Energy Efficiency in Sustainable Port Development and Operations

AAPA Facilities Engineering Seminar and Expo

November 07, 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.
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The result…
Agenda

- 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

- 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

## 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></td>
<td></td>
<td></td>
<td>25% of US manufacturing energy use</td>
</tr>
<tr>
<td>Forest Products</td>
<td>$243.1 billion</td>
<td>$9.5 billion</td>
<td>14% 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></td>
<td></td>
<td></td>
<td>6.7% of US manufacturing 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>
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## 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
    - 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

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
Port Modernization

- 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

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 Operations / Energy Policy

- 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
Greenville Yard
pre Hurricane Sandy

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
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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