CRUISE SHIP
SHORE POWER PROSPECTS

Rich Pruitt, Associate Vice President Environmental Programs
Royal Caribbean Cruises, Ltd.

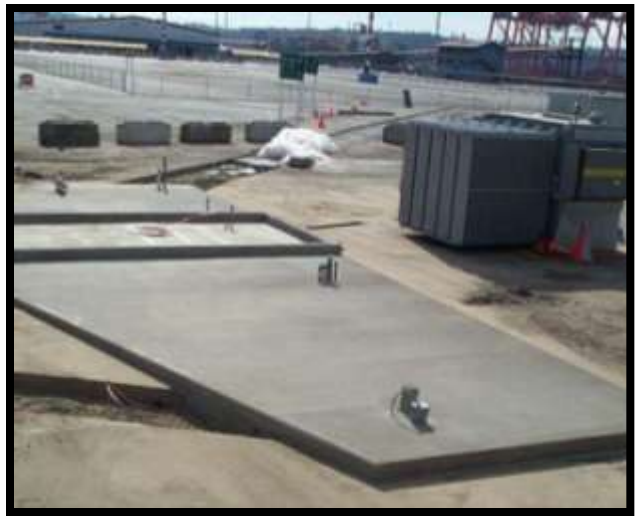
Shore Power Description

- Power is transmitted from an on-shore transformer to the ship through flexible electrical cables. The cables connect to the ships electrical system through traditional male/female plugs & sockets and enable the ship to operate or “hotel” on shore supplied power versus onboard generators

- Power is transferred and synchronized to the ship under a closed transition process monitored and controlled by the ship’s automation system

- Internal shore side monitoring and protection is achieved with protection relays, which insure safety and protection for both the ship and shore electrical systems

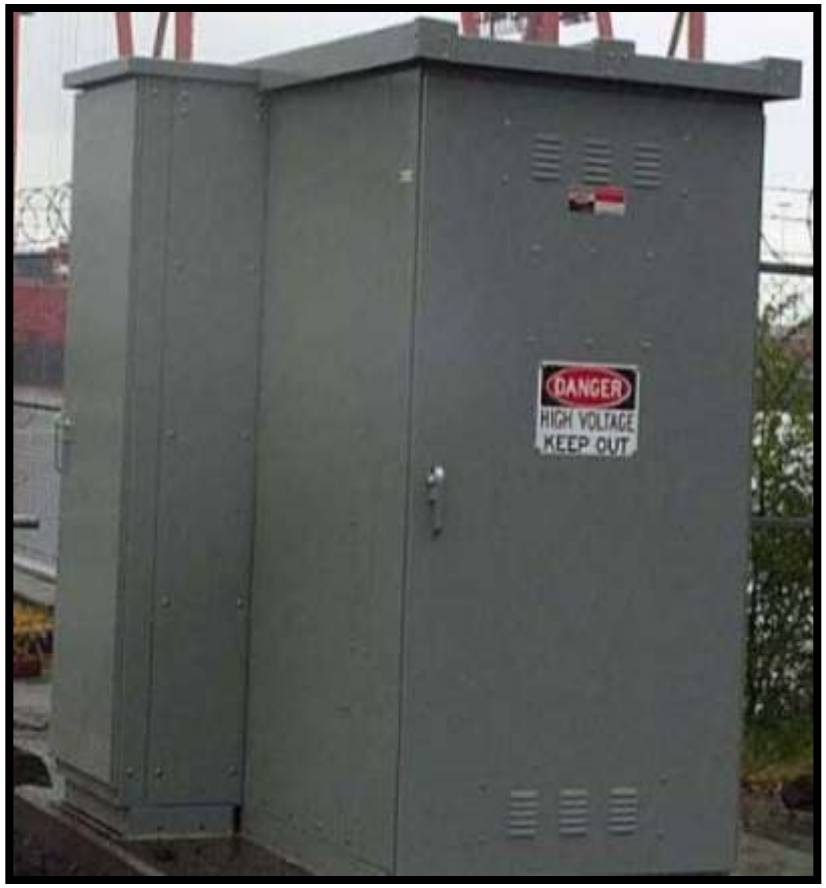
Excavation & Conduit Installation



Cable & Equipment

Main Metering Equipment, Transformer & Secondary Equipment

Ground Switch



Cable Positioning Device

Ship Side Equipment-Hardware

- Shorepower switchboard is installed, typically only on one side. This is connected into the ship's main power architecture
- Onboard automation must also be modified to allow the synchronization with the shore power
- Ship's engineers must then be qualified

Ship Side Equipment-Procedures

- Winch lowers cables into hull & cables are connected to the ships infrastructure.
- Onboard power loads are carefully shifted and synchronized with the shore power.
- Onboard engine(s) can then be deloaded and shut down.

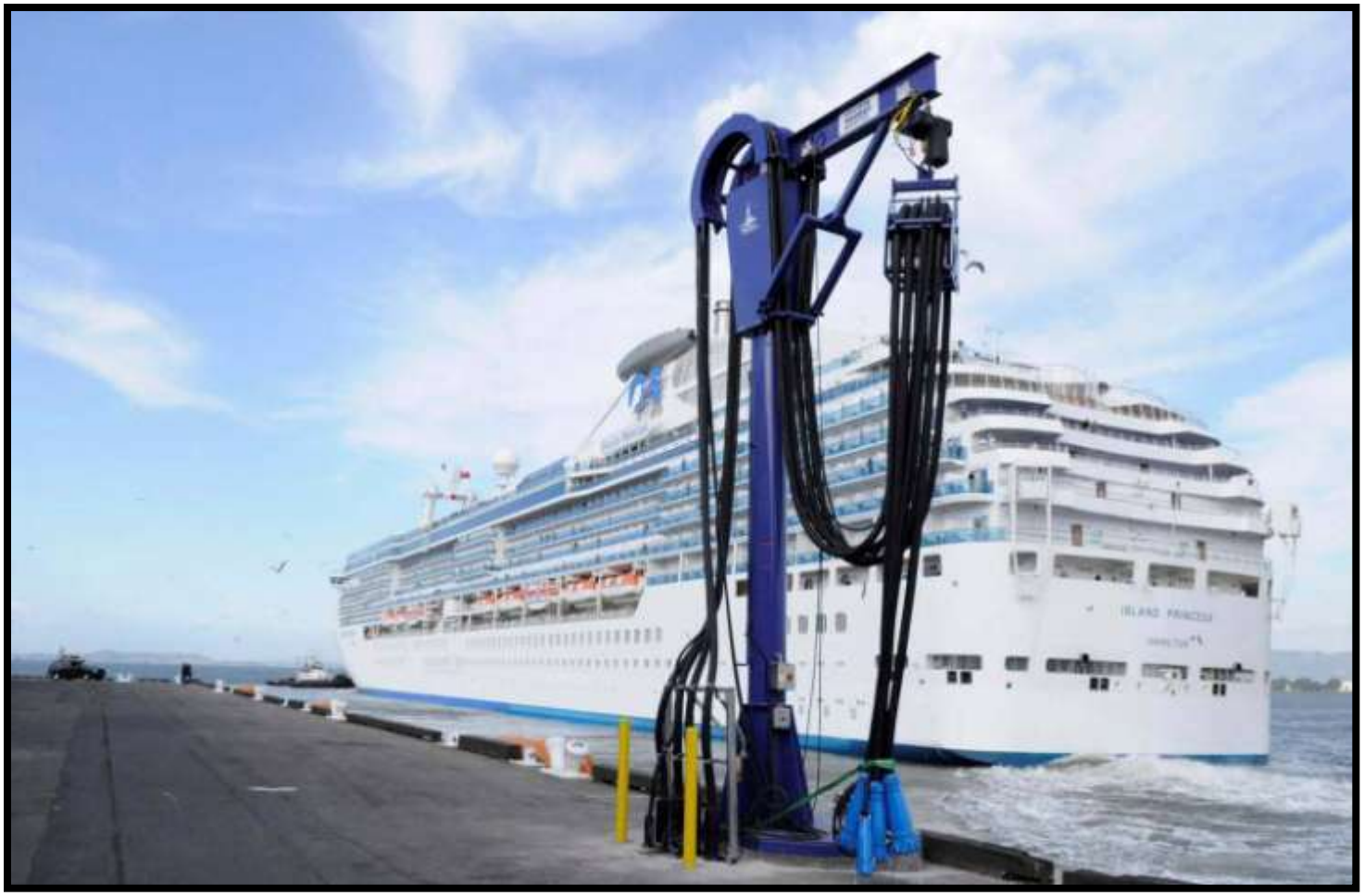
Criteria for a Successful Shore Power Project

- Source of shore side electrical power
  - Availability of an adequate supply of electricity at a reasonable cost
    - Not causing disruptions to local populace
    - Interruptable rates
    - Many calls are off peak on Saturdays and Sundays
    - Ships produce electricity for approximately $0.07 -.20/kWhr
    - Must be moored at a dock
  - Cleaner source than possible onboard
    - Renewables –vs- Coal or other fossil fuels
    - Onboard abatement options
    - Proximity to the port is important due to line loss
- Frequency of calls by cruise vessels equipped to connect to Shore Power.

Criteria for a Successful Shore Power Project.

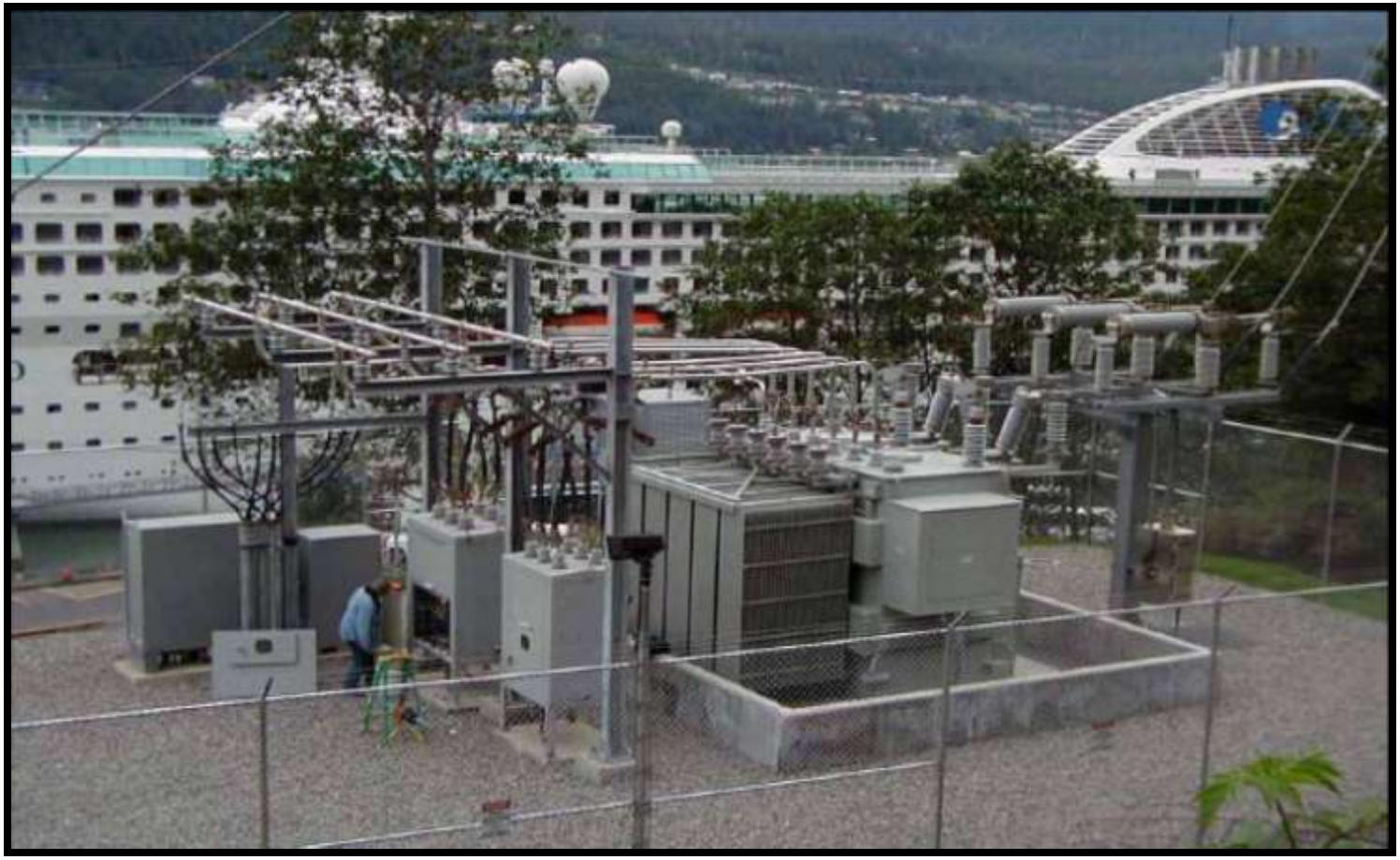
- Availability of the same dock and pier facility for these vessels for every call
- Adequate dock and uplands space for equipment
- Willing partners including –utility, port and government agencies

San Francisco Shore Power



Juneau, AK 2001 – Shore Power

First High Voltage Shore Power Connection for Cruise Ships



Existing Shore Power Projects

- Juneau, AK -1 installation, completed 2001
- Seattle, WA -2 installations (each dual voltage), completed 2005 & 2006
- Vancouver, BC -2 installations (each dual voltage) completed 2009
- San Francisco, CA -1 installation (dual voltage), completed 2010
- Los Angeles, CA -2 installations, (single voltage), completion 2011
- San Diego, CA -1 installation (dual voltage), completed 2010
- Long Beach, CA -1 installation (dual voltage), est. completion 2011
- Brooklyn Red Hook, NY -1 installation (dual voltage) est. completion 2012

Conclusion on Shore Power

- Chicken or the Egg Phenomenon when it comes to further deployment of this technology
- In some instances Shore Power is a good emissions reduction strategy
  - It can deliver benefits in high population density areas, but not always
  - If renewable/nuclear it delivers globally
- Recent European Union commissioned study found that for certain ports and for certain ships it is worth pursuing, but:
  - They found that only 1-3% of a ship's total emissions are reduced for each day plugged in
  - This does not include a correction for ships that are/may have onboard abatement systems onboard or revisions to emissions regulations
    - The ECAs will already dramatically reduce emissions, thus cutting into claims of shore power benefits
  - We need to remember that we must find solutions for the other 97 – 99% of the emissions when the ship is underway, wherever that is