



BWMS Treatment Technologies and Installation Challenges

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Hamburg
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26 April 2016

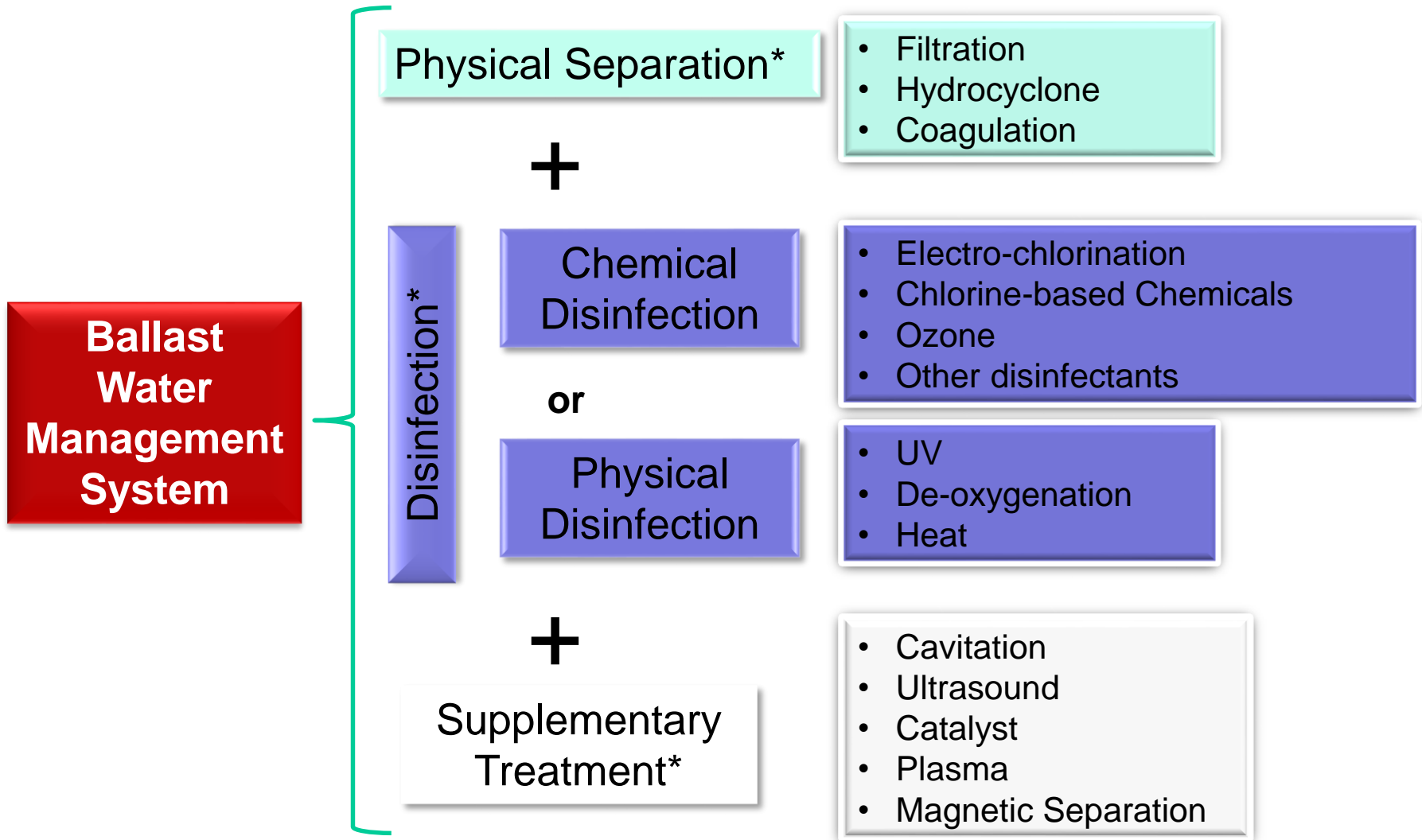
Istanbul
27 & 28 April 2016

Monaco
3 May 2016

Agenda

- Ballast Water Treatment Technologies
- Installation Locations
- General Cost Information

BWMS Technologies



*Note: BWMS have been developed using different combinations of the technologies.

Installation Challenges

- Maintenance space for all equipment of BWTS
- Special requirements from each vendor, i.e.: entrance of ballast water to multiple layers of UV systems equipment
- Interlock with existing systems (i.e.: if overboard valve is accidentally open during ballasting, in case we use active substances for treatment?)
- Location of flow meter (normally length of pipe equal to 3D before and 5D after the flow meter is required)
- Piping routes
- Support of filters, especially inside engine room.
- Need to start with cleaned WB tanks

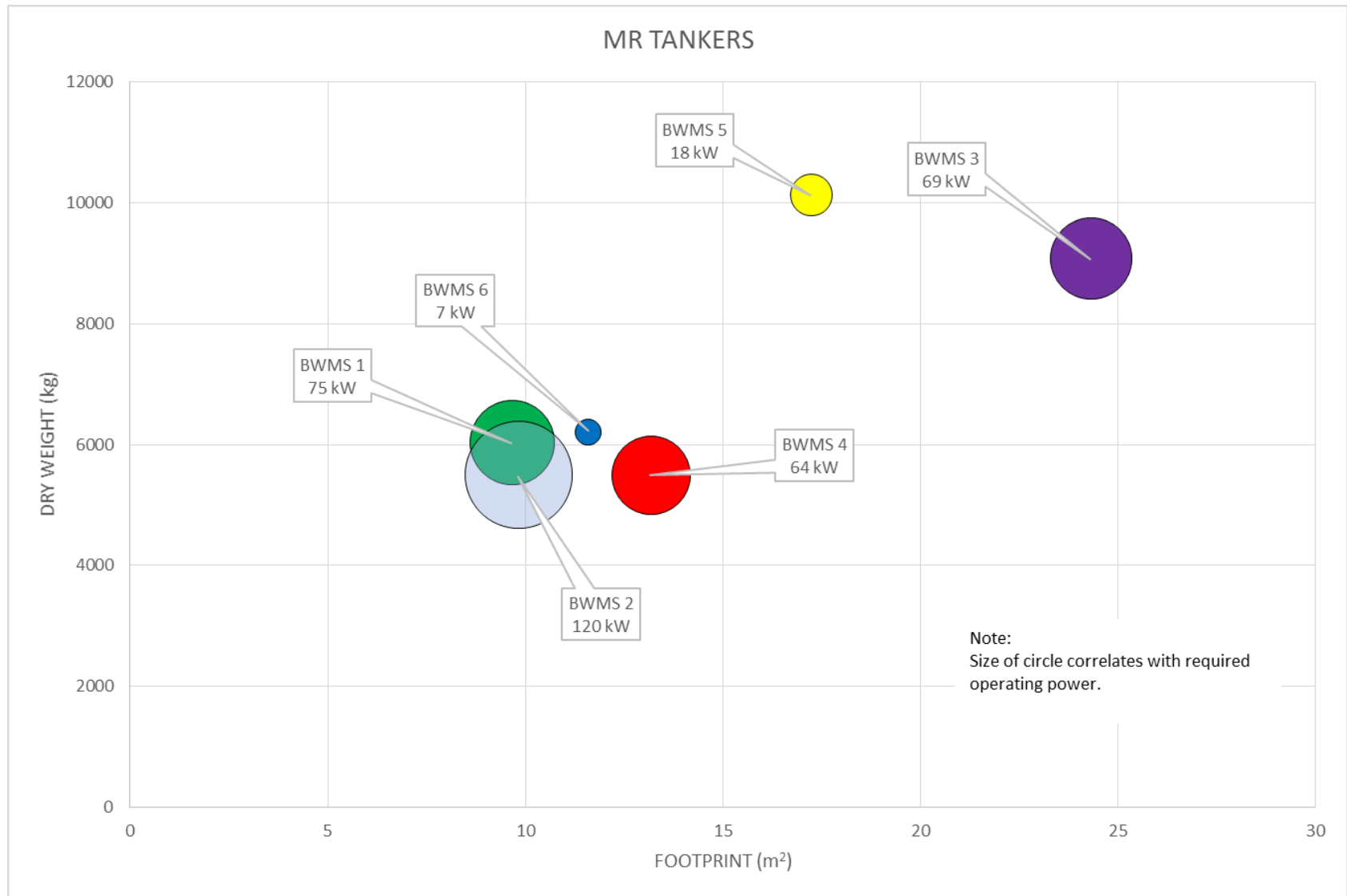


Financial aspects of BWMS

- Low-cost alternatives may not provide the lowest total cost of ownership when considering life-cycle operating expenses
- In 2012, the USCG estimated that:
 - Costs for engineering design: \$ 50,000 to \$ 200,000
 - including 3D scanning, drawings for Class approval and pre-fabrication drawings for yard.
 - Purchasing and installation of BWMS: \$105 to \$2,200 per m³/h.
 - Supervision of installation onboard is charged on daily rate: \$650 - \$1,500.
 - Direct operation: \$0.02 to \$0.08 per m³ of treated ballast water
 - Including fuel, electrical power, and chemical costs
 - Maintenance and repair costs: \$0.03 to \$0.42 per m³ of treated ballast water.
- In 2012, the USCG estimated deoxygenation systems costs: \$0.05/m³.
- A recent study estimated deoxygenation systems costs: \$0.07/m³
 - (40% higher than the 2012 USCG estimate).
- Expectations for sister vessels could be reduced to less hours of engineering depending on extent of reuse of drawings and plans.

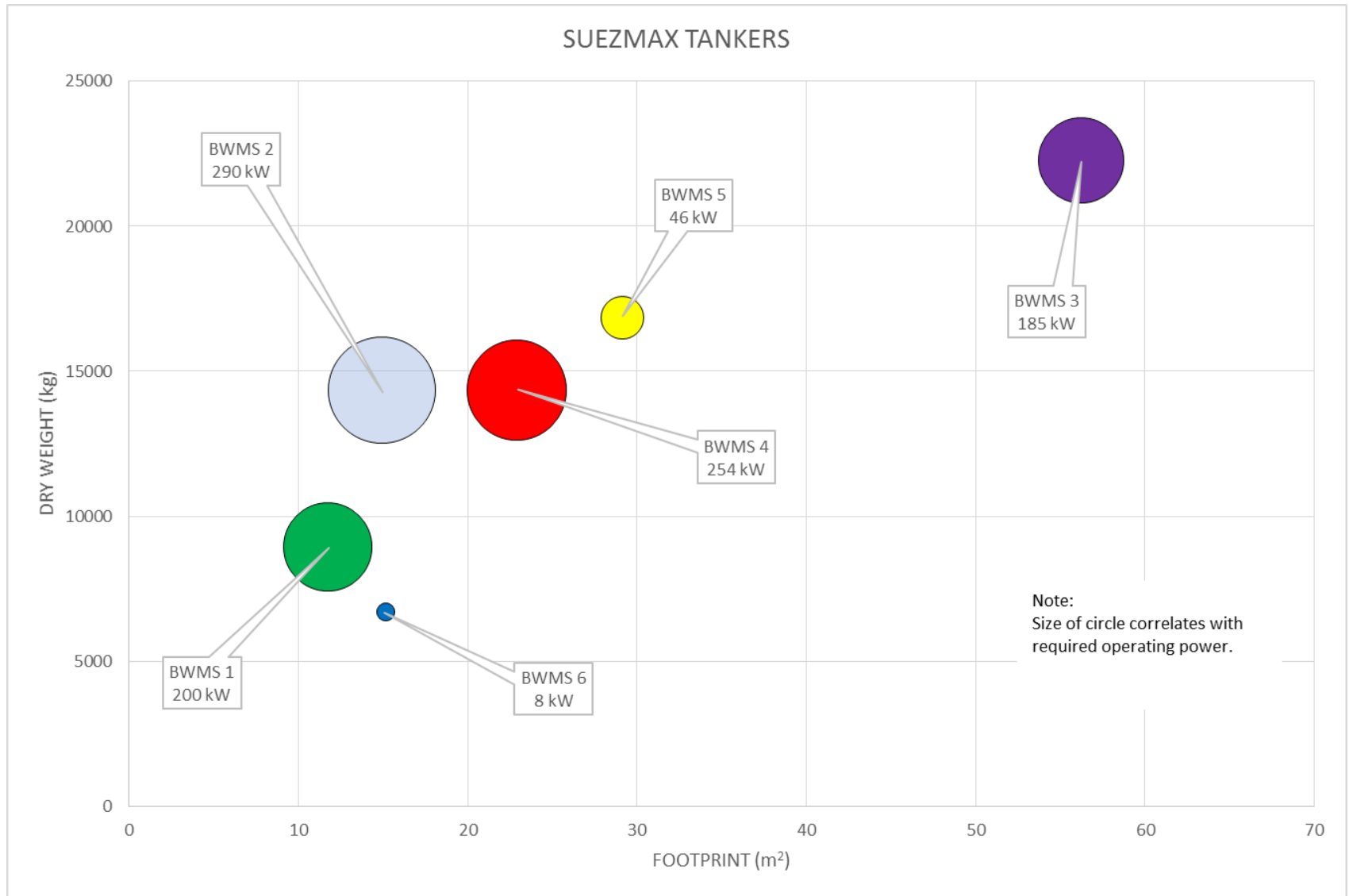
BWM Technology Evaluation

Results of Analysis – MR Tankers



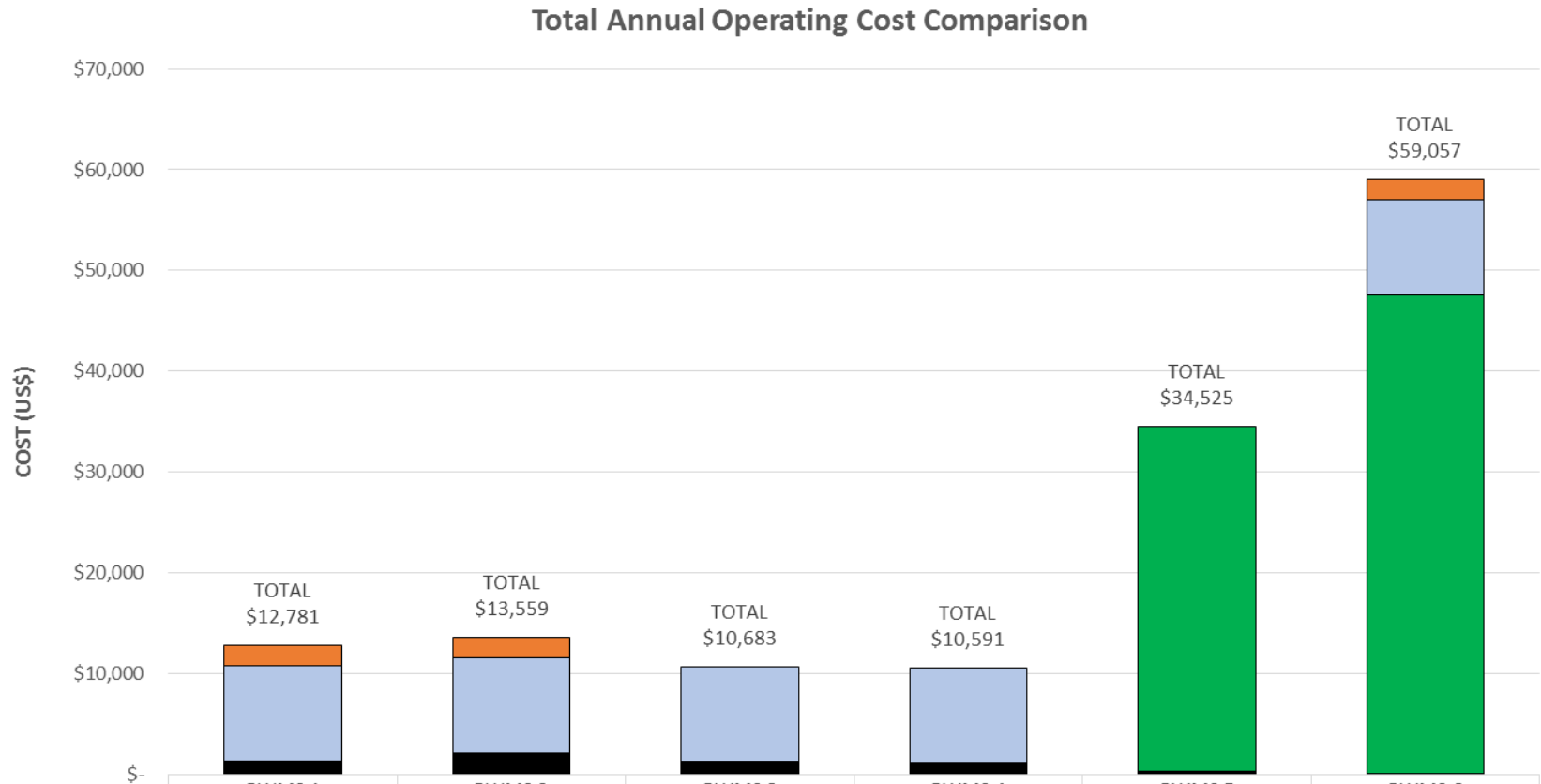
BWM Technology Evaluation

Results of Analysis – Suezmax Tankers



BWM Technology Evaluation

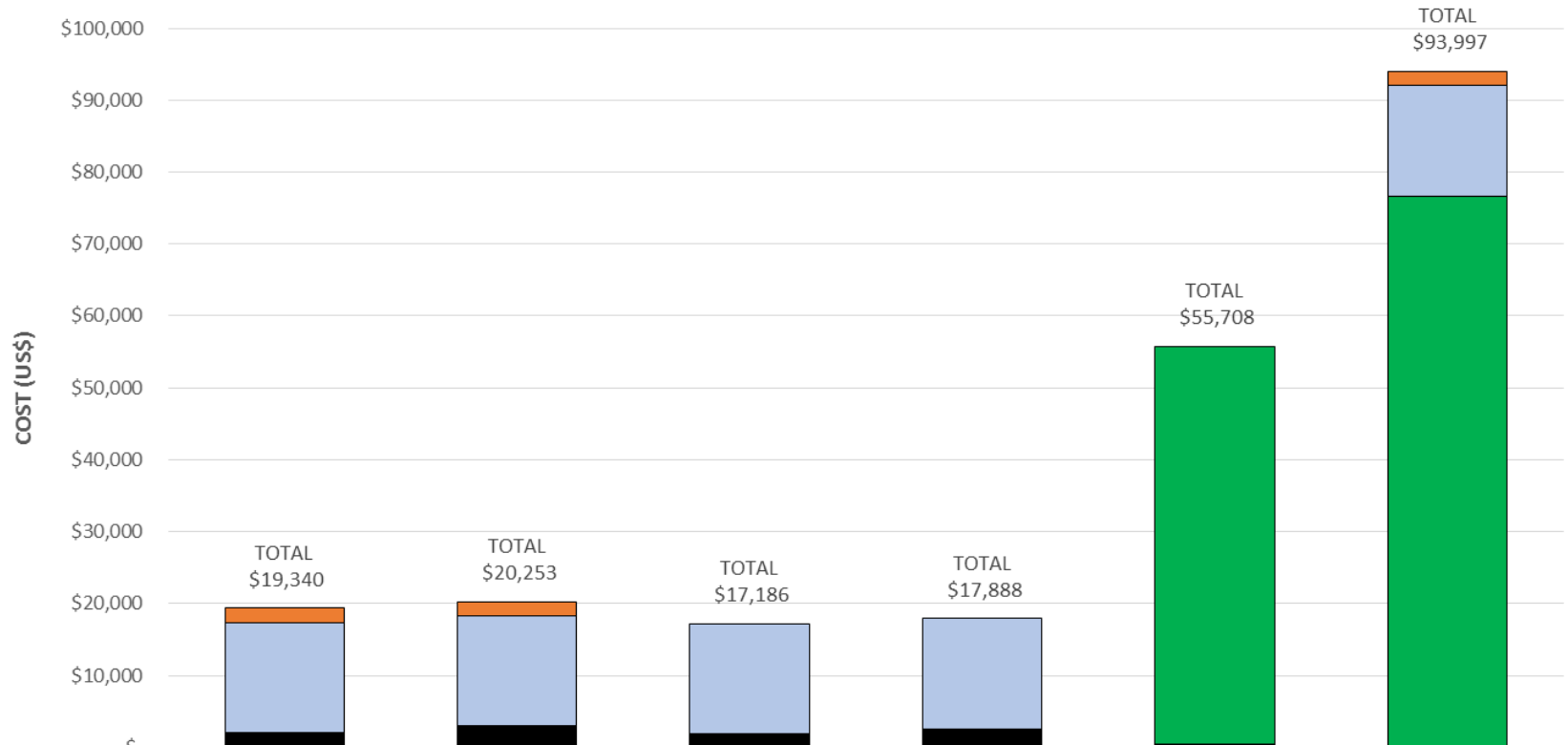
Results of Analysis – MR Tankers



BWM Technology Evaluation

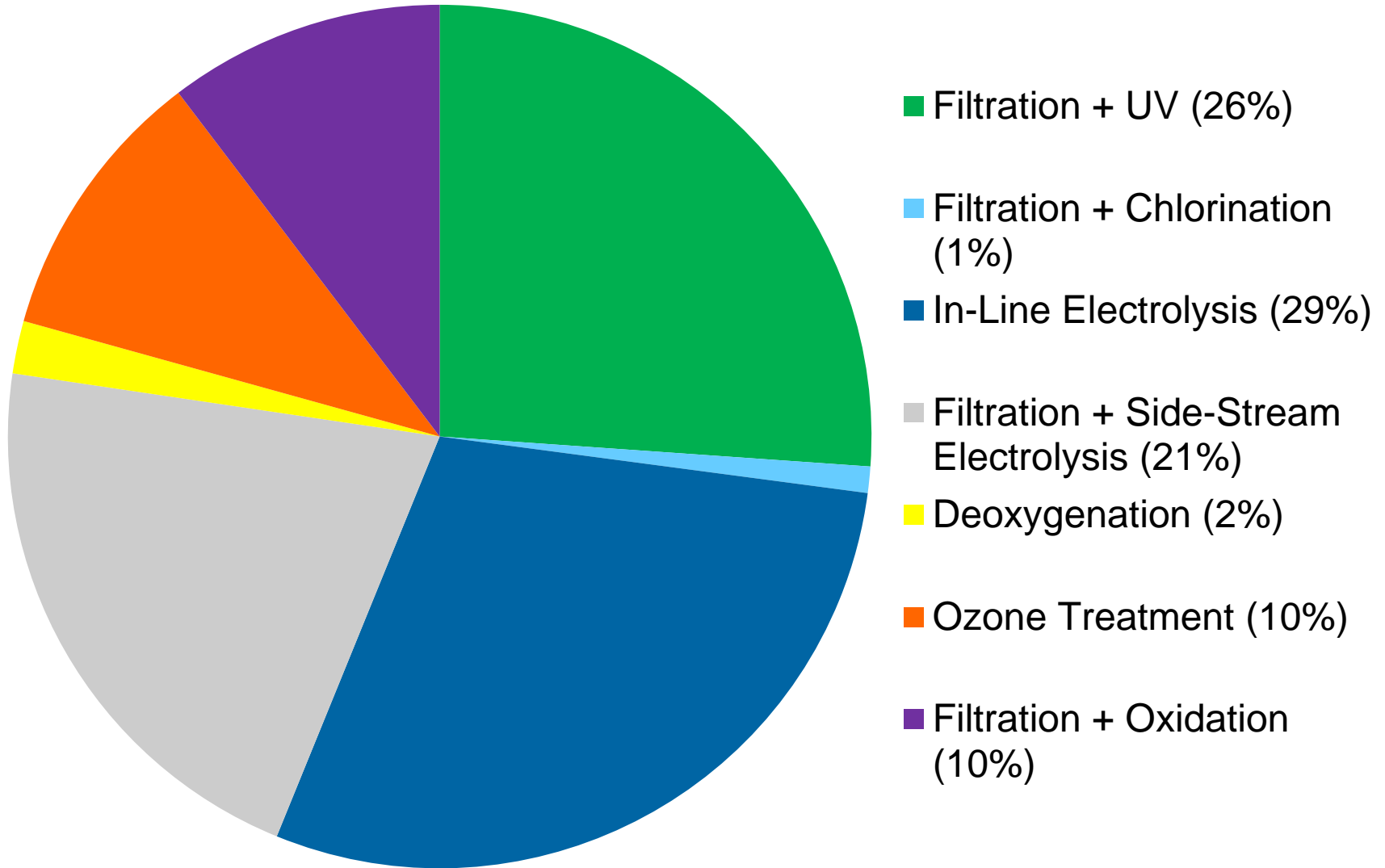
Results of Analysis – Suezmax Tankers

Total Annual Operating Cost Comparison

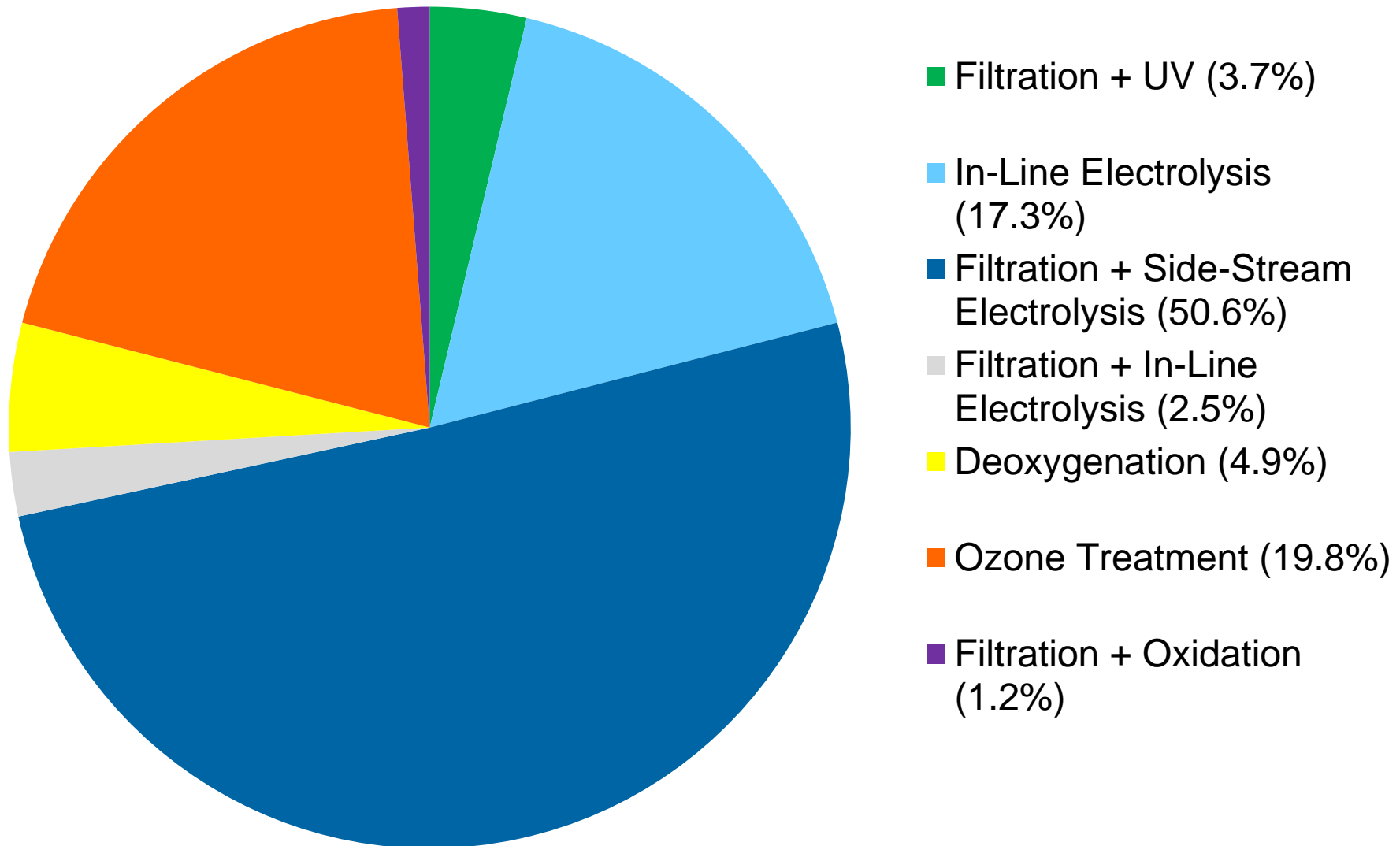


	BWMS 1	BWMS 2	BWMS 3	BWMS 4	BWMS 5	BWMS 6
TRO Chemical Costs (\$)	\$2,000	\$2,000	\$-	\$-	\$-	\$2,000
Neutralization Chemical Costs (\$)	\$15,312	\$15,312	\$15,312	\$15,312	\$-	\$15,312
Treatment Chemical Costs (\$)	\$-	\$-	\$-	\$-	\$55,240	\$76,603
Electrical Power Costs (\$)	\$2,028	\$2,941	\$1,874	\$2,576	\$468	\$81
TOTAL	\$19,340	\$20,253	\$17,186	\$17,888	\$55,708	\$93,997

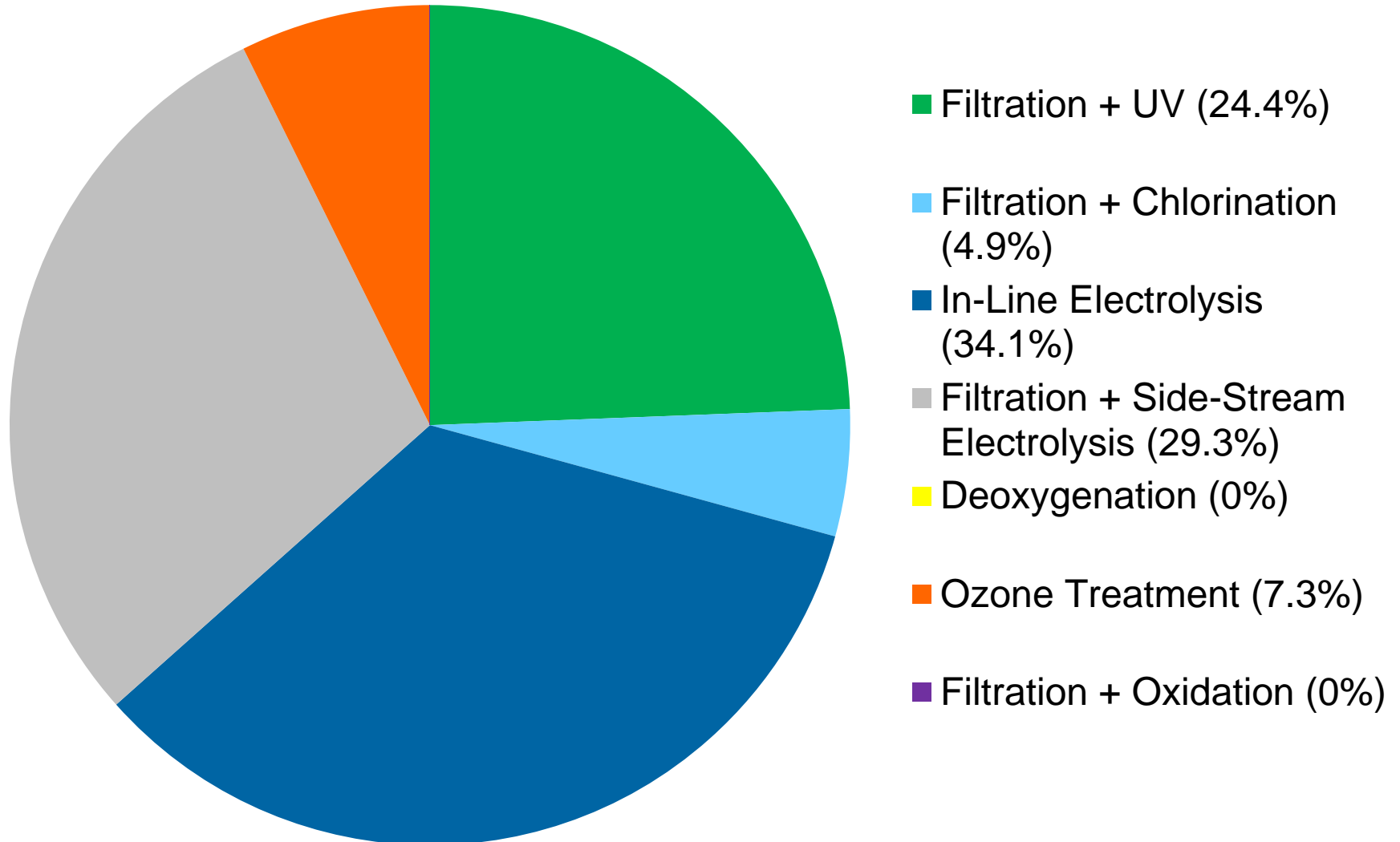
Breakdown of Installations on ABS-Classed Vessels by Technology



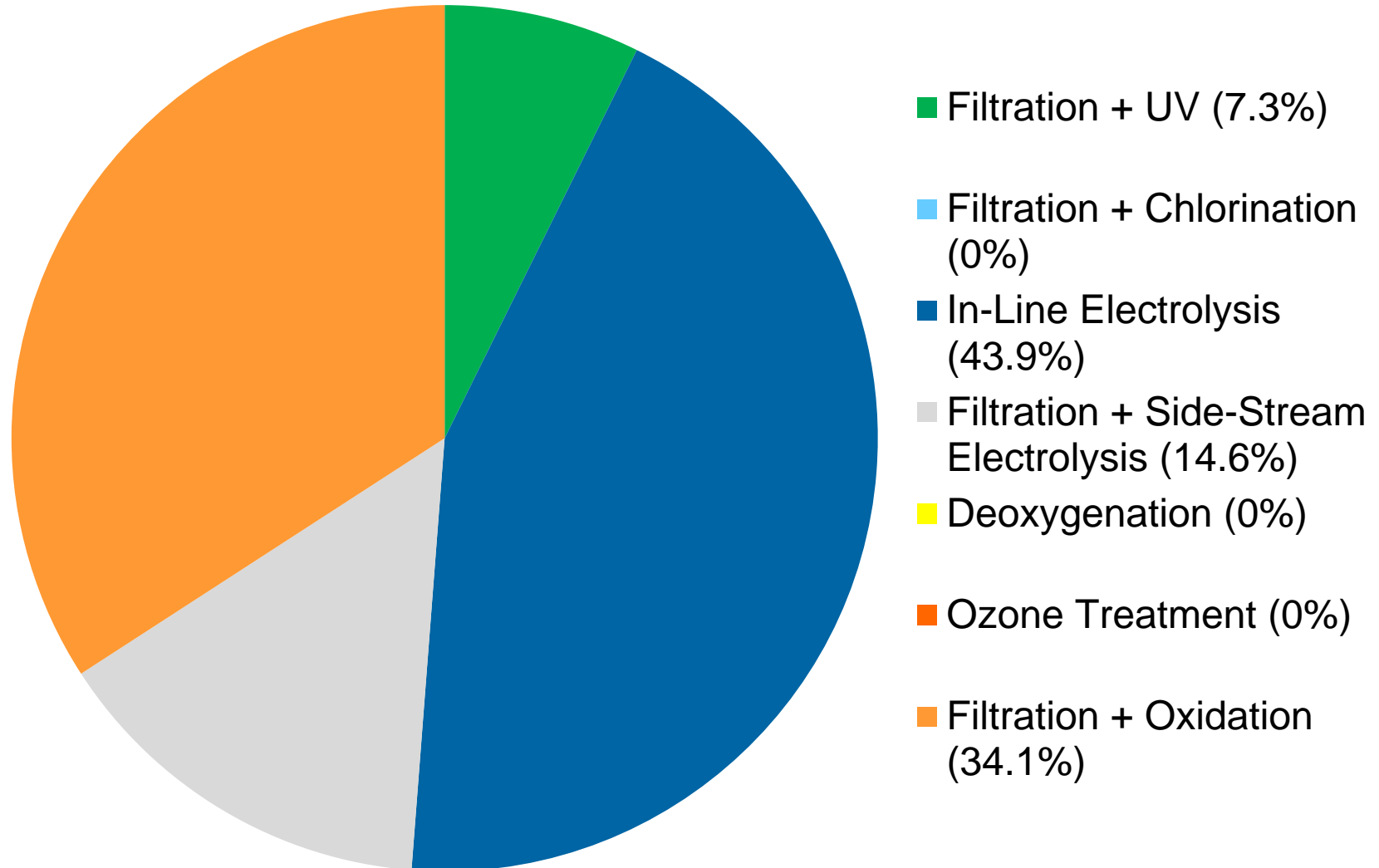
Breakdown of Installations on ABS-Classed Oil Carriers



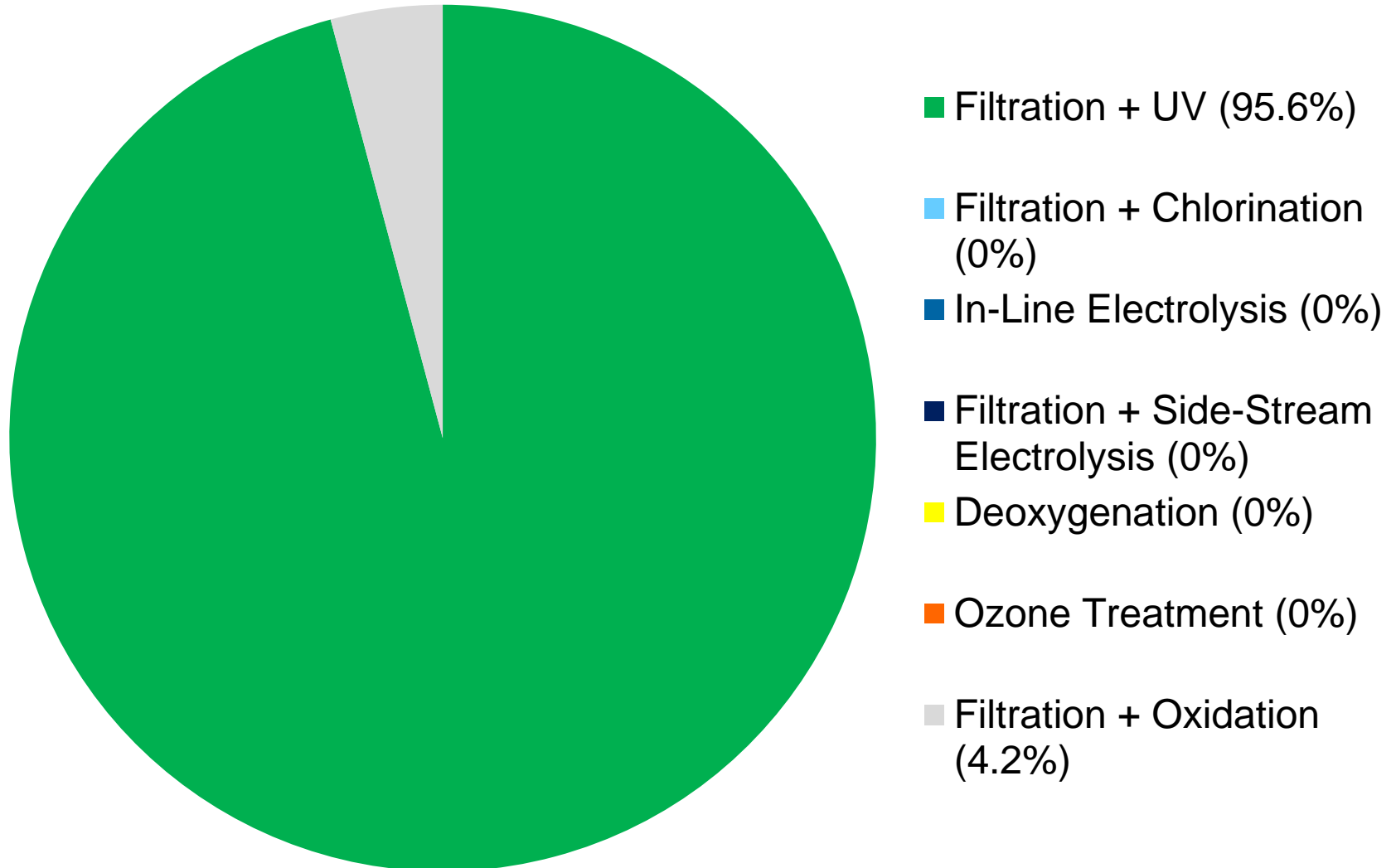
Breakdown of Installations on ABS-Classed Bulk Carriers



Breakdown of Installations on ABS-Classed Container Ships



Breakdown of Installations on ABS-Classed OSVs





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