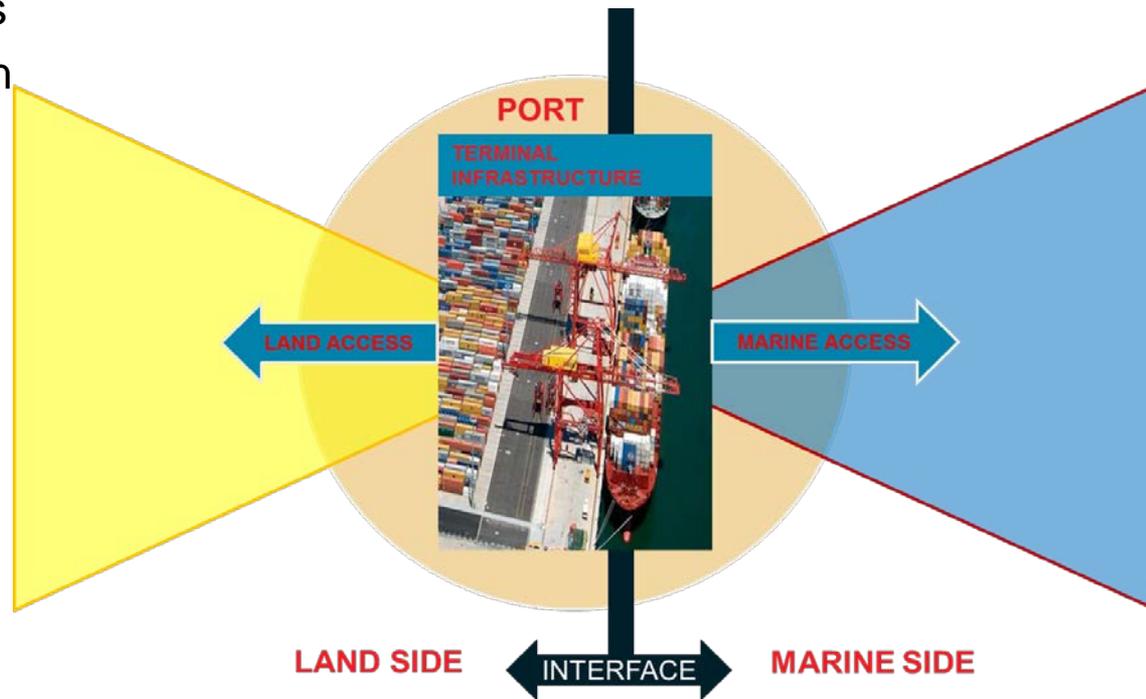
- Geographic Location
- Physical Characteristics
- Landside Transportation
- Urban Centers

► Dynamic Processes

- Globalization
- Containerization
- Modern Logistics

► Expansion Factors

- Available Land
- Environmental Concerns
- Political Influences
- Social Dynamics
- Operational Productivity and Managerial Efficiency Improvement



Growth Factors

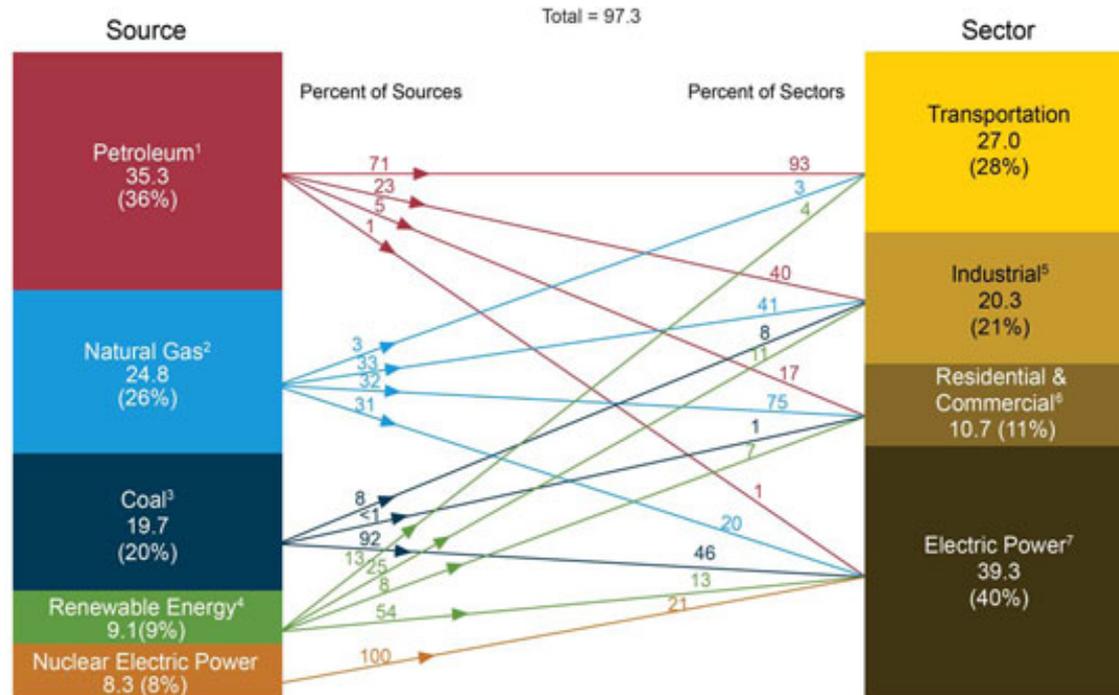


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- ▶ Persistent trade globalization
- ▶ Emerging economies and markets
- ▶ Increasing demand for resources and consumer goods
- ▶ Aging infrastructure
- ▶ Strict environmental regulations and permits
- ▶ Escalating competition among ports → modernization
- ▶ Mobilization of finance and investment funds
- ▶ Growing needs for efficiency in operations, productivity, and capacity

Energy Review

Primary Energy Consumption by Source and Sector, 2011 (Quadrillion Btu)



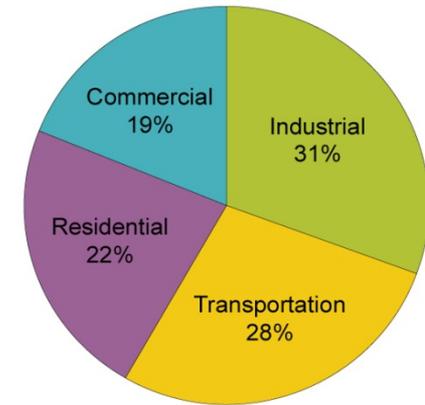
U.S. Energy Information Administration / Annual Energy Review 2011

97.3 quads in 2011 < 98.0 quads in 2010
due to energy efficiency and renewables



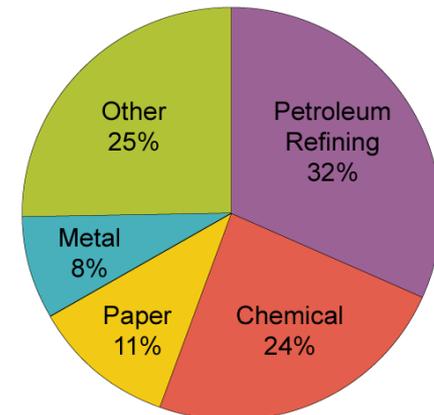
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Share of Energy Consumed by Major Sectors of the Economy, 2011



Source: U.S. Energy Information Administration, *Annual Energy Review 2011*, (September 2012).

Energy Use by Type of Industry, 2006



Source: U.S. Energy Information Administration, *Manufacturing Energy Consumption Survey 2006*, Table 1.2.

Energy Savings Potential

U.S. Most Energy-Intensive Industries

Industry	Value of Shipments	CAPEX	Energy Consumption
Petroleum	\$219 billion	\$7.3 billion	7.5% of total energy use
Chemicals	\$438.4 billion	\$18.9 billion	6% of total energy use 25% of US manufacturing energy use
Forest Products	\$243.1 billion	\$9.5 billion	14% of US manufacturing energy use
Steel	\$60.6 billion	\$1.79 billion	1.5% of total energy use 6.7% of US manufacturing energy use
Aluminum	\$28.1 billion	\$1.2 billion	1% of total energy use
Glass	\$27.7 billion	\$1.83 billion	energy cost 5-7% of shipments
Metalcasting	\$28 billion	\$1.5 billion	1% of US manufacturing energy use

Energy Savings Potential

► Refineries (Upstream)

- Thermal \$10MM/year – \$60MM/year
- Electrical \$2MM/year – \$10MM/year

► Other industrial facilities, i.e. Ports and Marine Terminals

- **10% - 15% Typical Energy Savings Potential**

10% energy reduction = 310 Tons Per Day (TPD) CO₂ emissions reduction

Port Current Operations



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► Existing Energy Infrastructure Conditions

- Port and Tenant Operations, Facilities, Vehicles, Equipment
- Existing Energy Portfolio
 - Energy Use Data and Profiles (Meters, Sub-meters, Tenants, Port)
 - Energy Audits and Reports
 - Energy baseline for Long-Term Demand Projections
- Port, Local, State and Federal Policies
 - Sustainability, Emissions Reduction, Strategic Plans, and Other
- Environmental and Regulatory Situation
- Capital Improvement Plans
- Port Master Plans
- Port as a Utility
 - Power Generation
 - T&D
 - Renewables

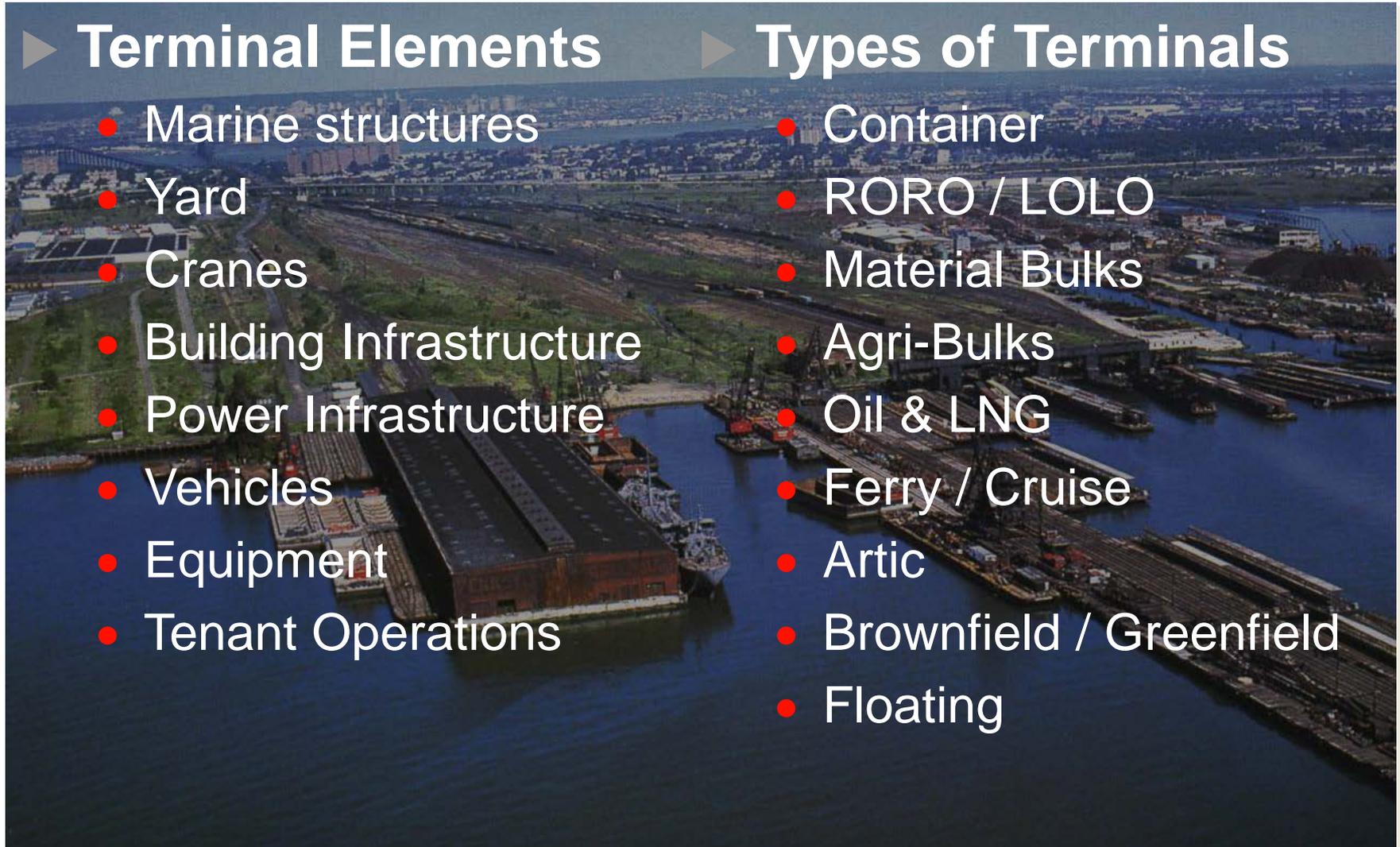
Port Operations / Terminals

► Terminal Elements

- Marine structures
- Yard
- Cranes
- Building Infrastructure
- Power Infrastructure
- Vehicles
- Equipment
- Tenant Operations

► Types of Terminals

- Container
- RORO / LOLO
- Material Bulks
- Agri-Bulks
- Oil & LNG
- Ferry / Cruise
- Artic
- Brownfield / Greenfield
- Floating



Energy Management Activities



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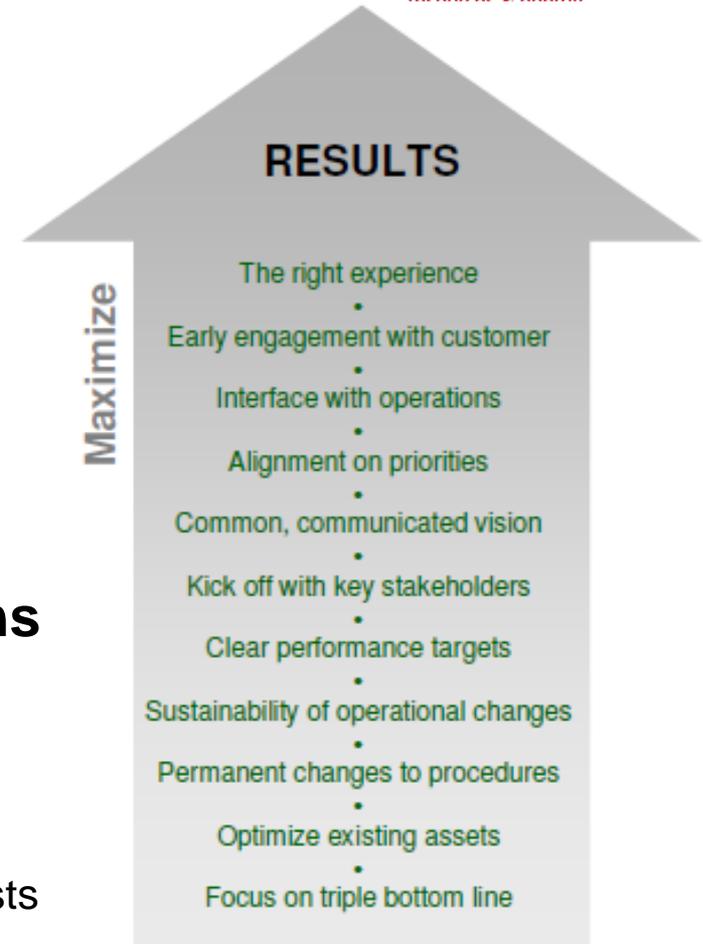
Energy Efficiency Activities

- ▶ Facilities (Lighting and HVAC)
- ▶ Load Factors
- ▶ Demand Response
- ▶ Combined Cycles and Cogeneration
- ▶ Waste Energy Minimization and Recovery
- ▶ Energy Storage
- ▶ Changing the Patterns of Energy Use
- ▶ Shifting to Other Sources of Energy
- ▶ Human Behaviors and Habits

Transportation Energy-Related Options

- ▶ On-Road, Air, Rail, Marine, Mass Transit
- ▶ Multi-Modal Intermodal Freight (Trucks, Rail)
- ▶ Alternative Fuels and Vehicles
- ▶ Electrification vs. Gasification
- ▶ Energy Efficiency Indicators: VMT, PMT, Fuel Costs

Optimizing Energy Usage

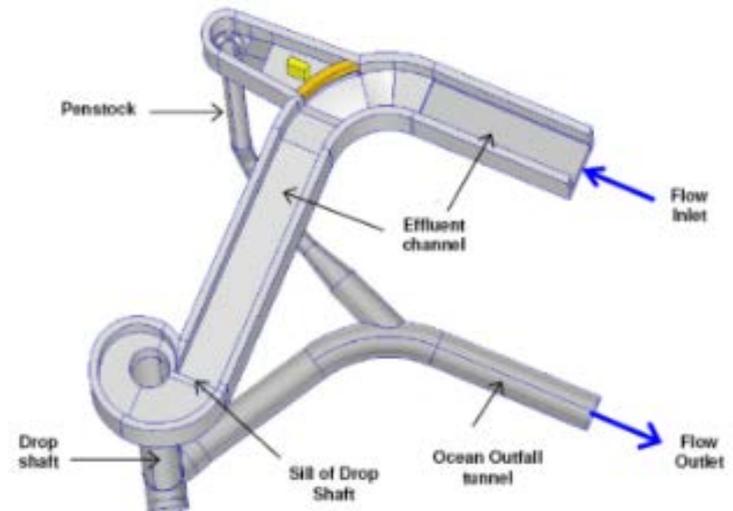


Port Modernization



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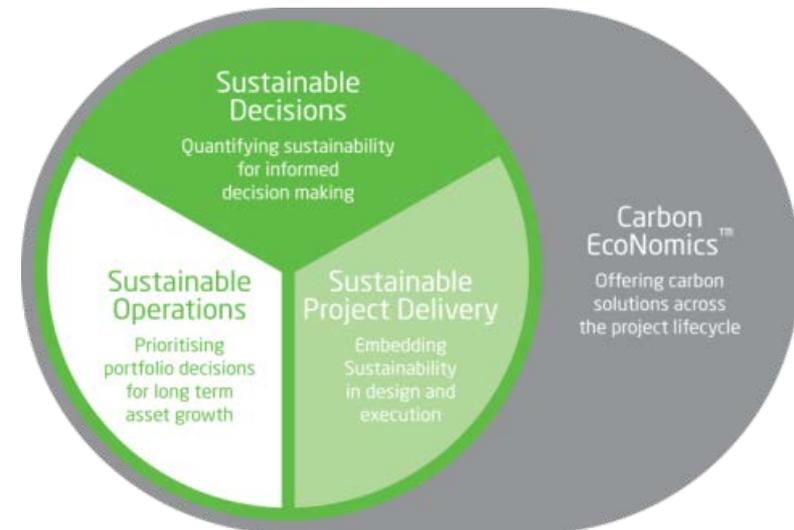
- ▶ Automation
- ▶ Cold Ironing
- ▶ Energy Security and Independence
- ▶ Port Security
- ▶ Resiliency
- ▶ Sustainable Modernization
 - Terminal Planning & Operations
 - Marine Shipping and Logistics
 - Intermodal Rail Yard / Barge
 - Resource Materials
 - Energy Innovation
 - Mini-Hydro Power Generation



Drivers, Risks, Monetization



- ▶ Climate Change, Energy Security, Environmental Impact
- ▶ Energy Use, Demand, Resources, and Generation
- ▶ Design, Construction, Operations, and Performance
- ▶ Initiatives, Program Implementation, and Evaluation
- ▶ Market Transformation and Competition
- ▶ Legislation, Guidance, and Goals
- ▶ Authorities and Utilities
- ▶ Costs, Benefits, and Funding
- ▶ Alternatives
- ▶ Public Outreach and Education
- ▶ Stakeholders Involvement
- ▶ Workforce Training
- ▶ Sustainable and Net Zero Energy Economies
- ▶ Human Behavior and Social Dynamics

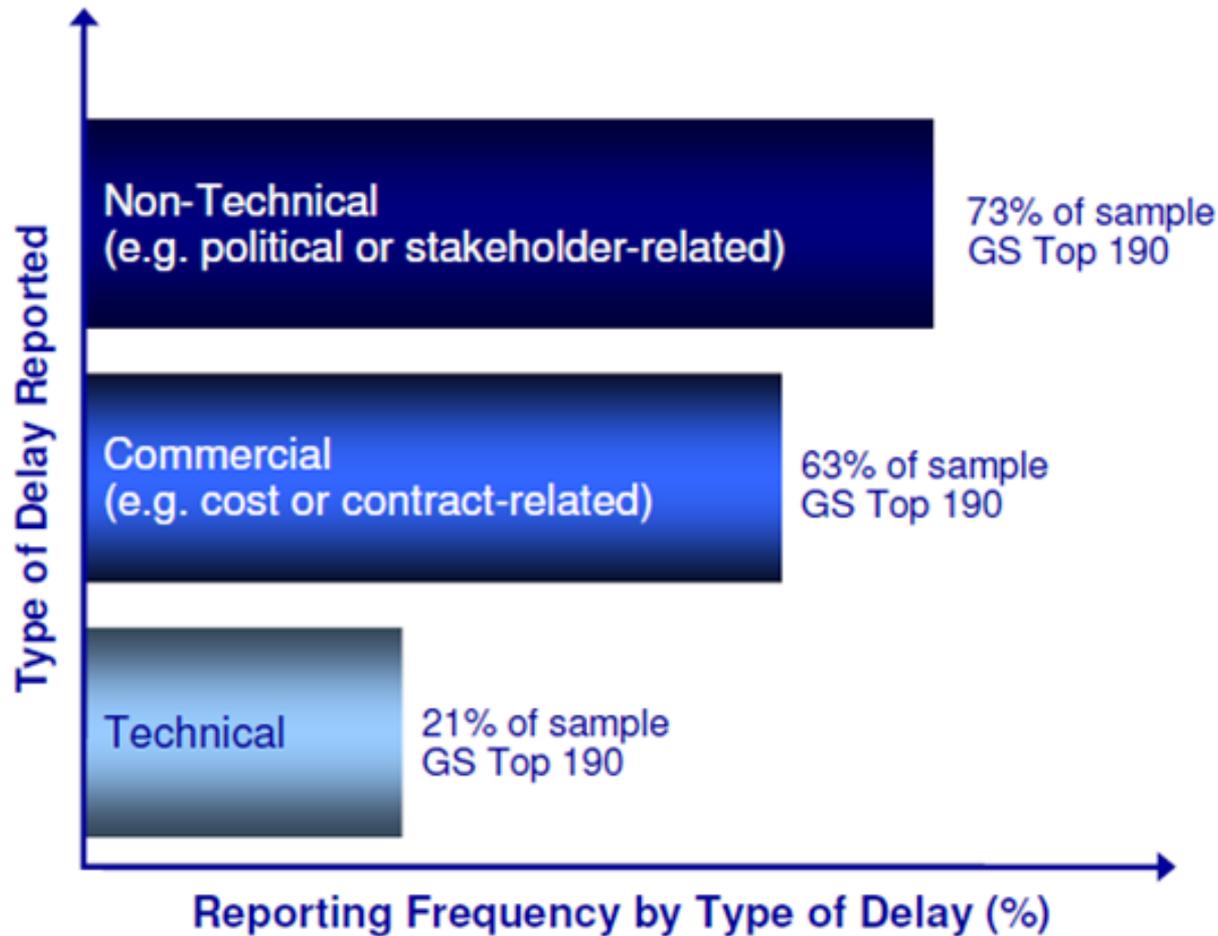


The Sustainability Imperative



- ▶ Sustainable Energy Modernization (SEM)
 - SEM Evaluation
 - SEM Plan
- ▶ Profitable sustainability
 - Economic Factors
 - CAPEX
 - OPEX
 - Political Factors
 - Environmental Factors
 - Social Factors
- ▶ Risk management

Challenge: Non-Technical Risk



Study of Top 190 Resource Projects

Projects in:

- N America
- S America
- Europe
- Africa
- Asia-Pacific
- Asia-Middle East

Of the 190 projects, average delay of 12 months for non-producing fields

Port Future Operations

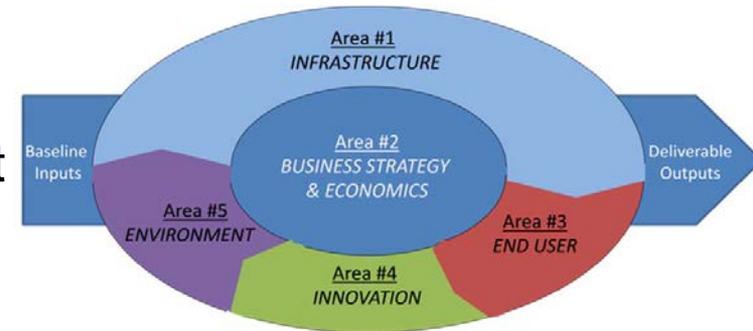
► Future Port's Energy Demand

- Long-Term Demand and Capacities
- Future Trends
- Energy Supply/Demand Management
- Strategic Partnerships
- Funding Opportunities
- Port Utilities' Transition to Renewable Power Generation

► Energy Demand/Carbon Footprint Reduction

- Energy Efficiency
- Renewable Energy
- Alternative Clean Energy Technologies and Initiatives

► Available & Developing Energy Generation Technologies



► Port's Energy Vision and Strategy

- Could the Port become carbon-neutral?
- Could the Port be powered by all renewable power sources?
- Could the Port become energy independent or generate power?
- How can the Port take advantage of emerging technologies?

► Port Energy Policy

- Port Sustainability Plan
- Port Energy Plan
- Stakeholder Engagement



Energy Efficiency Projects



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Global CCS Development Strategic Analysis

Customer: Global CCS Institute

Location: Global

Timeframe: Published 2009



IDENTIFY > EVALUATE > DEFINE > EXECUTE > OPERATE

- ▶ Strategic analysis of the global status of carbon capture, transport and storage projects and technologies
- ▶ The Global Carbon Capture and Storage (CCS) Institute, WorleyParsons, Schlumberger, Baker & McKenzie and Electric Power Research Institute
- ▶ Six reports to support broad deployment of carbon capture and storage by 2020

UCLA Cogeneration Facility

Customer: University of California Los Angeles

Location: California, USA

Timeframe: 1993 - ongoing



IDENTIFY > EVALUATE > DEFINE > EXECUTE > OPERATE

- ▶ 44MW CCGT cogenerating facility
- ▶ O&M, repair, production and delivery of thermal energy and electricity
- ▶ O&M outsourced to reduce costs, increase availability, engineering services

Collie Power Station

Customer: Verve Energy

Location: Western Australia

Timeframe: 2005 - ongoing

Contract Type: EPCM



IDENTIFY > EVALUATE > DEFINE > EXECUTE > OPERATE

- ▶ First full third party operation contract for a major Australian Power Plant
- ▶ O&M, asset and outage management, capital improvements
- ▶ Up-rate from 330MW to 340MW
- ▶ Top performance global benchmark (RWE nPower)

PANYNJ Cross Harbor Freight Program

Customer: Port Authority of New York & New Jersey

Location: Port Jersey Peninsula, N.J.

Timeframe: 2011- 2013

Project Value: \$1.214 m



IDENTIFY > EVALUATE > DEFINE > EXECUTE > OPERATE

- ▶ Rail Operational Planning and Process Mapping, Freight Capacity Study, Intermodal, Trade Flow Projections
- ▶ Marine Structural and Coastal Engineering, Naval Architecture, Terminal Operational Planning
- ▶ 10% of energy use reduction

Greenville Yard pre Hurricane Sandy



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The rehabilitation of the Greenville Yard is one of the key elements for the overall PANYNJ capacity expansion and system upgrades



Greenville Yard post Hurricane Sandy



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What's Your Port's Vision?

Do You Have Sustainable Energy Modernization Strategy for Your Port?





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