Energy Efficiency in Sustainable Port Development and Operations

AAPA 2013 Marine Terminal Management Training Program

September 12, 2013
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

- Port Development and 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

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

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


Source: U.S. Energy Information Administration, Manufacturing Energy Consumption Survey 2006, Table 1.2.
## Energy Savings Potential

### U.S. Most Energy-Intensive Industries

<table>
<thead>
<tr>
<th>Industry</th>
<th>Value of Shipments</th>
<th>CAPEX</th>
<th>Energy Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Petroleum</td>
<td>$219 billion</td>
<td>$7.3 billion</td>
<td>7.5% of total energy use</td>
</tr>
<tr>
<td>Chemicals</td>
<td>$438.4 billion</td>
<td>$18.9 billion</td>
<td>6% of total energy use</td>
</tr>
<tr>
<td>Forest Products</td>
<td>$243.1 billion</td>
<td>$9.5 billion</td>
<td>25% of US manufacturing energy use</td>
</tr>
<tr>
<td>Steel</td>
<td>$60.6 billion</td>
<td>$1.79 billion</td>
<td>1.5% of total energy use</td>
</tr>
<tr>
<td>Aluminum</td>
<td>$28.1 billion</td>
<td>$1.2 billion</td>
<td>1% of total energy use</td>
</tr>
<tr>
<td>Glass</td>
<td>$27.7 billion</td>
<td>$1.83 billion</td>
<td>energy cost 5-7% of shipments</td>
</tr>
<tr>
<td>Metalcasting</td>
<td>$28 billion</td>
<td>$1.5 billion</td>
<td>1% of US manufacturing energy use</td>
</tr>
</tbody>
</table>

### 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

- 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
  - Port, Local, State and Federal Policies
    - Sustainability, Emissions Reduction, Strategic Plans, and Other
  - Environmental and Regulatory Situation
  - Capital Improvement Plans
  - Port as a Utility
    - Power Generation
    - T&D
    - Renewables
  - Energy baseline for Long-Term Demand Projections
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

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
- Identify
- Evaluate
- Confirm viability
- Prioritize
- Implement
- Monitor
- EM&V
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
Port Modernization

- Automation
- Cold Ironing
- Energy Security and Port Security
- Resiliency

Sustainable Modernization
- Terminal Planning & Operations
- Marine Shipping and Logistics
- Intermodal Rail Yard / Barge
- Resource Materials
- Advanced Analysis
  - Computational Fluid Dynamics
  - Regression Analysis
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

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

Source: Goldman Sachs Investment Research, 2008
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

Global CCS Development Strategic Analysis
Customer: Global CCS Institute
Location: Global
Timeframe: Published 2009
- 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

Collie Power Station
Customer: Verve Energy
Location: Western Australia
Timeframe: 2005 - ongoing
Contract Type: EPCM
- 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 (RWEnPower)

UCLA Cogeneration Facility
Customer: University of California Los Angeles
Location: California, USA
Timeframe: 1993 - ongoing
- 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

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
- 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
What’s Your Port’s Vision?

Do You Have Sustainable Energy Modernization Strategy for Your Port?
For more information, please contact:

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