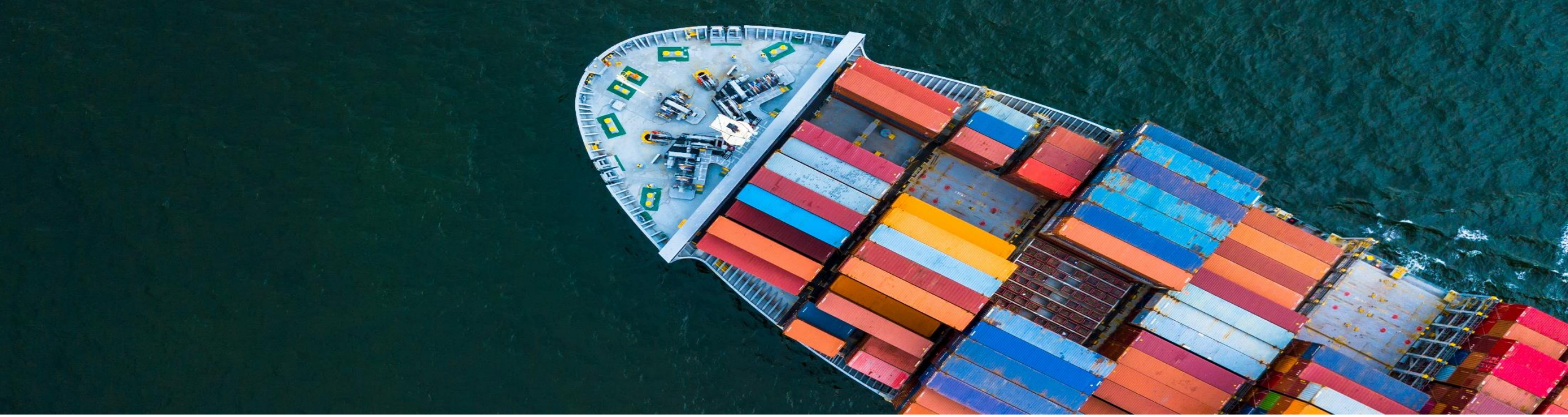


Hybrid Energy for Small Marine Vessels Toward a Green and Inclusive Maritime Sector

(IMO-WB ENV-P Project)

Prepared by: ***Prof. Aykut I. Ölçer &***
Capt. Dr. Seyed Vahid Vakili
Maritime Energy Department
World Maritime University (WMU)
ENV-P International Consultants

Presented by: Engr. Ramon C. Hernandez, MSc
Shipyards Regulation Service
Maritime Industry Authority (MARINA)
Project Focal Point

IMO'S RESPONSE & WIDE VARIETY of TECHNICAL & OPERATIONAL MEASURES

Policy approaches at the IMO

Technical

Operational

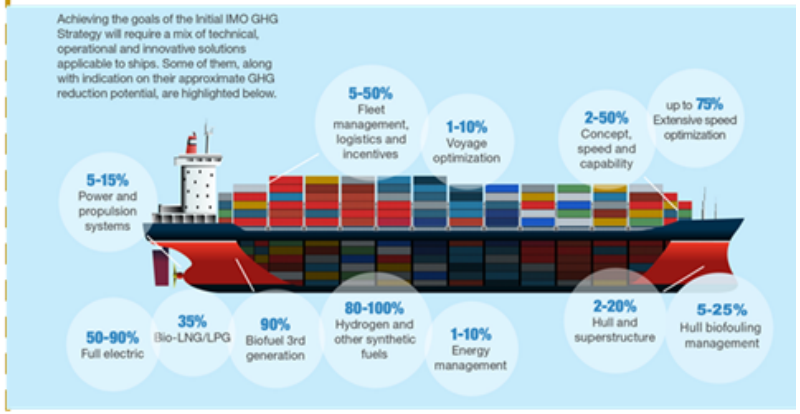
Command and control policy focus on Ships and management

Included in Annex VI Chapter 4

Economical

Market-based instrument focus on Global objective

Discussions Suspended



Source: (WMU Maritime Energy Management Specialization EGY102 Lecture Notes)

STUDY TO ADDRESS SAFETY & ENERGY EFFICIENCY of DOMESTIC PASSENGER SHIPS in the PHILIPPINES

Photos: courtesy of J. Schröder-Hinrichs and J. M. Uranza

Project Title: Study to Address Safety & Energy Efficiency of Domestic Passenger Ships in the Philippines

The STUDY is composed of two parts or subtopics:

Subtopic 1: Formal Safety Assessment for enhancing safety of domestic passenger ships in the Philippines as per the relevant IMO Guidelines (FSA-P); and,

Subtopic 2: Improving Energy Efficiency and Environmental Footprint of Domestic Passenger Ships in the Philippines (ENV-P).

Subtopic 2: Improving Energy Efficiency and Environmental Footprint of Domestic Passenger Ships in the Philippines (ENV-P)

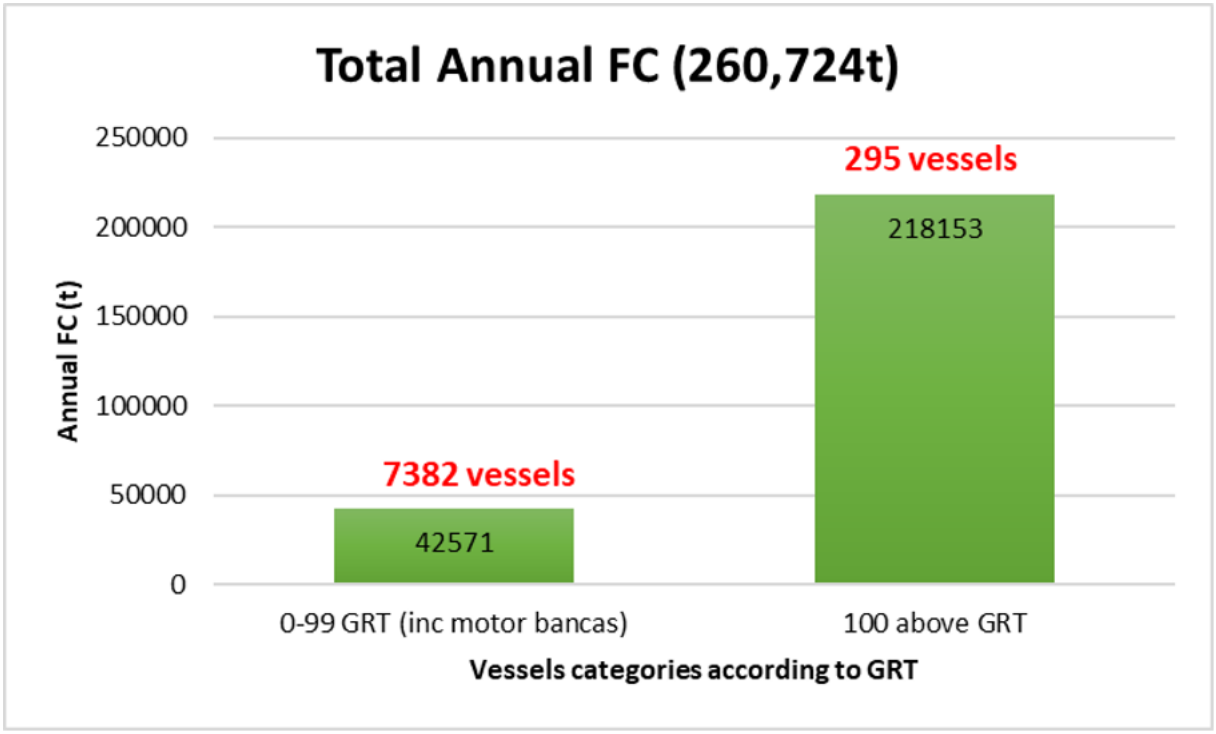
OVERALL OBJECTIVE

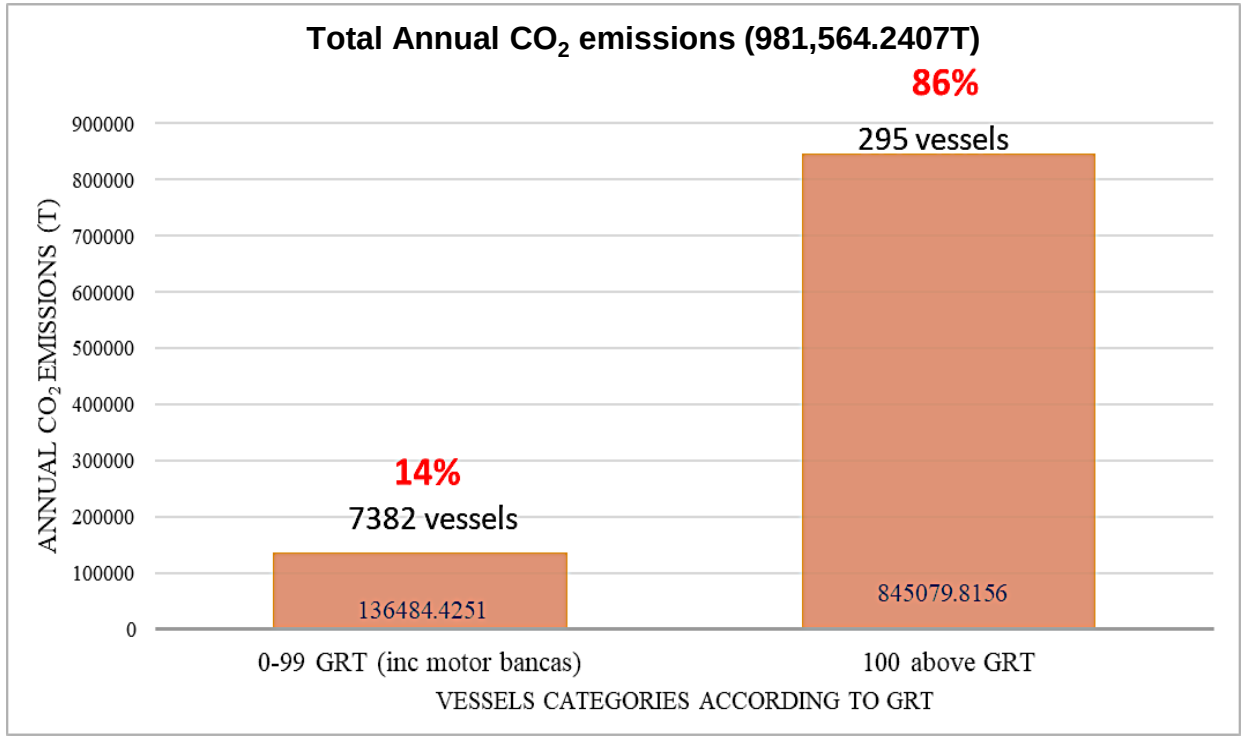
To analyse the current state of the **domestic ferry** industry from the point of view of **energy efficiency and carbon environmental footprint**, targeting to:

- Identify the most **practical and cost-effective options** to reduce the carbon footprint in the short-term;
- Propose a feasible **roadmap** for **short- medium- and long-terms**; and,
- Support the development and implementation of **National Action Plans** on reducing GHG emissions and improving energy efficiency.

Subtopic 2: Improving Energy Efficiency and Environmental Footprint of Domestic Passenger Ships in the Philippines (ENV-P)

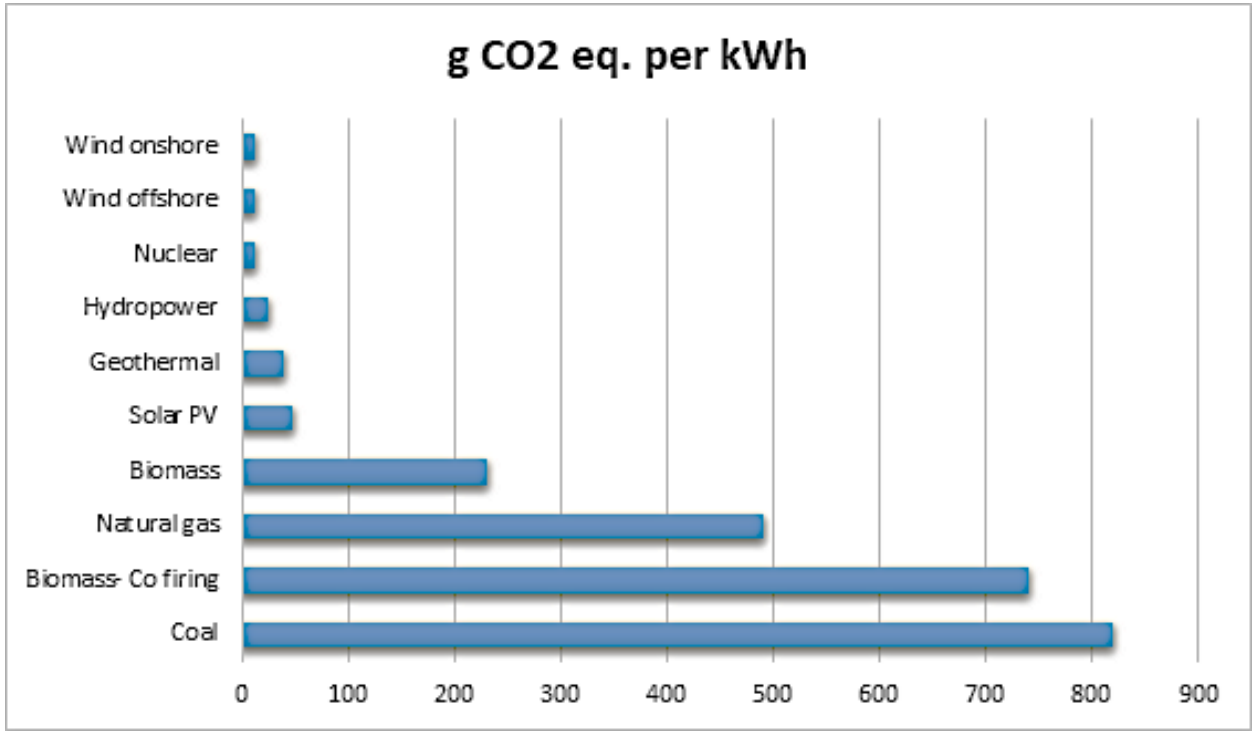
TOTAL ANNUAL FUEL CONSUMPTION & CO2 EMISSIONS



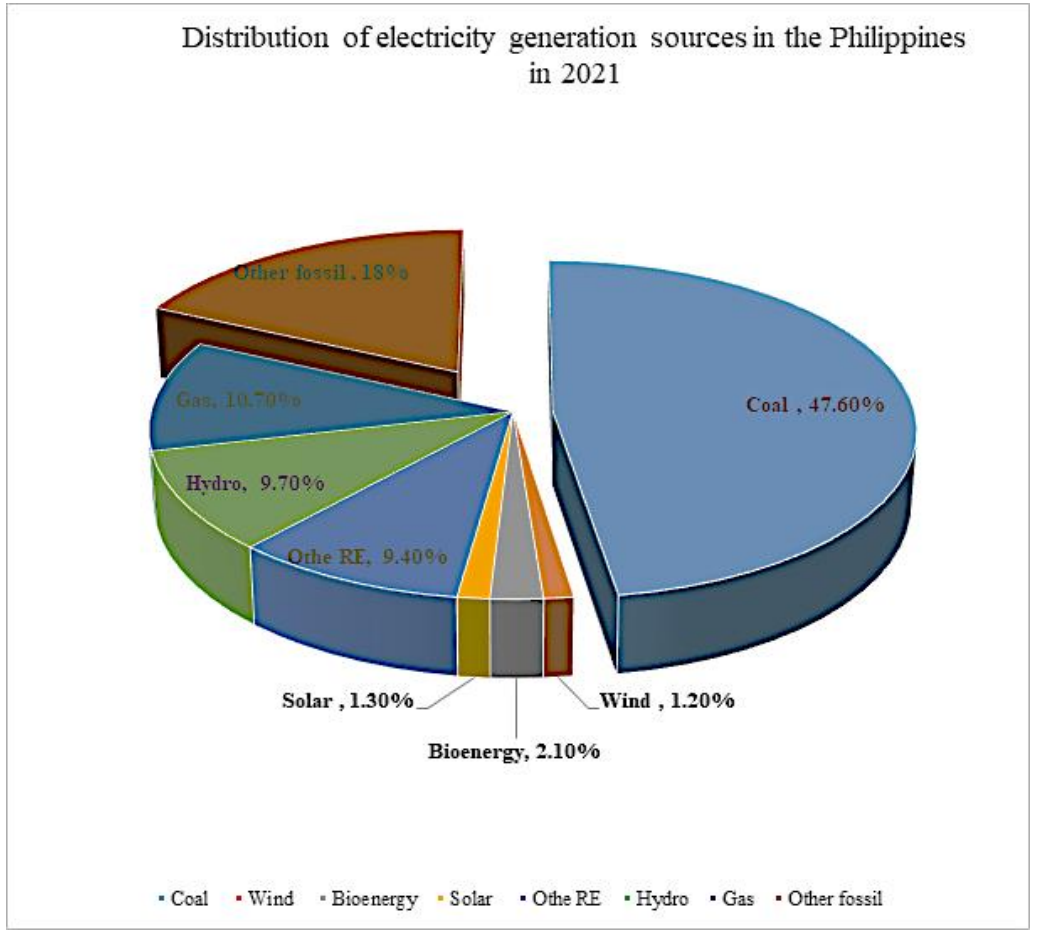


DETAILED STUDIES of BATTERY POWERED SHIP

Are battery-powered vessels the best solution for the domestic ferry segment?



Carbon dioxide equivalents (CO_2eq) of different fuel types for electricity generation.

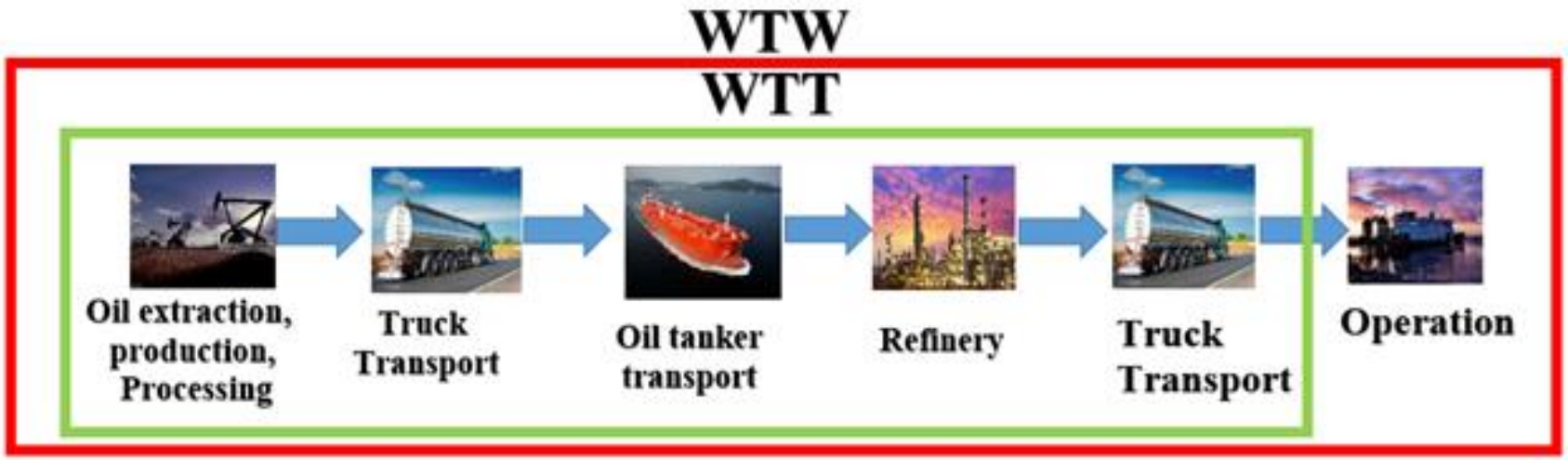


Distribution of electricity generation sources in the Philippines in 2021
Source: (Statista, 2021).

STUDIED SHIP & WELL-TO-WAKE ANALYSIS

Ship's particulars

Name	Particulars
Type	Ro Ro Passenger
Length Of Overall (LOA)	42.72 meters
Breadth	11.2 meters
Draught	2.0 meters
Depth	3.0 meters
Deadweight at summer draught	845 tonnes
Design speed	10 knots

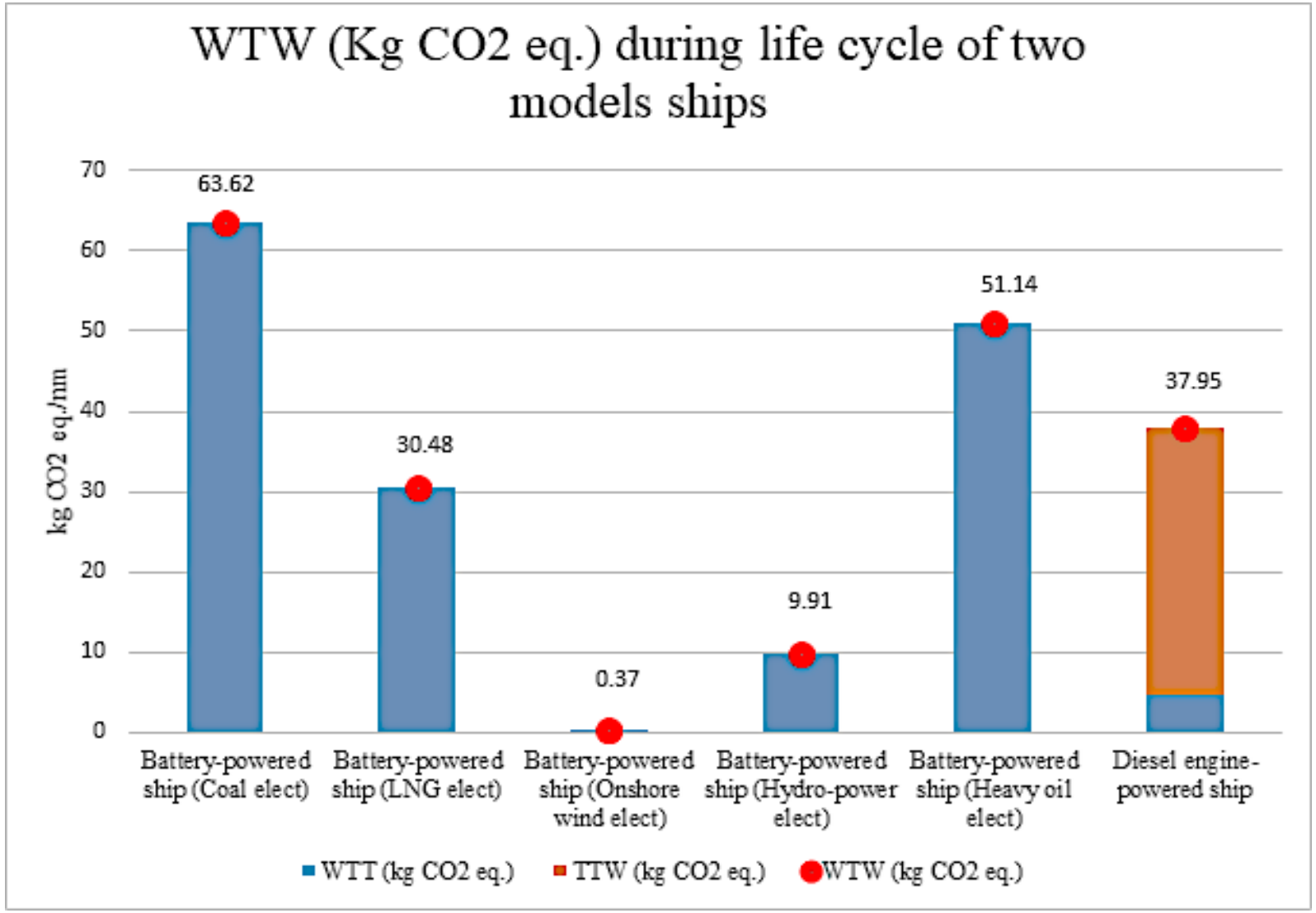


WTT and TTW sequences for diesel-powered vessels

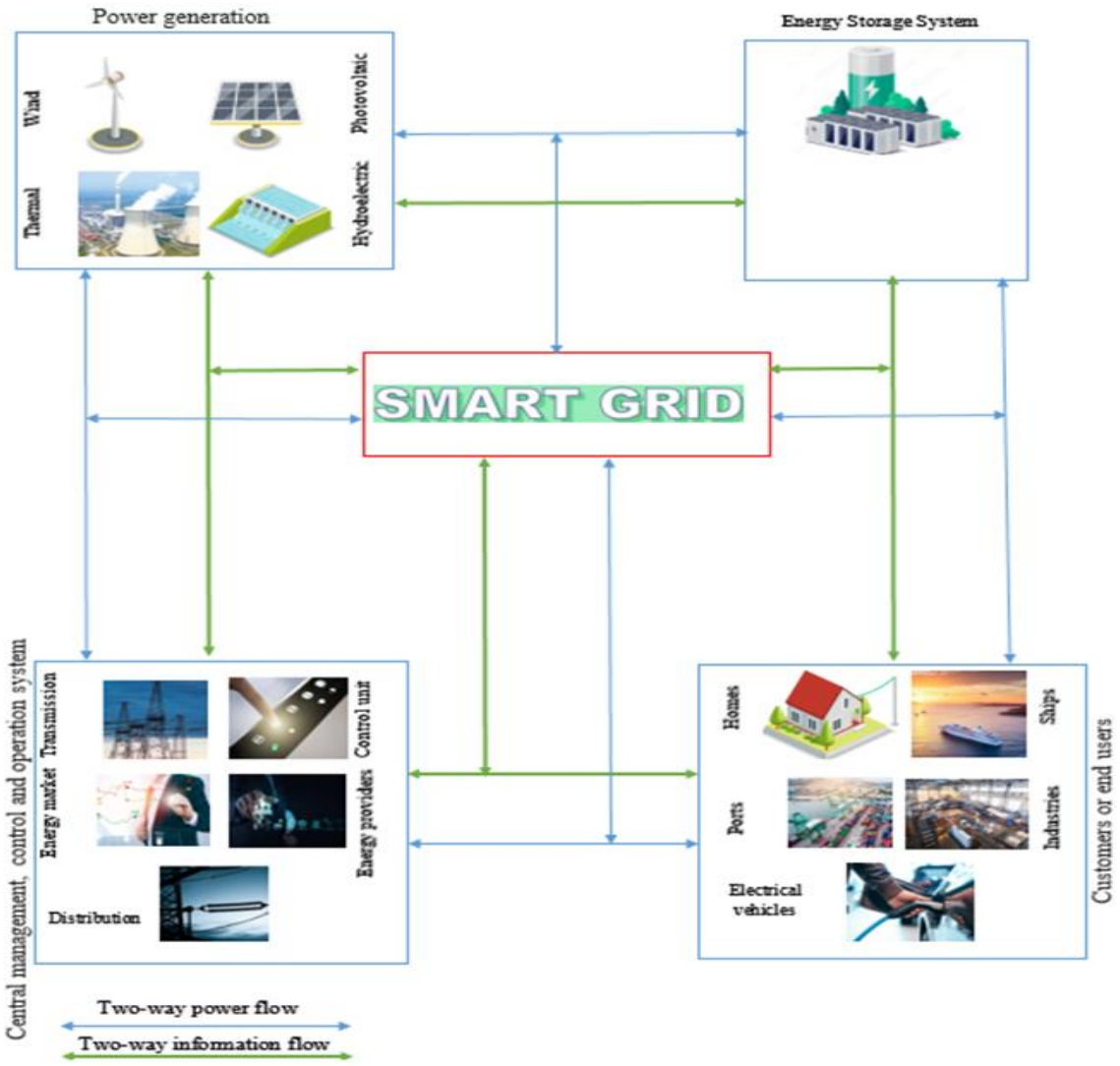
Note:
WTW - Well-to-Wake
WTT - Well-to-Tank
TTW - Tank-to-Wake

BATTERY POWERED SHIP

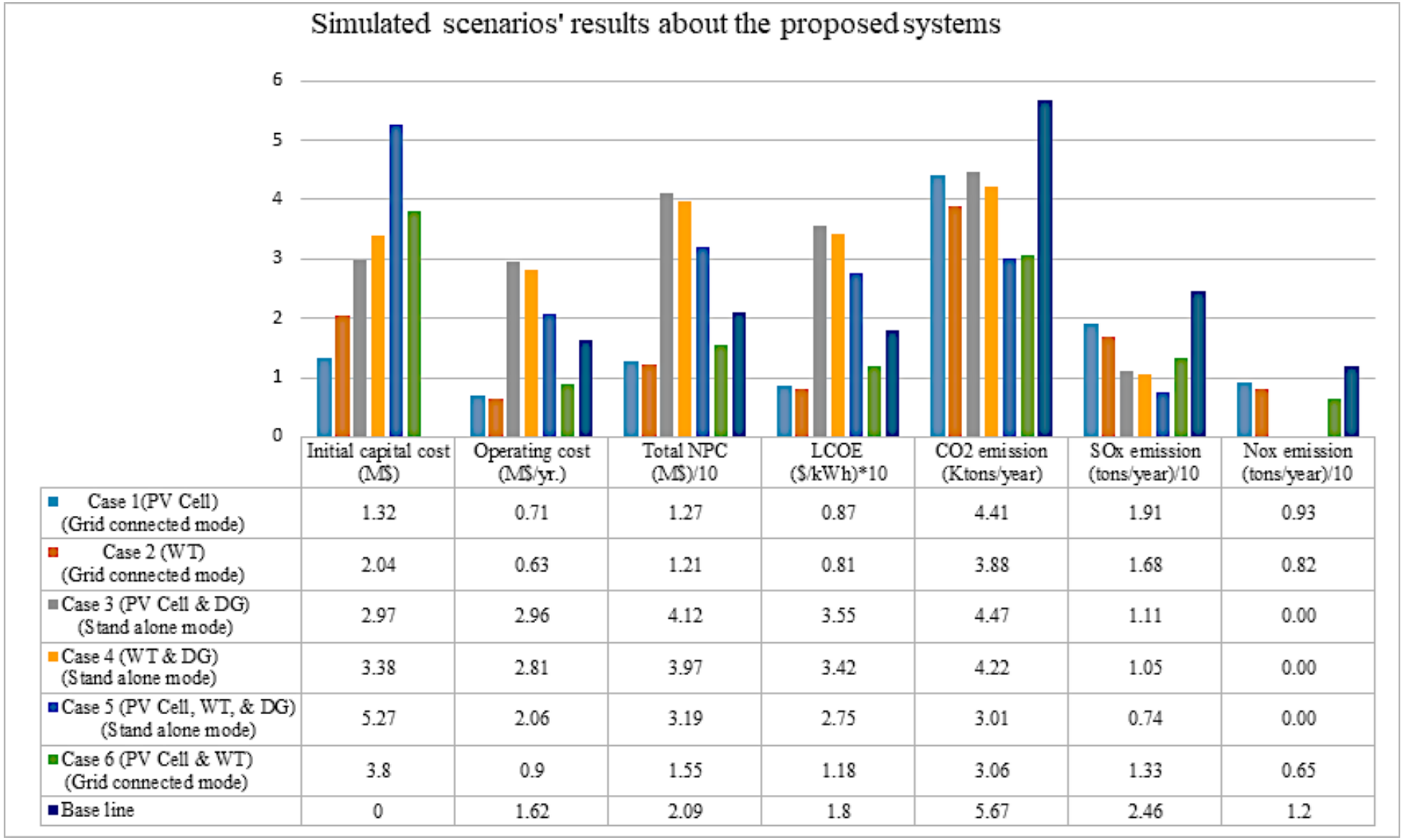
WTW (kg CO_2 eq/nm) during life cycle of two models ships



PORTS SMART GRIDS



PORTS SMART GRIDS



	Initial capital cost (M$)	Operating cost (M$/yr.)	Total NPC (M$)/10	LCOE ($/kWh)*10	CO2 emission (Ktons/year)	SOx emission (tons/year)/10	Nox emission (tons/year)/10
Case 1(PV Cell) (Grid connected mode)	1.32	0.71	1.27	0.87	4.41	1.91	0.93
Case 2 (WT) (Grid connected mode)	2.04	0.63	1.21	0.81	3.88	1.68	0.82
Case 3 (PV Cell & DG) (Stand alone mode)	2.97	2.96	4.12	3.55	4.47	1.11	0.00
Case 4 (WT & DG) (Stand alone mode)	3.38	2.81	3.97	3.42	4.22	1.05	0.00
Case 5 (PV Cell, WT, & DG) (Stand alone mode)	5.27	2.06	3.19	2.75	3.01	0.74	0.00
Case 6 (PV Cell & WT) (Grid connected mode)	3.8	0.9	1.55	1.18	3.06	1.33	0.65
Base line	0	1.62	2.09	1.8	5.67	2.46	1.2

Decarbonisation of Domestic Ferries in the Philippines

Target: Carbon free maritime transport by ?

Holistic, Systematic and Transdisciplinary (HST) approach

Applying Green economy (landscape), Alignment with Green supply chain system, Energy Power System, and conducting Impact assessment

Timelines	Short term 2023–2028	Medium term 2028–2033	Long term Beyond 2033
Ships	**Small ferries and motor bancas** – Hybridization/ Electrification – new designs – Economic scale **Large ferries** – Speed optimization – Appropriate maintenance programme – Propulsion devices – Wind propulsion (Flettner Rotor) – Transition fuels (LNG)/ Alternative fuel (biofuel/ methanol)	– Biofuels/ methanol from renewable energy	– Zero carbon fuels (Green Ammonia/ Green Hydrogen)
Shipping Companies	– Education ecosystem & Capacity building – Energy management plan		
Ports and Shipyards	– Renewable energy/ Alternative fuels (biofuels) – Digitalization/ automation – Cold ironing infrastructure – Energy efficient equipment – Energy management plan – Green supply chain	– Smart grids	– Zero carbon fuels
Managerial level (Landscape)	– Education ecosystem & Capacity building – Creating Data base – Set GHG emission reduction targets – Establish Green Corridors (GC)		
Economic aspects	– Global funds, Green national funds – Considering MBM/ Incentive program		

Energy Hub

Subtopic 2: Improving Energy Efficiency and Environmental Footprint of Domestic Passenger Ships in the Philippines (ENV-P)

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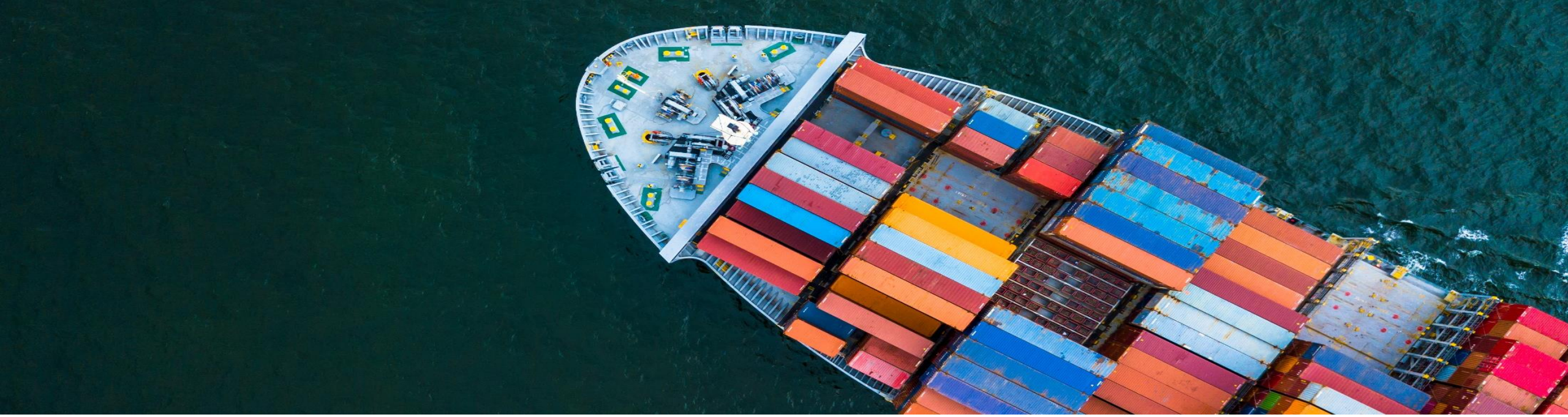

WORLD MARITIME UNIVERSITY

Thank you!

End of Presentation