Smoothing the demand of RTG cranes with intelligent energy storage systems

by

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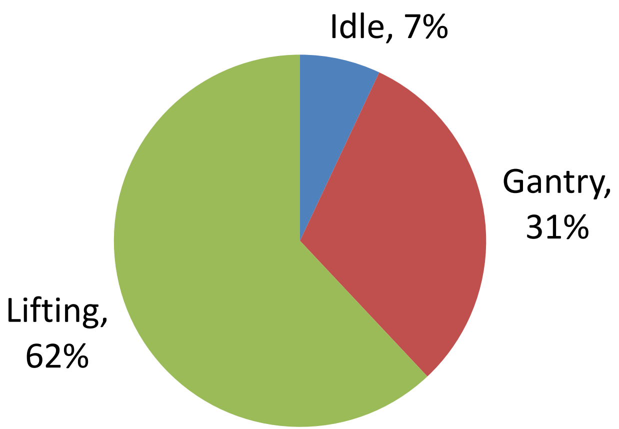
Challenges and solutions

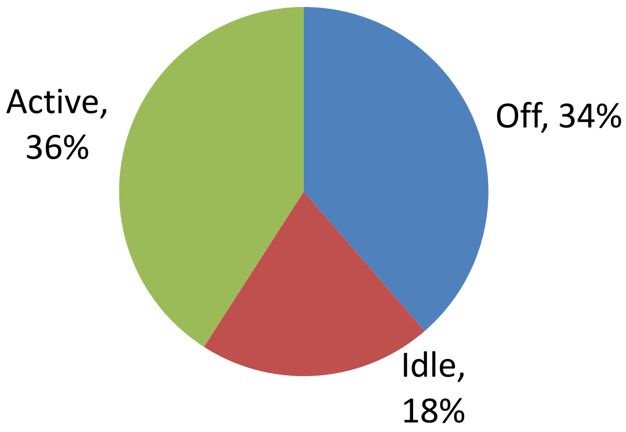
- The challenge for ports is to reduce their operating costs and their CO2 footprint in accordance with the recent IMO decision to reduce CO_2 emissions by 50% by 2050
- Also to reduce the demand for oil based products now that world supply of conventional oil has peaked
- Possible solutions include –
- Using energy storage to recover inertial energy when electrical braking of motors of RTG cranes or straddle carriers
- Downsizing the prime source
- Switching from diesel generation to grid electrical supplies

RTG crane one day's operation

Energy distribution



Time distribution



Energy and fuel savings

- Energy can be recovered when a crane motor is braked - either by exporting via an active front end or storing energy on crane for reuse when lifting next container

- Savings with dRTG up to 12,000 litres per year
- Savings with eRTG up to 30,000 kWh per year
- The highest fuel savings are achieved when storage PLC knows where crane is in duty cycle so it can decide when to take power in and when to give it out

Smoothing peak demand

- Over a period of one hour, the peak demand of 17 eRTGs was 1.6 MVA and the average 0.6 MVA
- Intelligent energy storage system enables the extreme value to be brought close to the average value which in turn can be decreased
- Reduces demand on primary supply
- Reduces energy bill as well as unit rate if rate is related to maximum peak demand in any fixed period say 30 minutes

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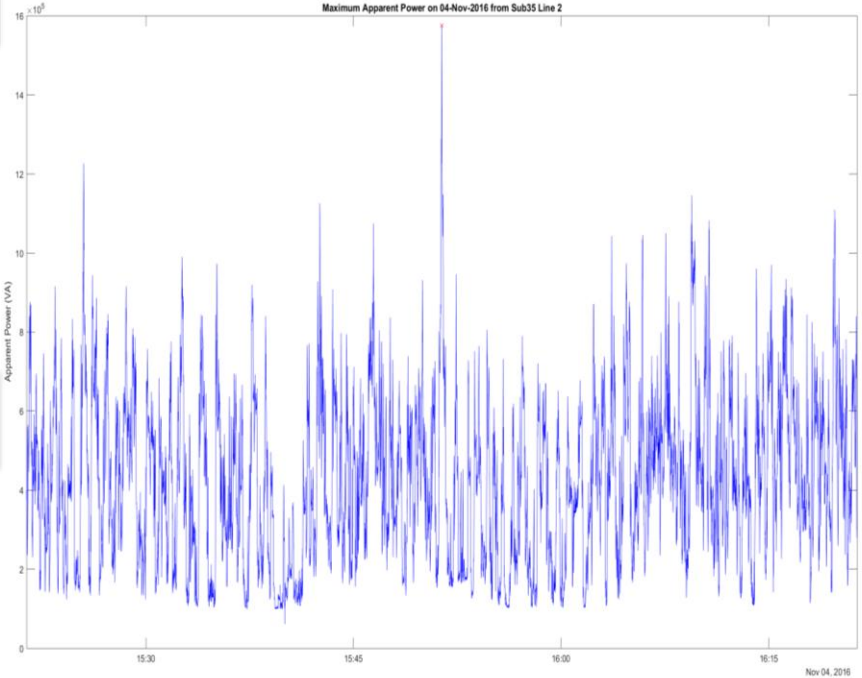

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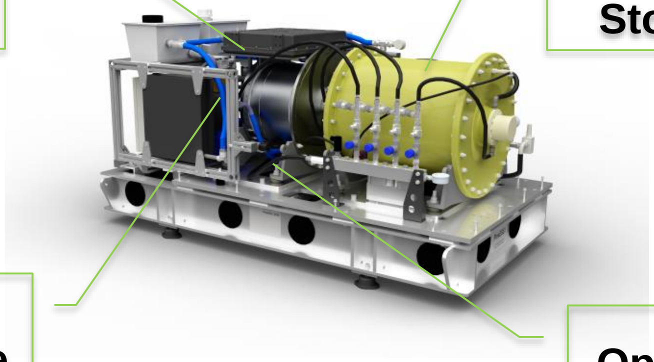
1 hour

CRESS storage system



CRESS specification

- Lightweight rotor rotating inside dedicated safety casing with energy transfer by switched reluctance motor
- PLC controller uses control algorithms to transfer energy and monitor performance
- System can be tuned for specific operational modes
- Low maintenance as bearings operate in vacuum
- Design life one million deep discharge (90%) cycles similar to that of portal frame of crane

Locating the energy store

Most suitable location for RTGs is on dump resistor platform

Dump resistor and energy store can then be wired in parallel

Energy storage and dRTGs

- CRESS system can be connected at any convenient point of the DC net of the crane; AC connection is also possible
- energy store controller is able to
  - recover energy which would be dumped
  - decide when to take in energy from primary source at a low rate
  - give out energy at a high rate so acting as a power multiplier
- possibility of downsizing genset to save further fuel when operating at no load or idle

Energy storage and eRTGs

- Energy can be recovered when any motor brakes for reuse in lifting next container or traversing gantry
- by working in parallel with grid supply, demand on transformer and primary supply can be reduced so reducing the need to strengthen grid supplies
- mounting on crane facilitates moves between container stacks

- by increasing efficiency, energy storage is able to save energy, power demand and CO_2 emissions