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Comments on draft National Ports Strategy

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Introduction

Infrastructure Australia and the National Transport Commission released the draft National Ports Strategy in early May 2010. CSIRO commends Infrastructure Australia and the National Transport Commission on the draft strategy, which we believe deals thoroughly with many pertinent issues. CSIRO welcomes the opportunity to provide feedback and comment on the draft strategy. CSIRO's response is informed by recent and ongoing CSIRO research activity. This response emphasizes

- issues relating to climate change adaptation
- energy strategies in a carbon-constrained economy; and
- the planning and operation of ports as integral elements of supply networks for coal, minerals and other bulk freight.

Impact of Climate Change

There are significant challenges for ports stemming from climate change. Predicted sea-level rise, more frequent storm surge and intense extreme wind under climate change presents a clear threat to coastal infrastructure and therefore port facilities[1]. In tandem with these broad-scale impacts are important yet less obvious pressures on port infrastructure also associated with climate change.

In-progress research by CSIRO investigates potential impacts of changing climate on the deterioration of concrete infrastructure, especially due to carbonation-induced and chloride-induced corrosion[2]. The mechanisms for this corrosion that are driven by factors such as temperature, humidity and carbon dioxide concentration could be exacerbated by changing climate. Changes attributable to future climate change in the initiation probability for corrosion depend on climate change scenario, local environmental exposure (i.e. arid, temperate or tropical climatic conditions, together with the distance to coast, etc.) and the design standard applied to the structure. Under a high emission climate-change scenario, CSIRO's simulation results predict an increase in Carbonation-induced corrosion initiation probability by 2100 of 25% in Hobart, 38% in Townsville and 33% in Sydney, as examples. For ports, increased corrosion hazards attributable to sea-level rise may also become significant as a result of the shift of "splash and tidal zone". This may potentially compromise the existing corrosion protection measures, such as cathodic protection. Therefore, current planning, design and maintenance procedures for port infrastructure may benefit from being carefully reconsidered.

Relatively inexpensive adaptation measures for corrosion-related climate change impacts are available for port infrastructure, when applied site-specifically and at the design and construction stages. These measures include increasing concrete cover to provide more protection to reinforcement material, upgrading concrete strength grade, and selecting carbonation/chloride resistant concrete and corrosion resistant reinforcement. By contrast, remedial work on corroding port structures is estimated to be far more expensive (for example, through comparing current labour-intensive concrete patching repair to cover-increase for prolonging the service life of port concrete infrastructure).

In summary, under climate change there are considerable changes in the way ports should be planned, designed, constructed and maintained. *Planning for Relevant Ports and Infrastructure* is one of the four priority areas identified in the draft proposed National Ports Strategy, where it is also noted that "*ports and freight supply chains are long life assets*". In light of the aforementioned research and the clear threat that climate change presents to coastal infrastructure, in CSIRO's view it would be appropriate for informed assessments of likely climate-change impacts to be an integral component of future port infrastructure planning. Furthermore, we consider that given the significance of this issue it would benefit from more prominence in the finalised National Ports Strategy proposal. The cost-effectiveness of adaptation measures when applied at the design-and-construction stage further emphasizes the importance of CSIRO's view.

[1] Refer *Climate Change Risk to Australia's Coast,* Dept Climate Change, 2009.
[2] This research is in progress and includes in-situ case studies in Australian ports. Research results are expected to be publicly released during the second half of 2010.

Energy considerations

CSIRO-led research into Australia's stationary and transport energy needs indicates the significant future role of demand management and localised electricity generation in a Carbon-constrained economy[3]. According to CSIRO's integrated technological and economic modelling, such *Distributed Energy* (DE) solutions are integral to the development of least-cost solutions for fulfilling Australia's energy demands.

Port-specific initiatives leading to major reductions in carbon emissions, peak demand and energy consumption are mainly at concept stage internationally at present[4]. Further upstream in freight supply chains, however, CSIRO has partnered with organisations to research and deploy DE technologies. For example, in 2007 CSIRO conducted research with Food Science Australia regarding electricity use in cold storage[5], and in 2008-2009 CSIRO contributed to the Maine's Power project which investigated ways by which four of the largest businesses in Castlemaine, Victoria, could achieve major improvements in greenhouse performance, energy efficiency and reliability[6].

CSIRO acknowledges that DE considerations may be considered secondary compared to the direct climate-change impacts on ports and the key logistical, regulatory and operations-management issues that apply. Nevertheless, we encourage Infrastructure Australia and National Transport Commission to consider incorporating (as elements of port infrastructure planning) discussion around energy security, energy efficiency, local generation and (peak) demand management within in a revised National Ports Strategy proposal.

Logistical issues

The draft National Ports Strategy already incorporates many insights into port and landside logistics-related issues. CSIRO's research and experience within the coal, minerals and bulk freight industry (primarily in NSW and Queensland)[7] generally supports these insights contained in the draft National Ports Strategy.

Analyses by CSIRO of coal supply chain operations data, supplied by a large Australian port facility and spanning the period from November 2007 to July 2008, uncover issues that we suggest are important for shared port facilities:

- *Logistics planning and its execution*: Significant downtime of a port occurs when the arrivals of ships are not synchronized with arrival of the corresponding material to the stockyard of the port. Better operations planning (i.e., synchronization of the supply chain) and execution management will lead to increase in available capacity on the scarce resources of a shared port. (These improvements can be facilitated by IT innovation, more collaborative inter-organisational operations management practices, and the provision of software tools to support planning and scenario analysis).
- *Pricing strategies*: Pricing policies can be adapted in order to penalize losses of port throughput that are caused by the actions of individual stakeholders. This would encourage efficient utilization of a shared port. Moreover, it would also serve as a reward mechanism promoting good (i.e., unselfish) behaviour by each user/stakeholder.
- *Synchronization of the entire coal supply chain*: We have found that long queues of ships awaiting berthing are not necessarily a good representation of the (in-)effectiveness or otherwise of a port's

[3] *Intelligent Grid: A value proposition for wide scale distributed energy solutions for Australia*, CSIRO, 2009.
[4] Refer, e.g., *Clean Green Terminal of the Future*, Wallenius Wilhelmsen Logistics, 2010, http://www.pitchengine.com/walleniuswilhelmsenlogistics/clean-green-terminal-of-the-future--/62938/.
[5] *Electricity usage in the Australian cold chain*, S. Estrada-Flores and G. Platt, *Food Australia*, Volume 59 Number 8.
[6] Refer http://www.csiro.au/news/Castlemaine-shows-how-to-cut-emissions.html
[7] Refer http://www.cmis.csiro.au/asn/capital-intensive-sc/index.htm and http://www.cmis.csiro.au/or/pdf/transport-for-agri-and-bmh.pdf for overview information

operations. Our analyses also show that changing the vessel mix (i.e., which types of vessels and in what quantity) or vessel allocation rules (i.e., at which berths should vessels be loaded) would not substantially reduce queues. However, our analyses do reveal that the shipping queues can be substantially reduced by synchronizing/improving the entire coal supply chain.

In earlier work in partnership with a port operator for a Queensland coal chain, CSIRO used simulation studies to address the dependencies between port infrastructure utilisation (or equivalently, loss of capacity) and the protocols/policies relating to port stakeholder's railing and stockyard-use entitlements[8]. In general terms, the more the operational policies in the simulated supply chain emphasize responses to actual shipping demand, rather than longer-term contractually-based entitlements, the more efficient the utilisation of the available port infrastructure. In relation to priority areas 1 and 3 of the draft National Ports Strategy proposal, this helps to further demonstrate that infrastructure requirements of a port depend strongly on the operating protocols embedded in port usage/access contracts as well as upstream supply chain operating policies.

For coal and minerals supply chain infrastructure planning CSIRO has partnered with port operators and supply chain coordination teams to build and apply infrastructure-network optimisation tools. These tools identify the cost-optimal infrastructure investment options across a network, so as to satisfy growing export demand. The results of applying these tools (jointly by CSIRO and the adopting organisations) amply demonstrate to us that whole-of-chain throughput increases require whole-of-chain infrastructure planning. Furthermore, the best solutions for increasing export volumes through ports most often specify simultaneous infrastructure upgrades upstream of the ports in the supply chain. This we believe is partly due to tightly integrated bulk-materials supply chain systems rarely having a single bottleneck at any given point in time. CSIRO also perceives increasing interconnectivity and interdependency between bulk materials supply chains. We therefore see whole-of-region freight transport planning and whole-of-chain infrastructure planning as complementary to the port infrastructure planning that is identified as a priority area in the draft National Ports Strategy proposal.

[8] *Solving Regional Infrastructure Bottlenecks: Rail Allocation Policies for a Coal Terminal*, Ernst, Krishnamoorthy, Sier and Marquez. *Australasian Journal of Regional Studies*, 14(2), 2008.