



Arab Academy

for Science , Technology and Maritime Transport



The International Maritime Transport
and Logistics Conference

“MARLOG 13”

Towards _____
**Smart Green Blue
Infrastructure**

3-5 March 2024 - Alexandria, Egypt





Raúl Redondo

raul.redondo@Siport21.es



Predictive Simulation of Onshore Power Supply (OPS) Requirements For Ports



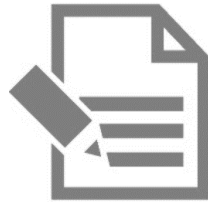


Siport21

Port Consultancy Company (Madrid, Spain)



24 years



**+1500
projects**



**58
countries**



**30
workers**

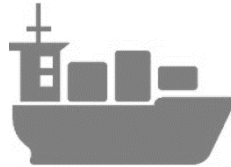
Ship Maneuvering Simulation Center



**+1800
sailors**



**600 training
courses**



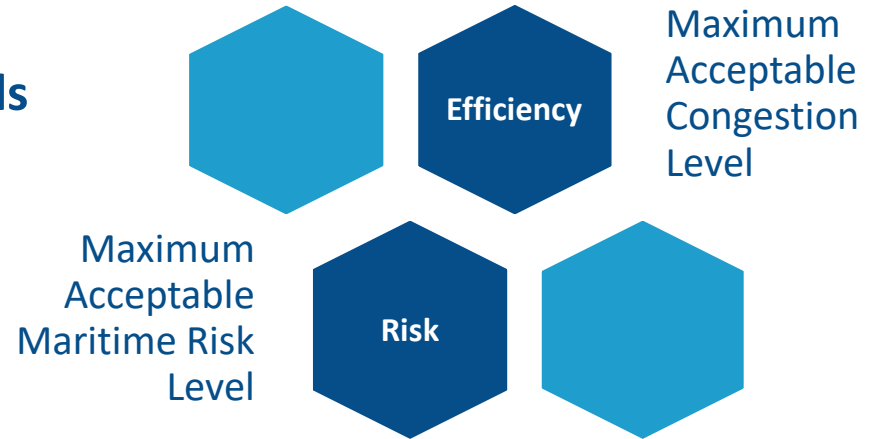
**50 international
shipping lines**



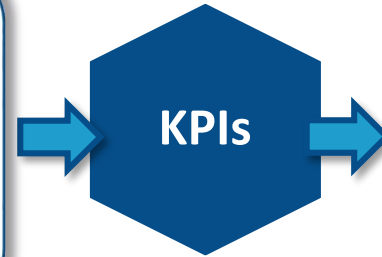
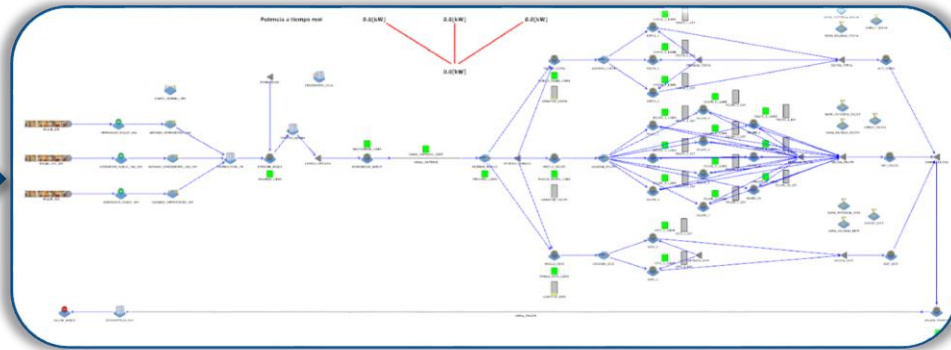
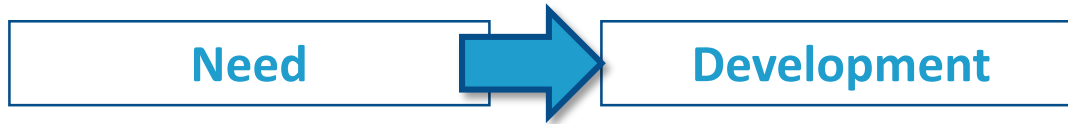
Bases

Projects Involving Port Infrastructure Developments

- ↳ Dredging to Deepen Access Channels
- ↳ Masterplans – New Terminals
- ↳ Maritime Traffic Volume Increase
- ↳ Changes in Rules & Regulations
- ↳ ...



Methodology



Inputs

Simulation of Maritime Traffic Flow at Port

Results

Benefit

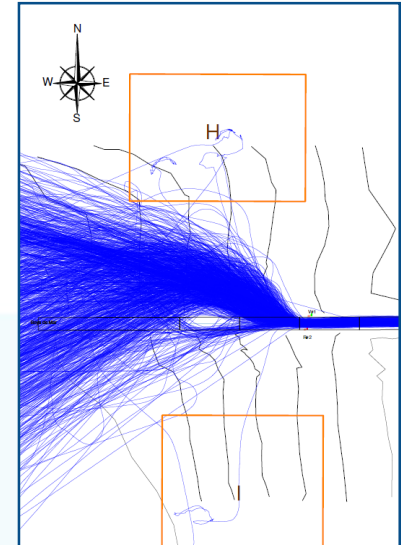
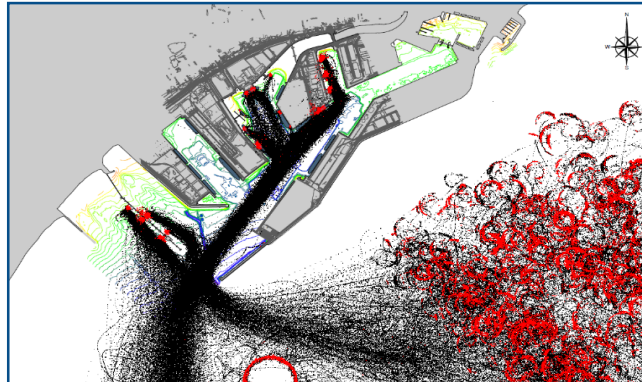
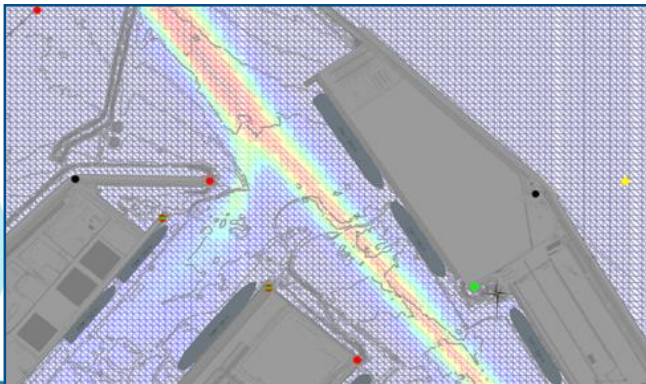
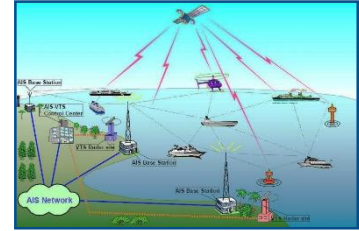
Work Methodology for the Cost / Benefit Assessment



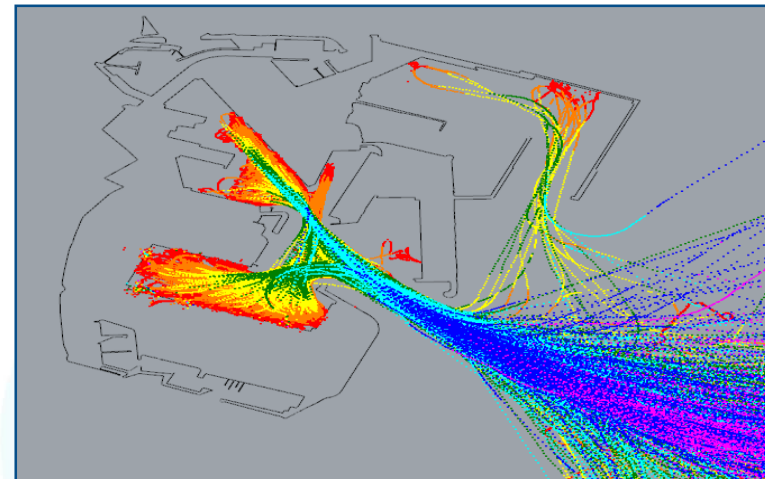
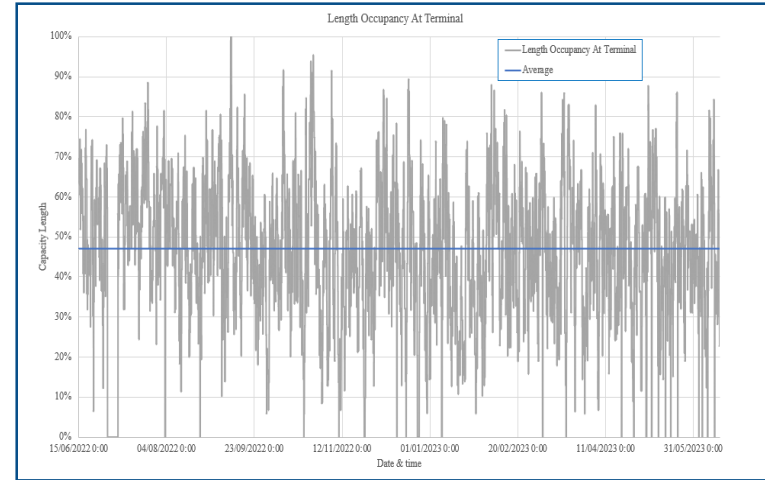
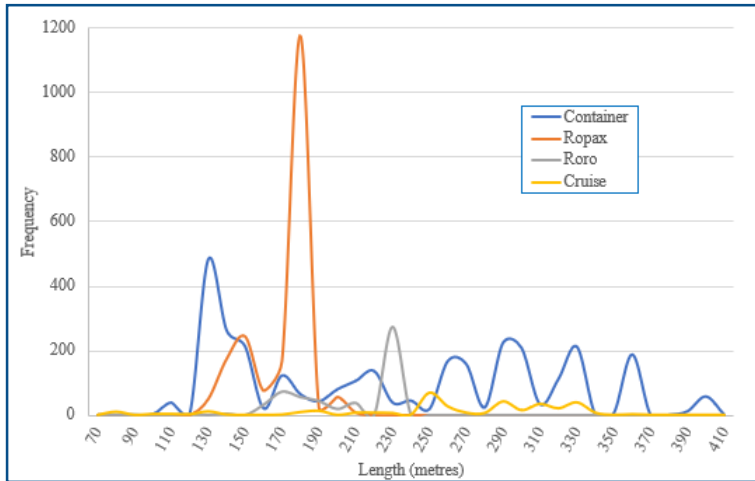
AIS Data Analysis

AIS Data

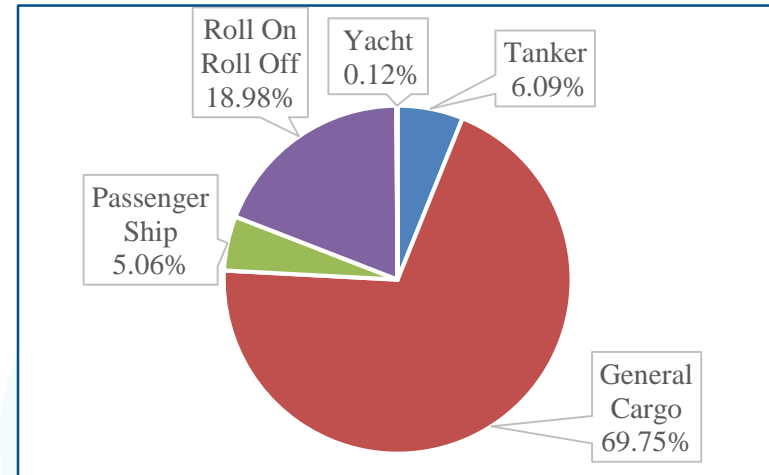
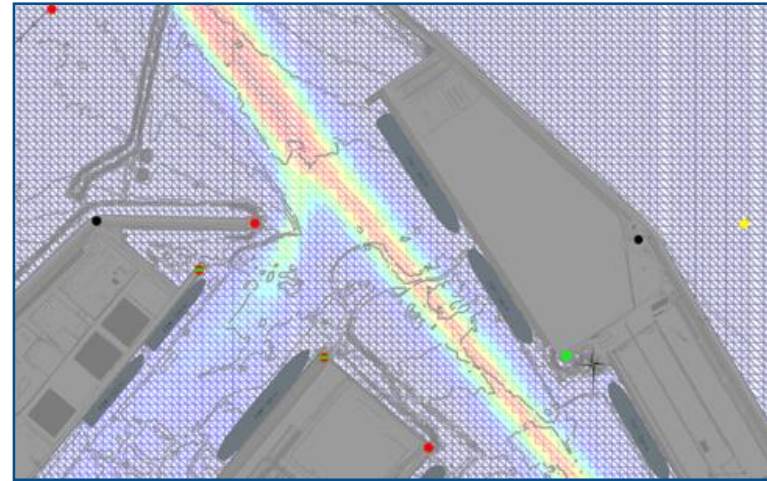
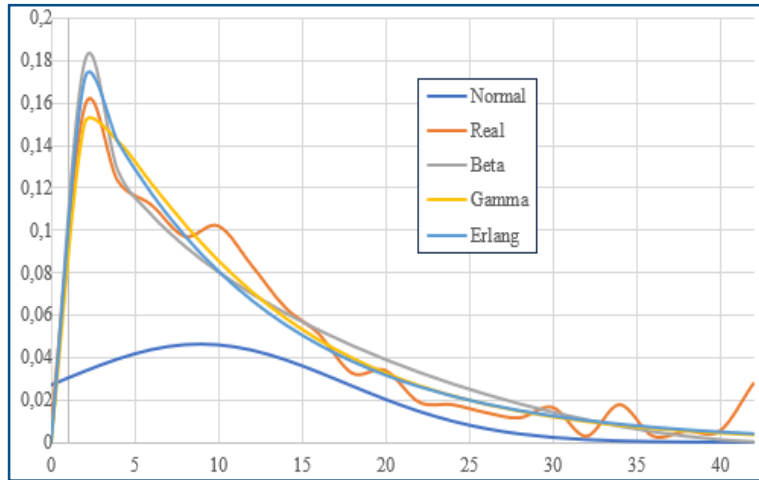
- Large Data Volume
 - Big Data, DataAnalytics & DataViz techniques
 - Detailed Quantitative Description of the Traffic Flow
-
- Vessel Types, Size Distributions and Draught
 - Routes & Speed, Seasonality
 - Berth Stays (Number & Time)



AIS Data Analysis



AIS Data Analysis





KPIs Definition

KPIs

- Key Performance Indicators ad-hoc for each Project
- Aligned with Individual Projects Aims & Particularities
- Parameters for Calibration (Base Model) & Evaluation (Alternative Scenarios)



Efficiency

- Terminals Occupancy Level
- Service Time (Loading / Unloading)
- Waiting Time & Causes (Bottlenecks)



Power Demand

- Substations Requirements (Trends, Average, Peaks, etc.)
- Percentage to Cover (Regulations)



Financial

- Electricity Fees
- Required System Sources (Operators, Cranes, etc.)



Environmental

- Carbon Footprint Reduction
- Elimination of Noise and Vibrations

Model Building

SiOPS21

- Simulation of Port Traffic & OPS Connection
 - OPS Connection at Terminal
 - Discrete Event Simulator
- Sequential Process
 - Joint Decision-Making: Rules, Infrastructure, ...
 - Analyze Period: One Year (Seasonality), Several Random Repetitions (Statistical Analysis)



Vessels (Dynamic)

- SIZE: Length, Beam, Draught
- ROUTE: Destination, Time at Berth
- SEASONALITY

Port Elements (Static)

- BERTHS: Number of Berths, Berthing Length
- CAPACITY: Length, Simultaneity, Power Demand

Other Conditions

- ENVIROMENTAL: Wind, Tide, Waves
- REGULATIONS: Carbon Footprint, OPS

COMPONENTS

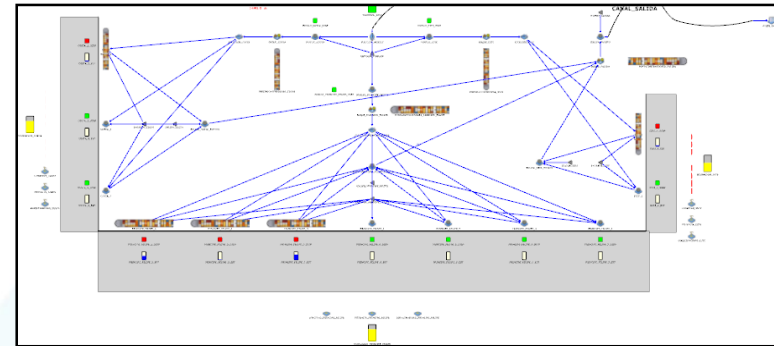
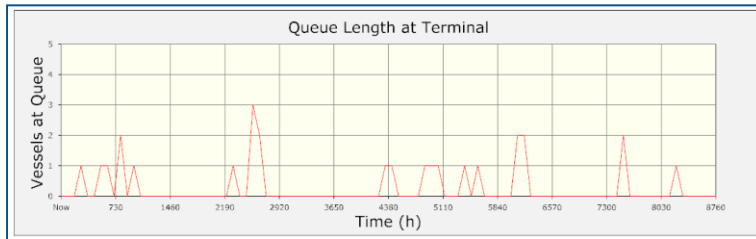
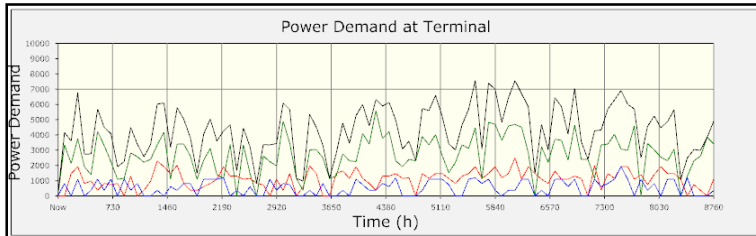




Model Building



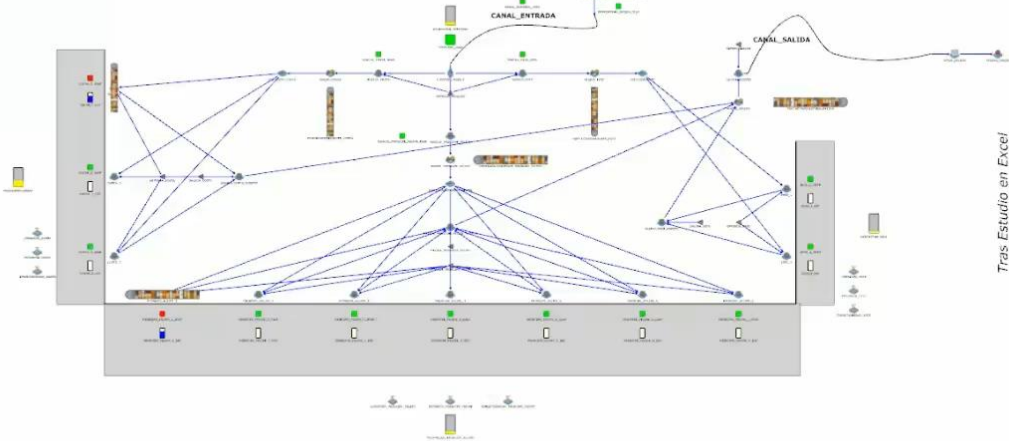
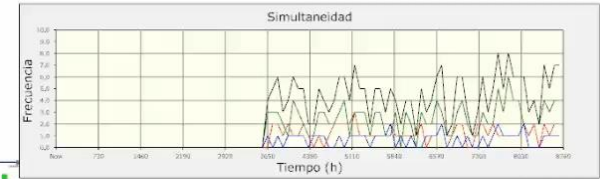
- Discrete Event Simulation Software
- Input & Output Processing - Performance Analysis
- Planning & Decision-Making



Model Building

View1

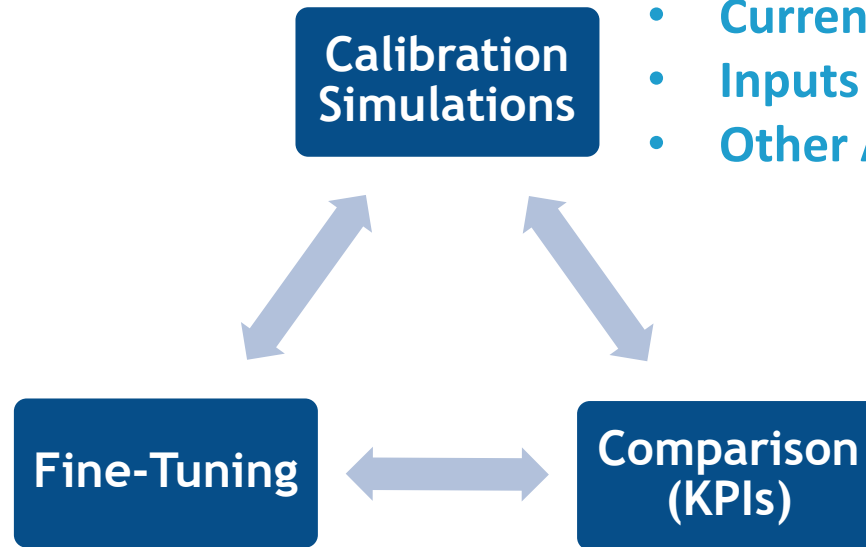
MODELO



Tras Estudio en Excel

ESTUDIO DE POTENCIA en kW	
MODELO	RESULTADO
DISTRIBUCION	1000 kW
ESTANCIA 1 (kW)	1000 kW
ESTANCIA 2 (kW)	1000 kW
ESTANCIA 3 (kW)	1000 kW
ESTANCIA 4 (kW)	1000 kW
ESTANCIA 5 (kW)	1000 kW
ESTANCIA 6 (kW)	1000 kW
ESTANCIA 7 (kW)	1000 kW
ESTANCIA 8 (kW)	1000 kW
ESTANCIA 9 (kW)	1000 kW
ESTANCIA 10 (kW)	1000 kW
ESTANCIA 11 (kW)	1000 kW
ESTANCIA 12 (kW)	1000 kW
ESTANCIA 13 (kW)	1000 kW
ESTANCIA 14 (kW)	1000 kW
ESTANCIA 15 (kW)	1000 kW
ESTANCIA 16 (kW)	1000 kW
ESTANCIA 17 (kW)	1000 kW
ESTANCIA 18 (kW)	1000 kW
ESTANCIA 19 (kW)	1000 kW
ESTANCIA 20 (kW)	1000 kW
ESTANCIA 21 (kW)	1000 kW
ESTANCIA 22 (kW)	1000 kW
ESTANCIA 23 (kW)	1000 kW
ESTANCIA 24 (kW)	1000 kW
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ESTANCIA 31 (kW)	1000 kW
ESTANCIA 32 (kW)	1000 kW
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ESTANCIA 34 (kW)	1000 kW
ESTANCIA 35 (kW)	1000 kW
ESTANCIA 36 (kW)	1000 kW
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ESTANCIA 38 (kW)	1000 kW
ESTANCIA 39 (kW)	1000 kW
ESTANCIA 40 (kW)	1000 kW
ESTANCIA 41 (kW)	1000 kW
ESTANCIA 42 (kW)	1000 kW
ESTANCIA 43 (kW)	1000 kW
ESTANCIA 44 (kW)	1000 kW
ESTANCIA 45 (kW)	1000 kW
ESTANCIA 46 (kW)	1000 kW
ESTANCIA 47 (kW)	1000 kW
ESTANCIA 48 (kW)	1000 kW
ESTANCIA 49 (kW)	1000 kW
ESTANCIA 50 (kW)	1000 kW

Model Calibration



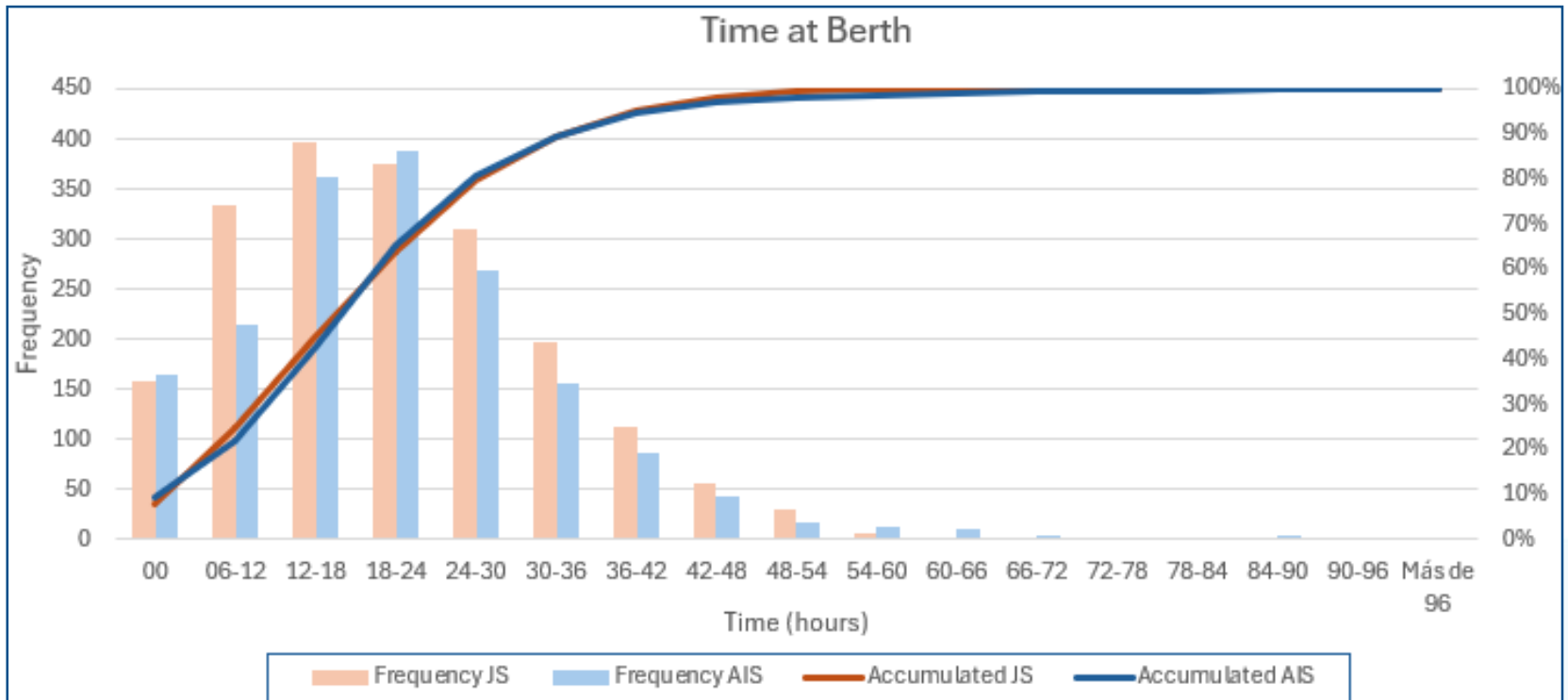
- Current Situation
- Inputs from Info (AIS data)
- Other Aspects to Consider

- Model Parameters
- Level of Detail
- Additional Inputs

- Model Results vs. Reality (AIS Data)
- Acceptable Deviations

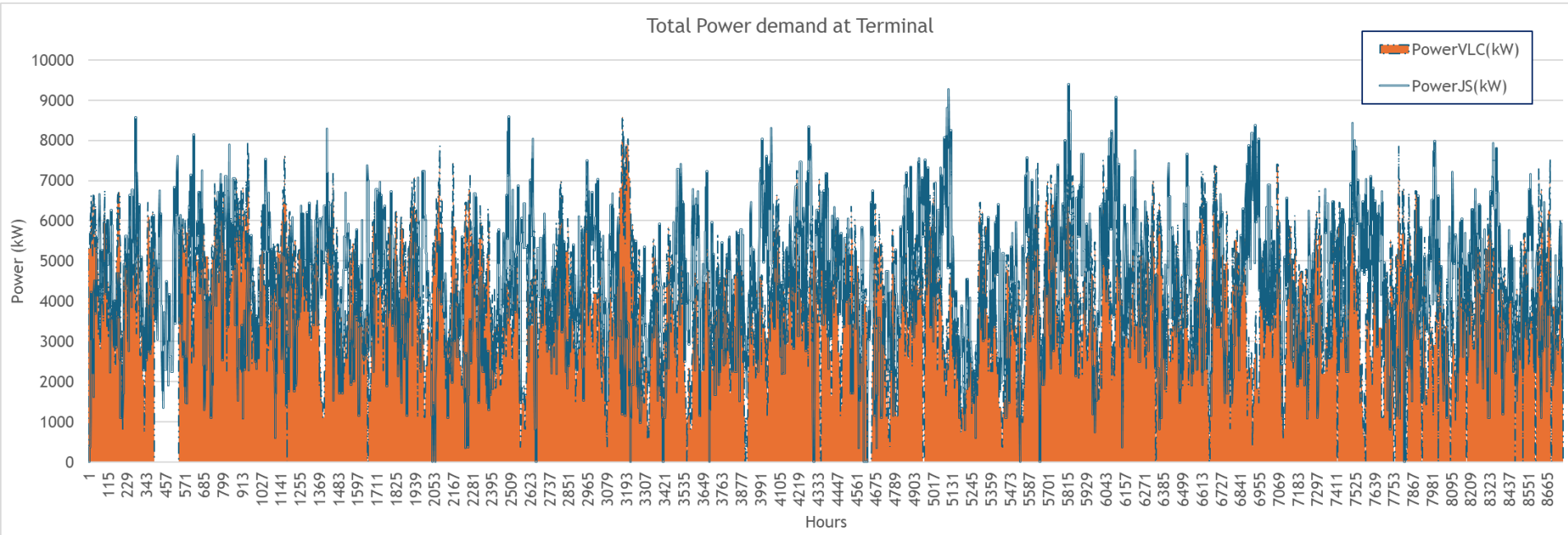


Model Calibration

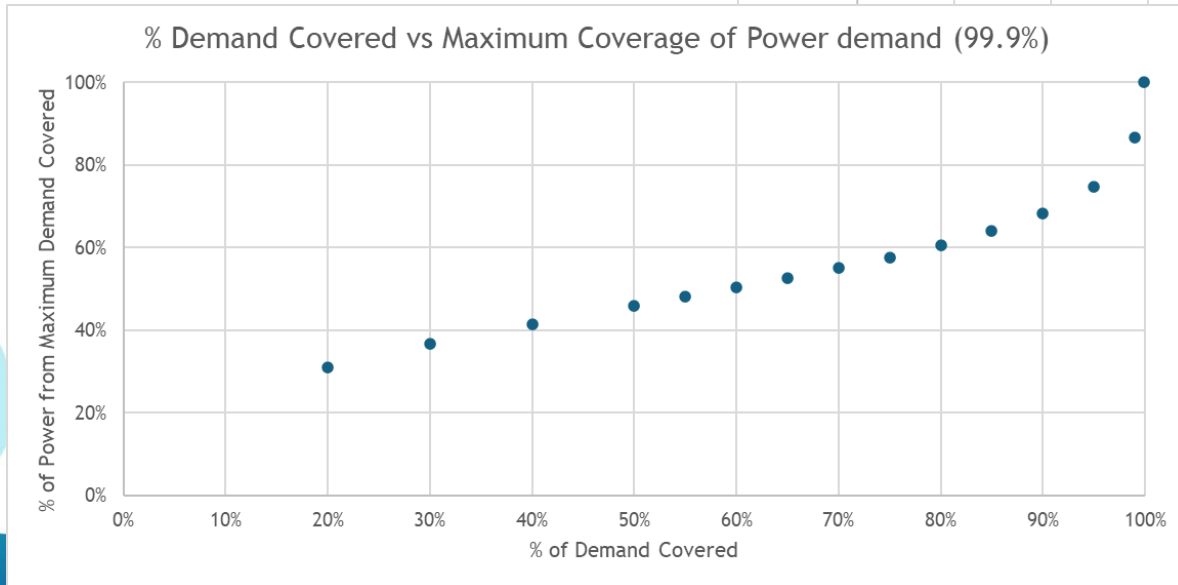
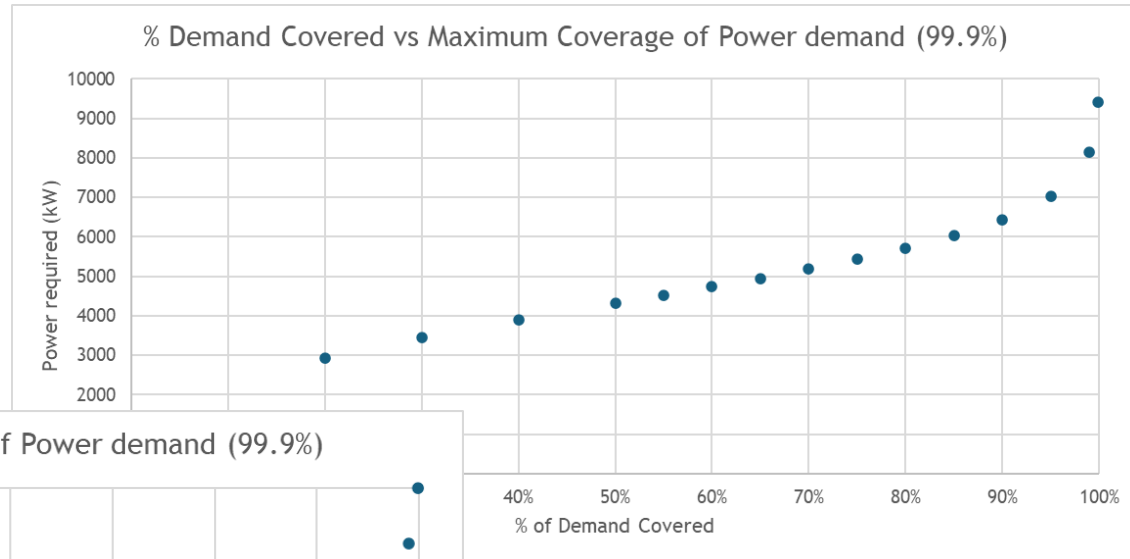




Model Calibration



Results



Alternative Scenarios

KPIs Justified
Decision-Making

SiOPS21

- Alternative Scenarios Definition
- Potential Impact on Current Traffic Flow

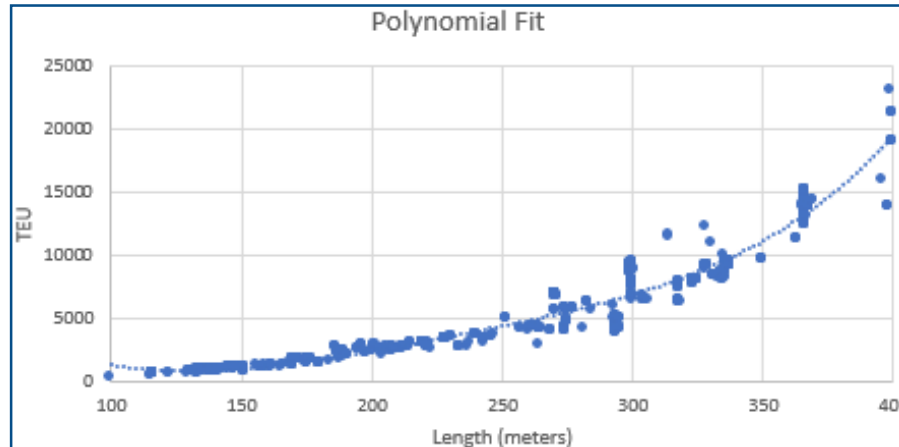
VERSATILITY

- New Infrastructures
- Traffic Volume Increase

LIFESPAN

- Traffic Forecast
- Historical Data
- Masterplans

CURRENT + FUTURE (OPTIMISTIC + PESIMISTIC)



ing to
topics

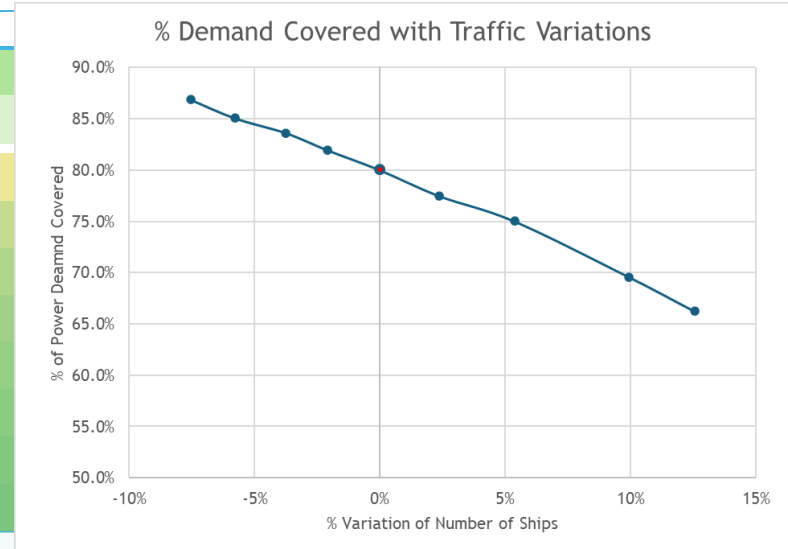
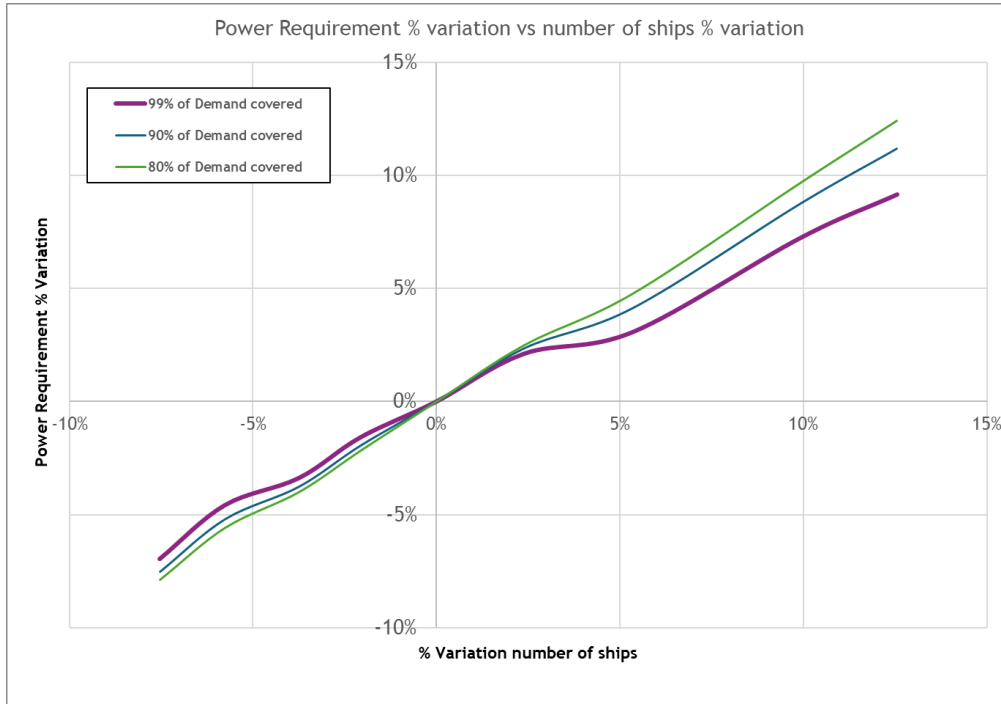


Conclusions

Variation of Number of Ships	13%	10%	5%	2%	0%	-2%	-4%	-6%	-8%
Average Power requirement (kW)	5000	4843	4599	4439	4314	4193	4114	4028	3932
Standard desviation of power requirment (kW)	1675	1675	1634	1669	1649	1645	1617	1611	1569
99% Coverage of Power Demand (kW)	8896	8740	8401	8322	8150	8021	7874	7776	7583
95% Coverage of Power Demand (kW)	7754	7598	7287	7184	7026	6900	6773	6678	6513
90% Coverage of Power Demand (kW)	7146	6989	6693	6578	6427	6302	6185	6093	5943
85% Coverage of Power Demand (kW)	6735	6579	6293	6169	6023	5899	5789	5698	5559
80% Coverage of Power Demand (kW)	6409	6253	5974	5843	5702	5578	5474	5384	5253
75% Coverage of Power Demand (kW)	6129	5973	5701	5564	5426	5303	5204	5114	4991
70% Coverage of Power Demand (kW)	5878	5721	5456	5314	5179	5056	4961	4873	4755
65% Coverage of Power Demand (kW)	5645	5488	5229	5082	4950	4827	4737	4648	4537



Conclusions



topics





Conclusions

- **Decision Making tool for Port Authorities**
- **Make most adequate investment for each port**
- **Assessment of OPS Power Requirements as a global or by Terminals**
- **Predicted evolution of OPS requirements on alternate future scenarios**
- **Siport21 specialized Experience and *Smart Ports* working Methodologies**

according to
topics





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The International Maritime Transport
and Logistics Conference

“MARLOG 13”

Thank You

