Optimal Siting and Sizing of Charging facilities for Electric Harbor Crafts

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1. Growingly concerns on maritime environmental issues

- Maritime transportation has produced 3% global CO₂ emission and 15% NOx emission in 2017. IMO has proposed strict regulations on the maritime emission reductions. Some reduction targets are shown in the following figures.
- The emission in the harbor territory has more severe impacts on urban lives, which should attract more attentions.







2. Electrification of harbor crafts



• Intermittency and noises



• Not suitable for commercials





• Low efficiency



• Not suitable for small vessels





2. Electrification of harbor crafts

• First all-electric ferry world-wide "Ampere" (Norway)





- ▶ 1,598tons / 13.9knots
- ➢ Battery capacity: 1.04MWh
- ➤ 34 round trip a day
- ➤ 5.6km for each trip
- ➤ Save 1 million liters diesel annually
- Reduce 27t NOx annually
- Reduce 2,680t CO₂ annually

2. Electrification of harbor crafts

- Advantages and problems
- Environmental friendly: CO₂, NOx, SOx emission reductions.
- Fuel saving since high efficiency of electricity.
- Space and operation fee saving for the fuel storage.





*2. Impact to Distribution Grid

Problem Description



3. Aims of ports' electrification





5. Optimal siting and sizing of charging facilities | Planning





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<u>Bioinspired Materials</u> <u>for Clean Energy &</u> Environment



<u>Ship Structures, Offshore</u> <u>and Shipyard</u> <u>Management</u>



Intelligent System Design & Predictive Analytics for Battery, Marine Vehicle, Noise & Vibration



<u>Fluid</u> Dynamics

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<u>Combustion,</u> Engine and Fuel



Marine Hydrodynamics



Offshore Floating Strectures



<u>Lightweighting</u> composite materials and Structures



<u>Electrical</u> <u>integration and</u> <u>Energy efficiency</u>



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Thank you!