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Sustainable Flow

TAL TECH

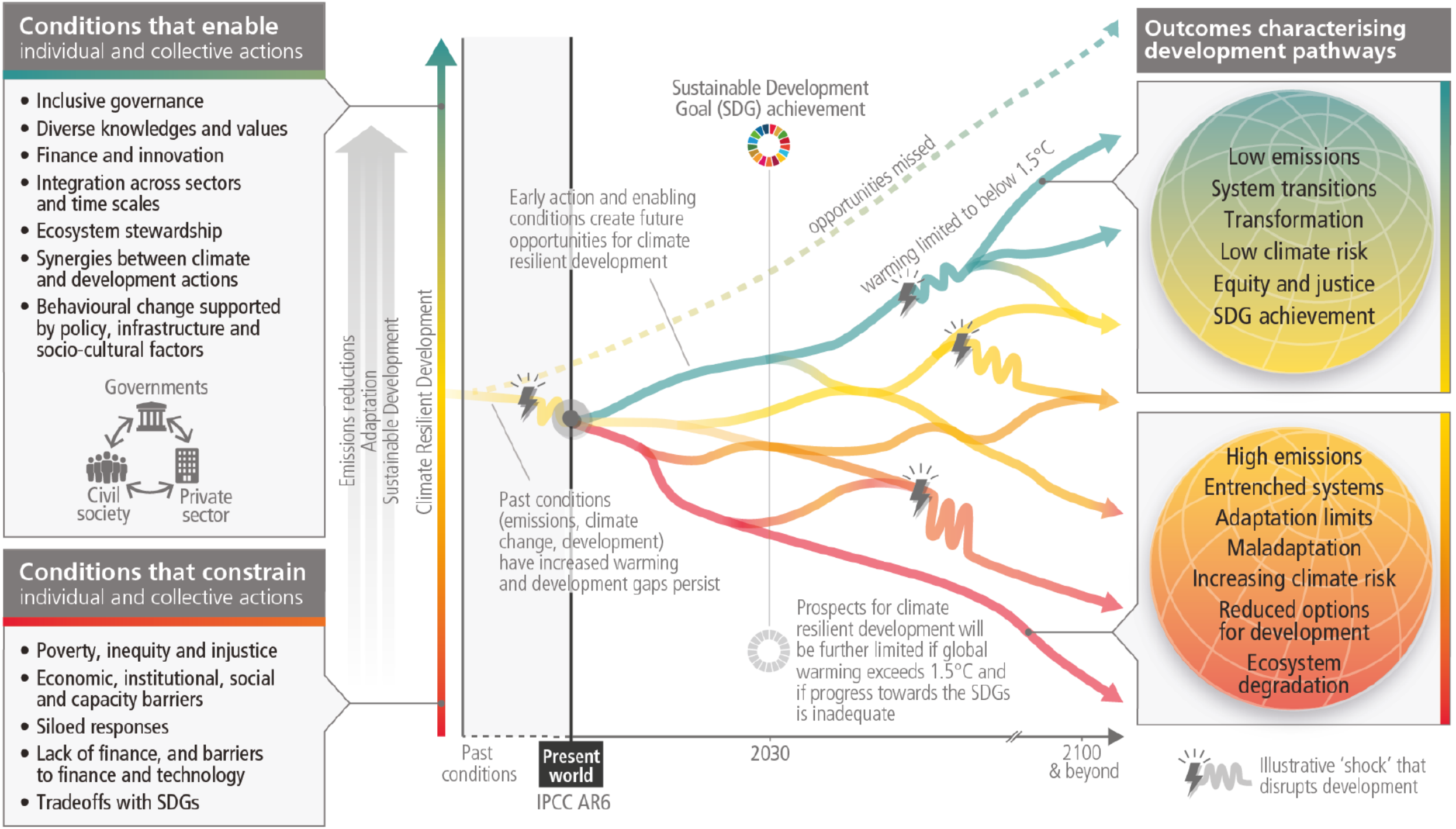
Integrating knowledge and data for improved GHG emissions calculation: The Port of Tallinn case study

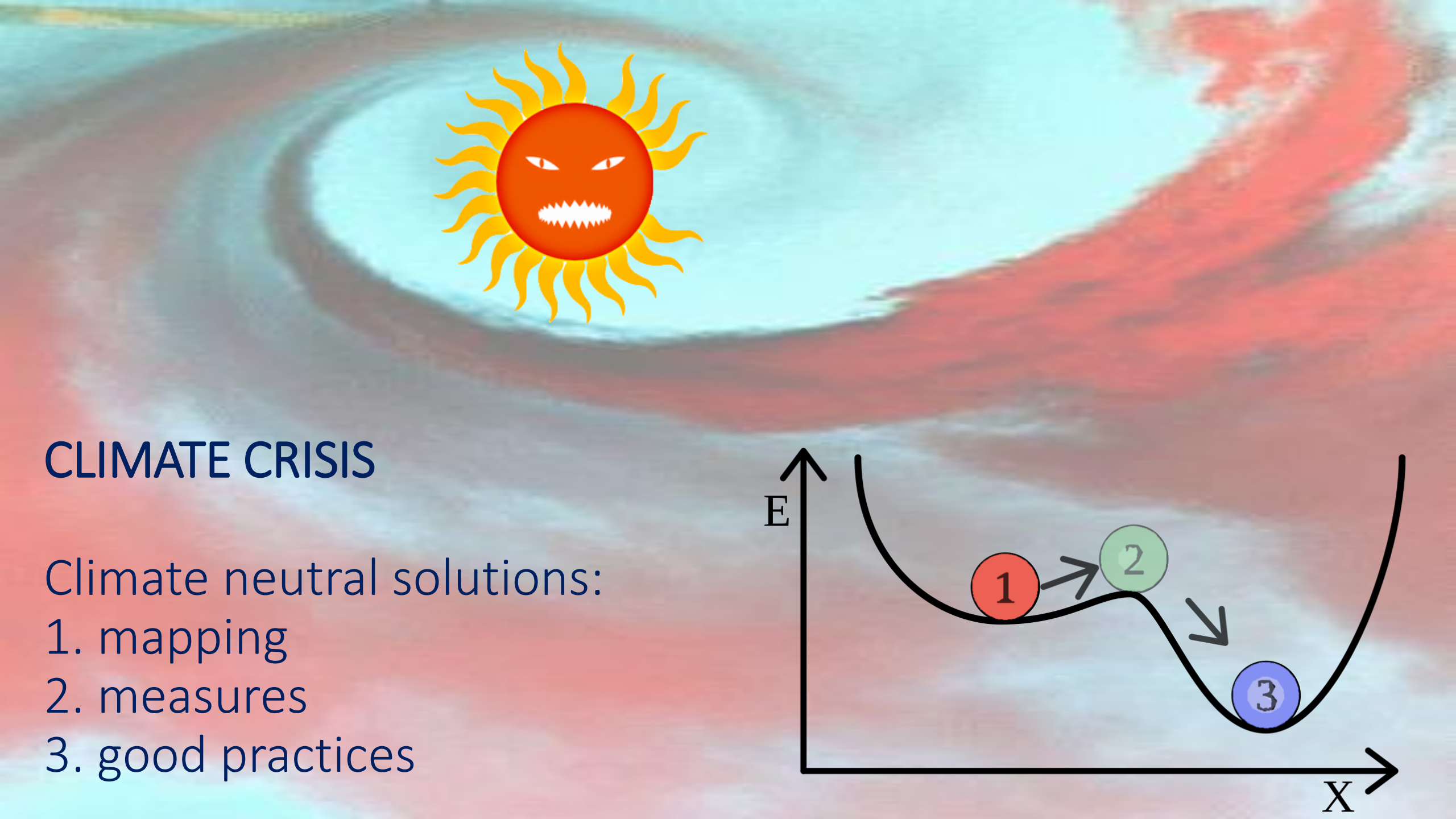
Jonne Kotta and many other contributors

Sixth Assessment Report

The Working Group I contribution was released on 9 August 2021. The Working Group II and III contributions were released on 28 February and 4 April 2022 respectively. The Synthesis Report was released on 20 March 2023.

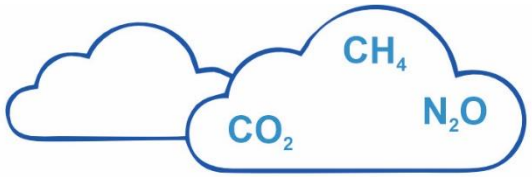
SYNTHESIS REPORT


Conditions that enable
individual and collective actions
• Inclusive governance
• Diverse knowledges and values
• Finance and innovation
• Integration across sectors and time scales
• Ecosystem stewardship
• Synergies between climate and development actions
• Behavioural change supported by policy, infrastructure and socio-cultural factors
Governments
Civil society
Private sector
Conditions that constrain
individual and collective actions
• Poverty, inequity and injustice
• Economic, institutional, social and capacity barriers
• Siloed responses
• Lack of finance, and barriers to finance and technology
• Tradeoffs with SDGs
Emissions reductions
Adaptation
Sustainable Development
Climate Resilient Development
Sustainable Development Goal (SDG) achievement
Early action and enabling conditions create future opportunities for climate resilient development
opportunities missed
warming limited to below 1.5°C
Past conditions (emissions, climate change, development) have increased warming and development gaps persist
Prospects for climate resilient development will be further limited if global warming exceeds 1.5°C and if progress towards the SDGs is inadequate
Past conditions
Present world
IPCC AR6
2030
2100 & beyond
Outcomes characterising development pathways
Low emissions
System transitions
Transformation
Low climate risk
Equity and justice
SDG achievement
High emissions
Entrenched systems
Adaptation limits
Maladaptation
Increasing climate risk
Reduced options for development
Ecosystem degradation
Illustrative 'shock' that disrupts development



CLIMATE CRISIS

Climate neutral solutions:
1. mapping
2. measures
3. good practices



Scope 1

Port direct

Port-owned fleet vehicles, buildings, stationary sources

Scope 2

Port indirect

Purchased electricity for port-owned buildings and operations

Scope 3

Port tenants and other sources

Ships, trucks, cargo handling equipment, rail, harbour craft, port employee vehicles, buildings, purchased electricity

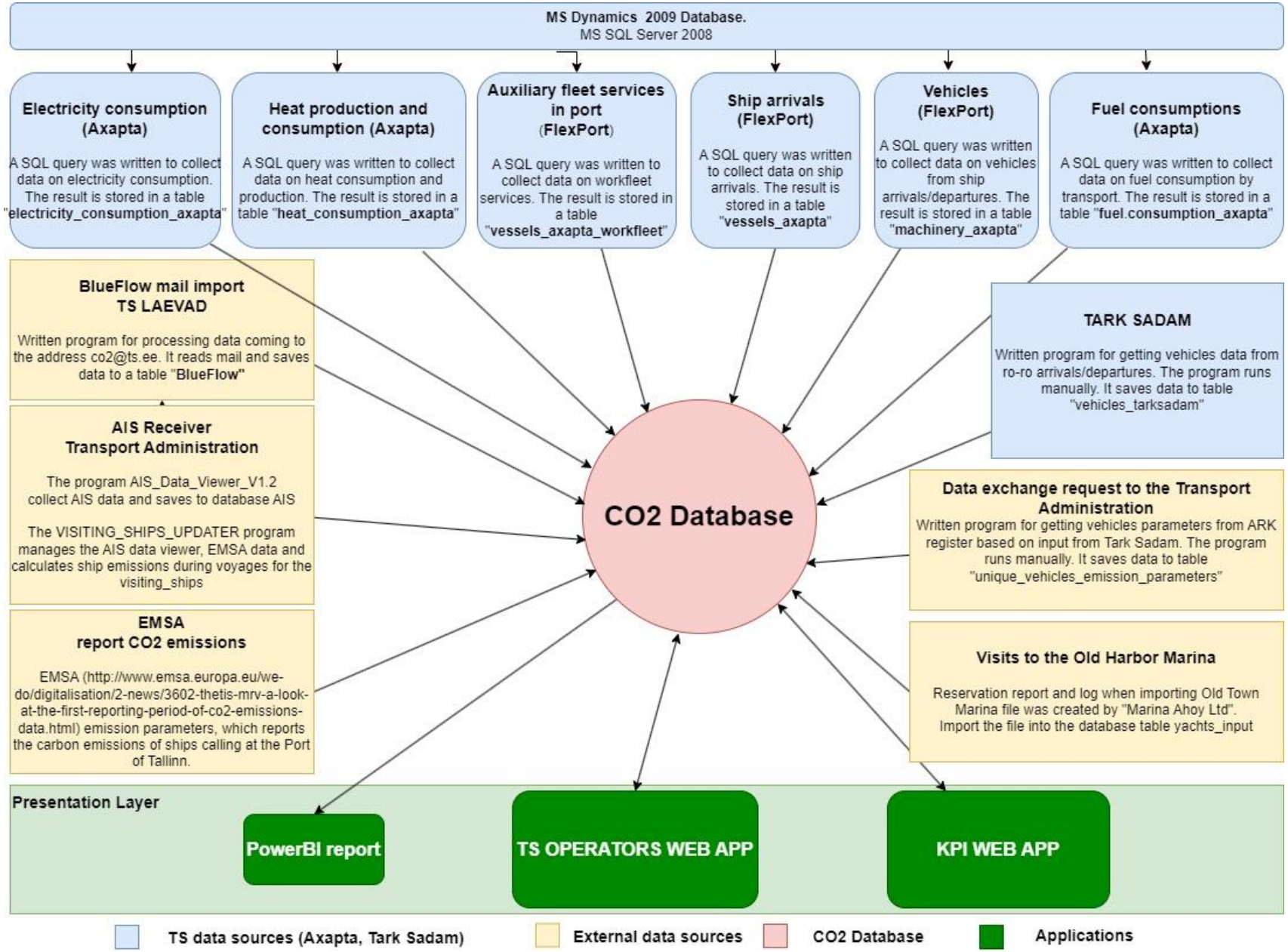
Organisatsioonide KHG jalajälg

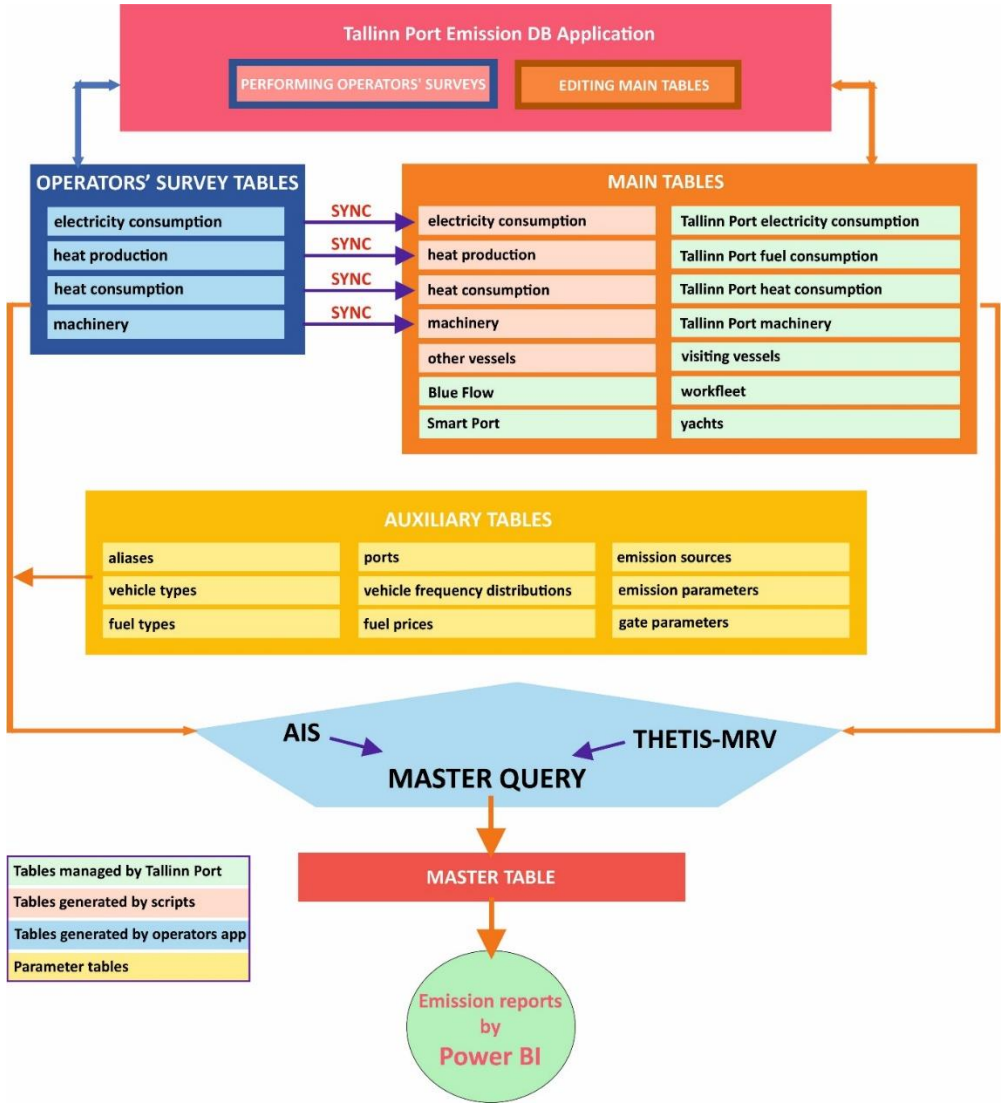
Selleks, et hinnata ettevõtte tegevuse mõju kliimale ning kavandada organisatsiooni tegevusi selle vähendamiseks, on oluline arvutada välja kasvuhoonegaaside (KHG) jalajälg. KHG jalajälg on üks osa organisatsiooni keskkonnamõjust.

Keskkonnaministeeriumi tellimusel koostatud suunised ja arvutusmudel toetavad Eesti ettevõtete ning organisatsioonide KHG jalajälje arvutuste ühtsetele alustele viimist.

Linking different technologies and databases:

Huge data and analysis challenge

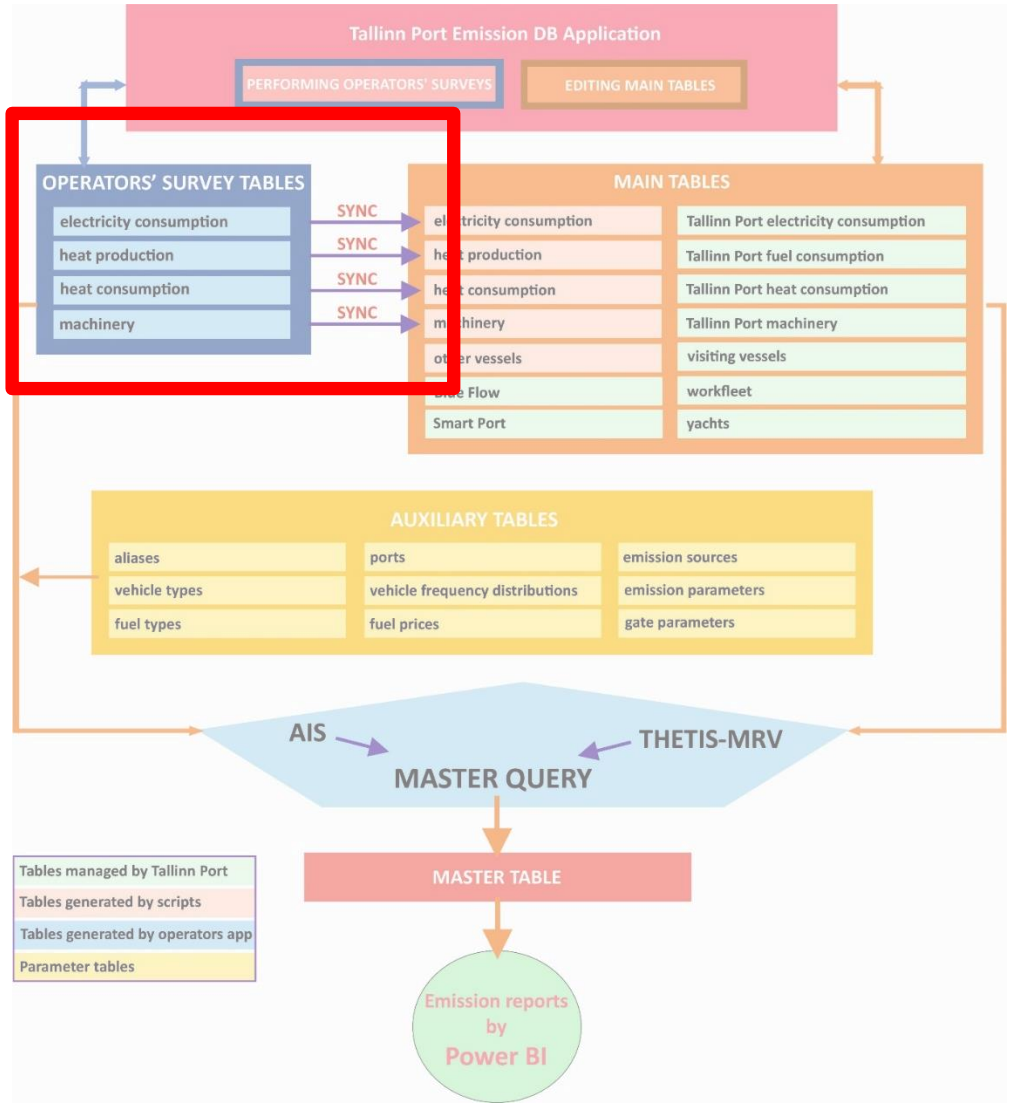

MS Dynamics 2009 Database.
MS SQL Server 2008
Electricity consumption (Axapta)
A SQL query was written to collect data on electricity consumption. The result is stored in a table "electricity_consumption_axapta"
Heat production and consumption (Axapta)
A SQL query was written to collect data on heat consumption and production. The result is stored in a table "heat_consumption_axapta"
Auxiliary fleet services in port (FlexPort)
A SQL query was written to collect data on workfleet services. The result is stored in a table "vessels_axapta_workfleet"
Ship arrivals (FlexPort)
A SQL query was written to collect data on ship arrivals. The result is stored in a table "vessels_axapta"
Vehicles (FlexPort)
A SQL query was written to collect data on vehicles from ship arrivals/departures. The result is stored in a table "machinery_axapta"
Fuel consumptions (Axapta)
A SQL query was written to collect data on fuel consumption by transport. The result is stored in a table "fuel.consumption_axapta"
BlueFlow mail import TS LAEVAD
Written program for processing data coming to the address co2@ts.ee. It reads mail and saves data to a table "BlueFlow"
AIS Receiver Transport Administration
The program AIS_Data_Viewer_V1.2 collect AIS data and saves to database AIS
The VISITING_SHIPS_UPDATER program manages the AIS data viewer, EMSA data and calculates ship emissions during voyages for the visiting_ships
EMSA report CO2 emissions
EMSA (http://www.emsa.europa.eu/we-do/digitalisation/2-news/3602-thetis-mrv-a-look-at-the-first-reporting-period-of-co2-emissions-data.html) emission parameters, which reports the carbon emissions of ships calling at the Port of Tallinn.
CO2 Database
TARK SADAM
Written program for getting vehicles data from ro-ro arrivals/departures. The program runs manually. It saves data to table "vehicles_tarksadam"
Data exchange request to the Transport Administration
Written program for getting vehicles parameters from ARK register based on input from Tark Sadam. The program runs manually. It saves data to table "unique_vehicles_emission_parameters"
Visits to the Old Harbor Marina
Reservation report and log when importing Old Town Marina file was created by "Marina Ahoy Ltd". Import the file into the database table yachts_input
Presentation Layer
PowerBI report
TS OPERATORS WEB APP
KPI WEB APP
TS data sources (Axapta, Tark Sadam)
External data sources
CO2 Database
Applications

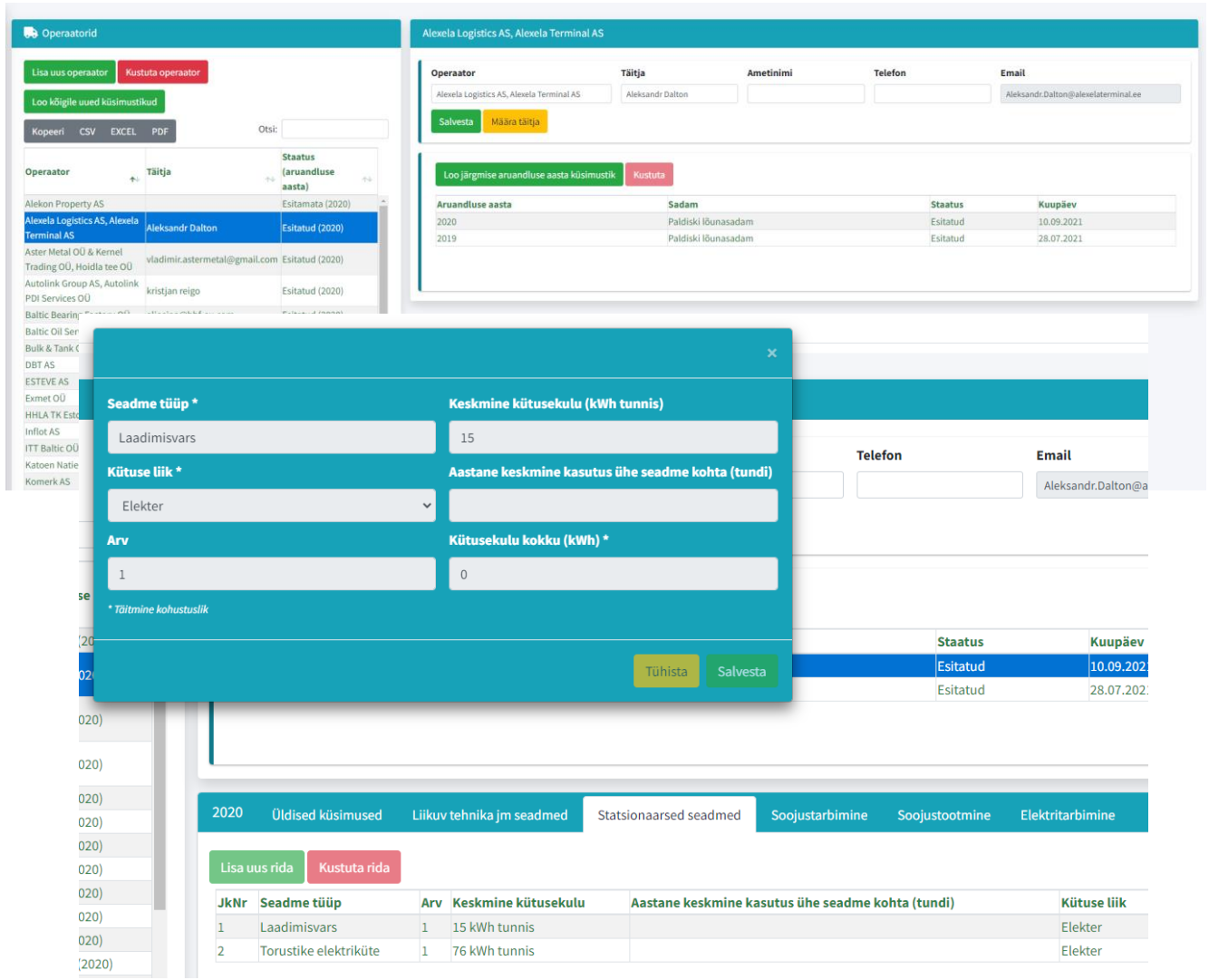


Key building blocks:

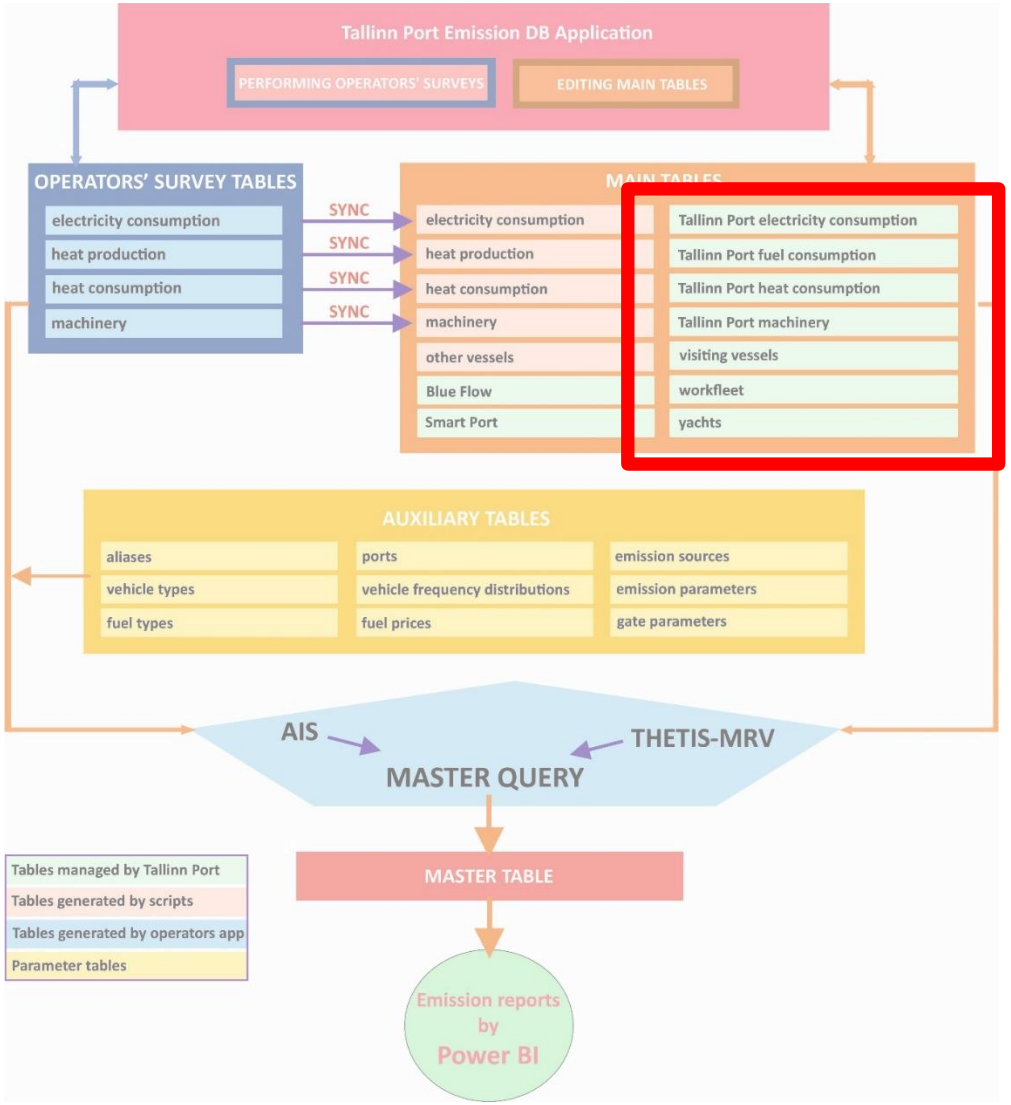
- central database
- supporting databases
- calculation scripts
- visualization tools

COLLECTING DATA FROM TENANTS & SIMPLER DATA HANDLING

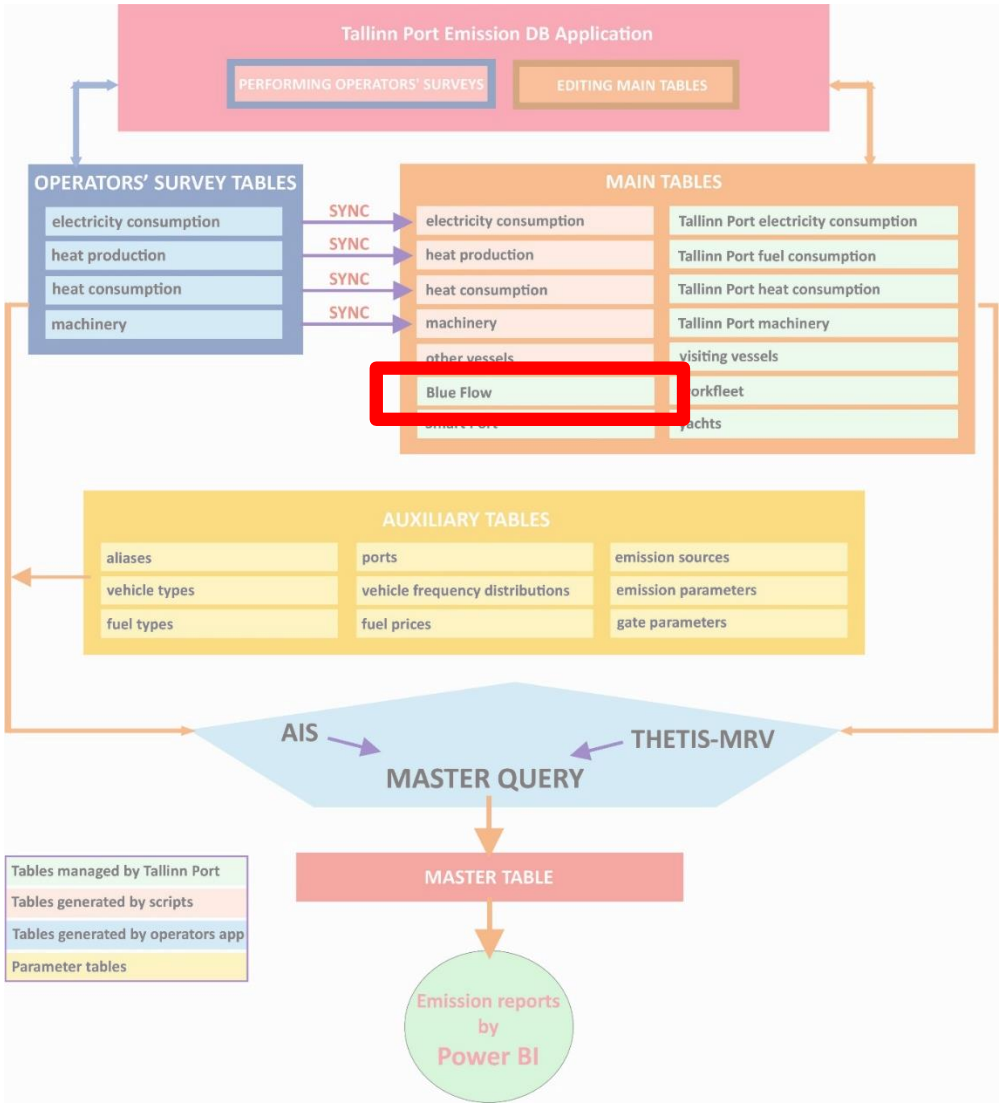




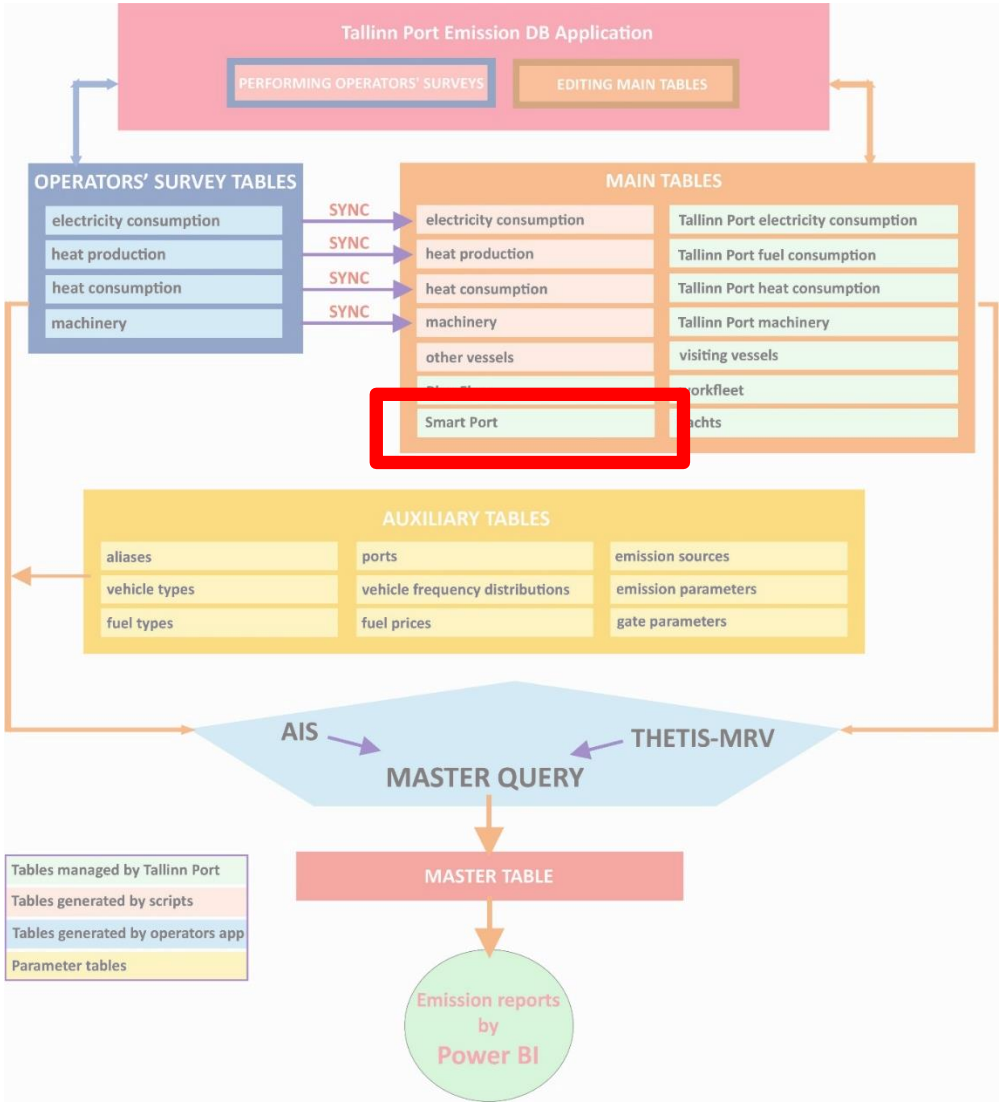
COLLECTING DATA FROM DBs MANAGED BY THE PORT OF TALLINN

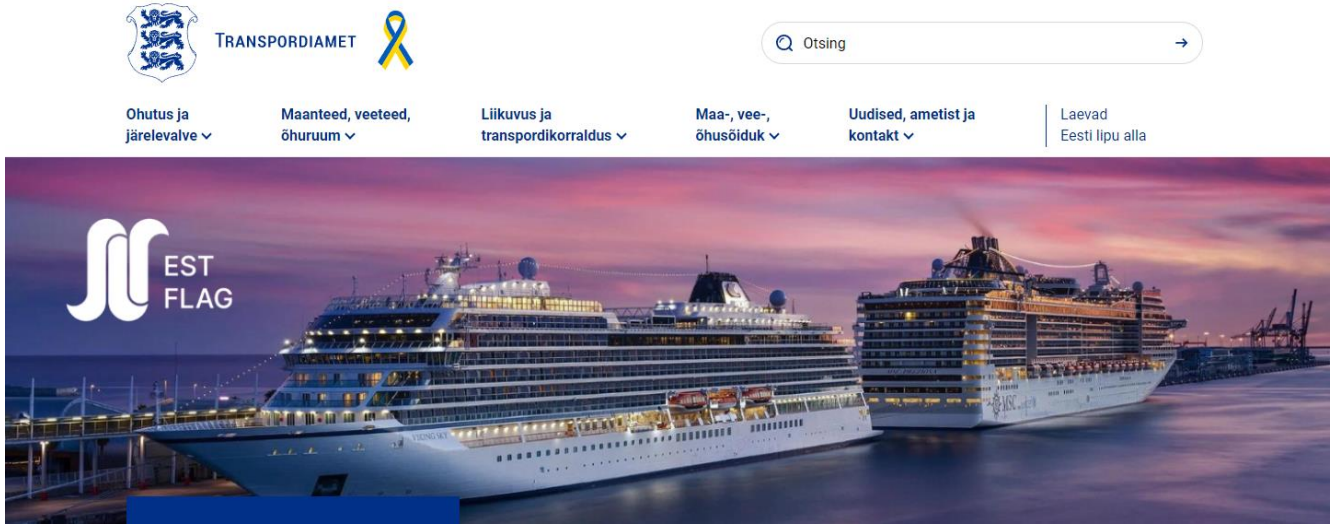


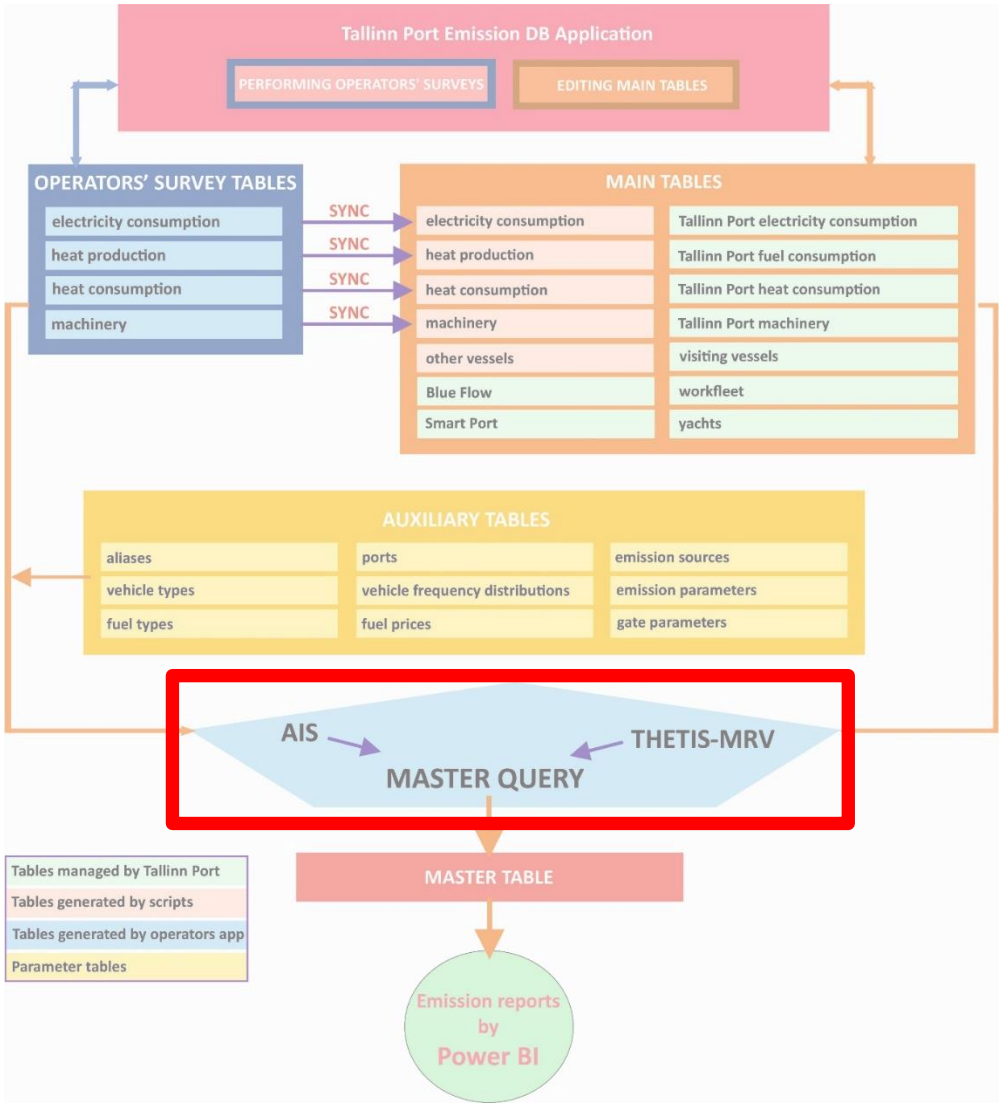
BLUE FLOW (TSL ship fuel and electricity)



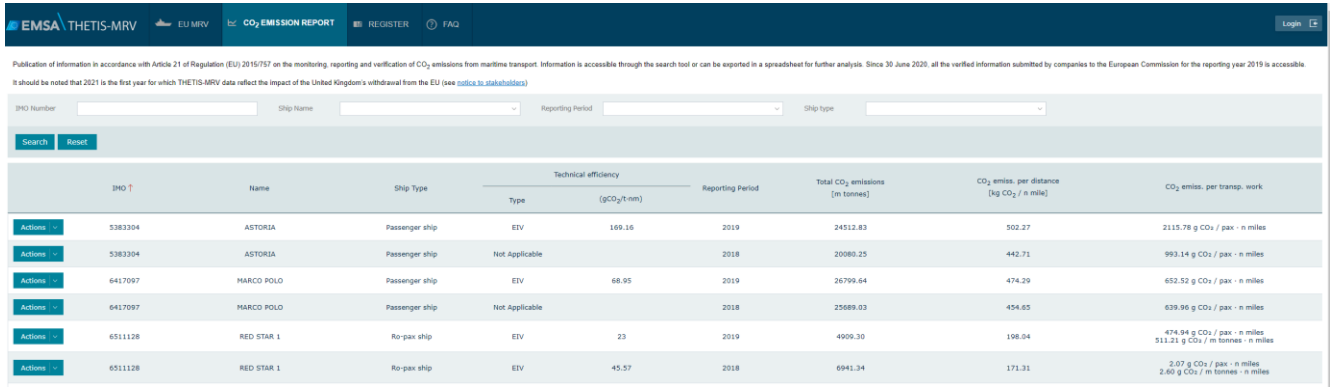
SMART PORT & TRANSPORT ADMINISTRATION

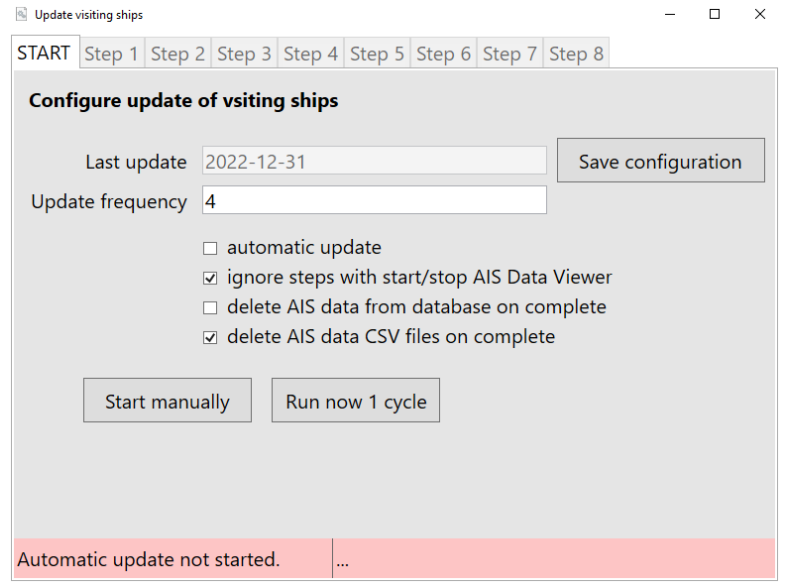


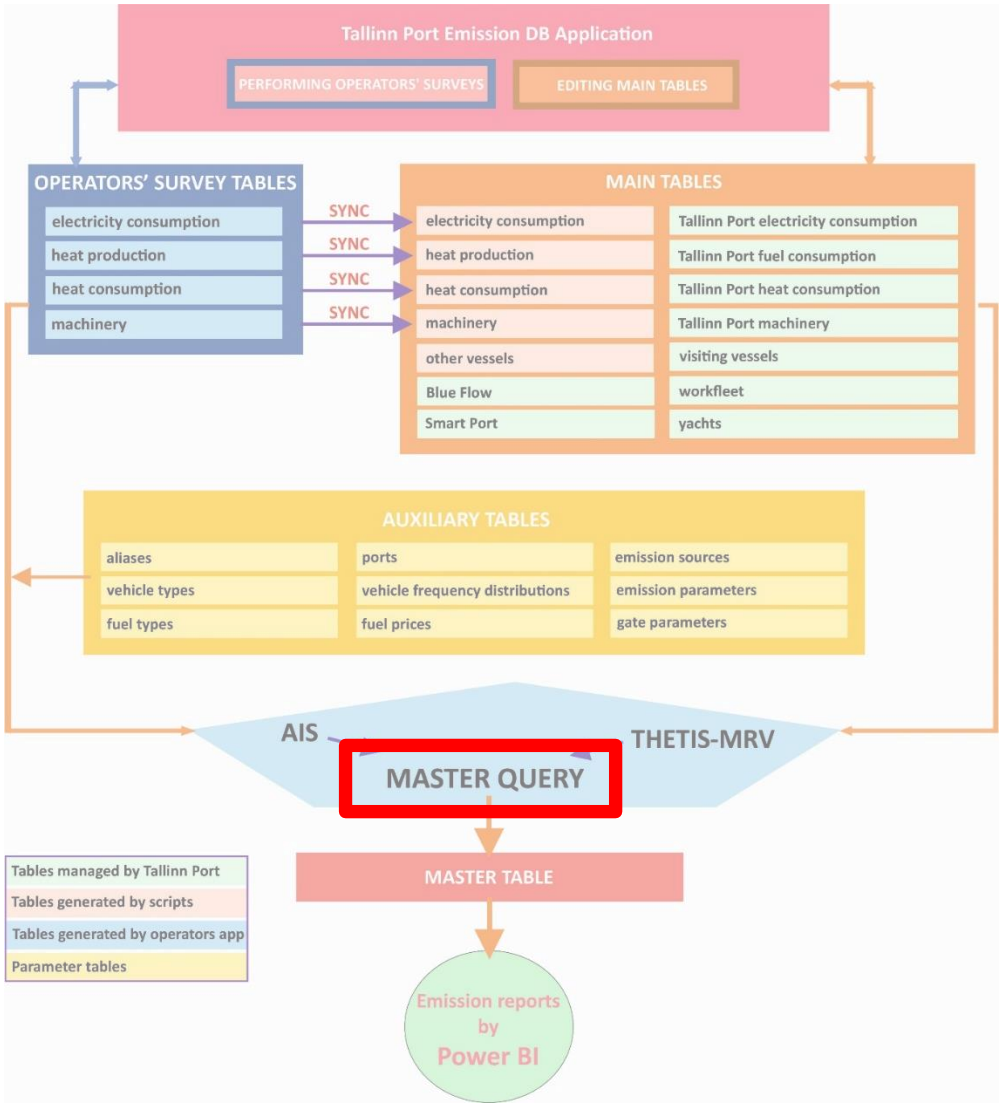




VISITING SHIPS

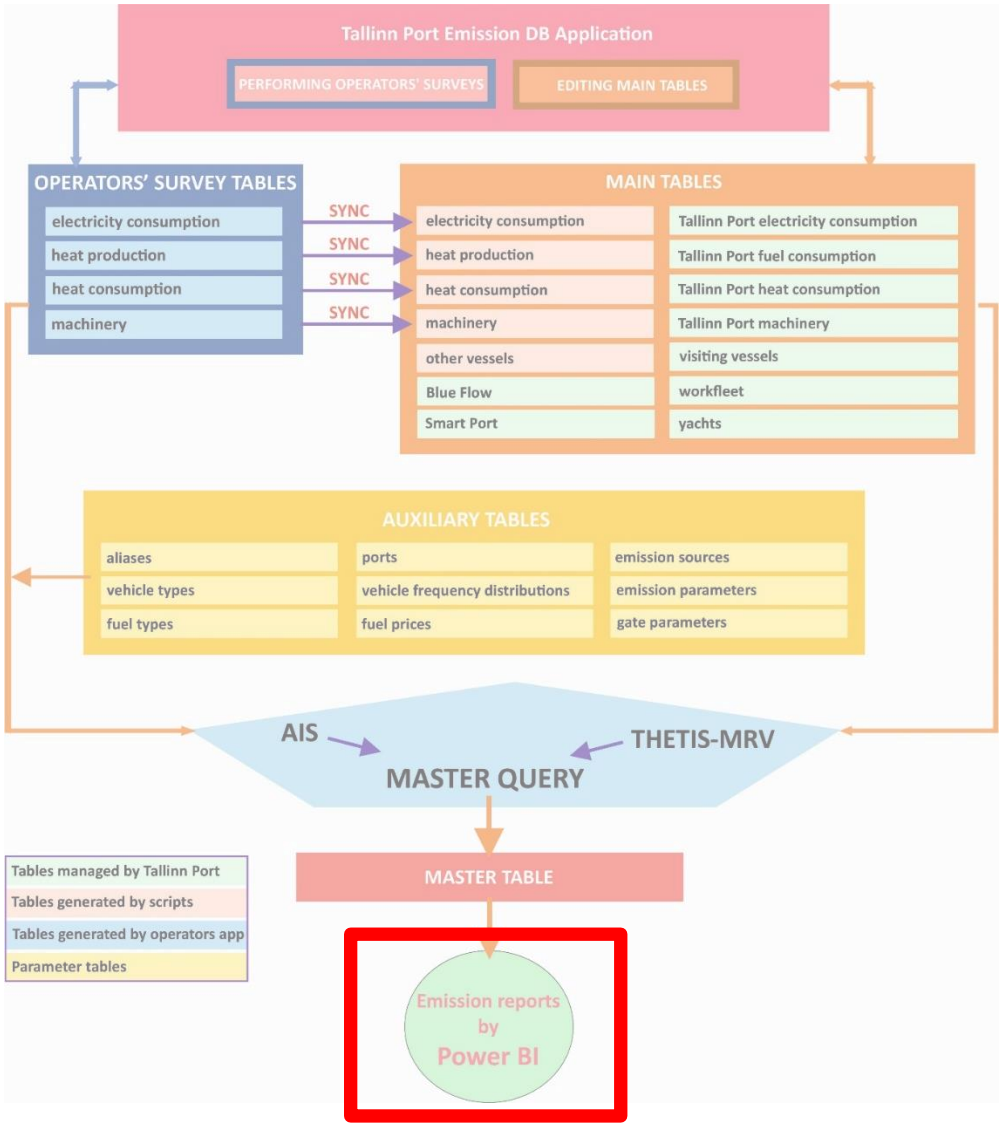




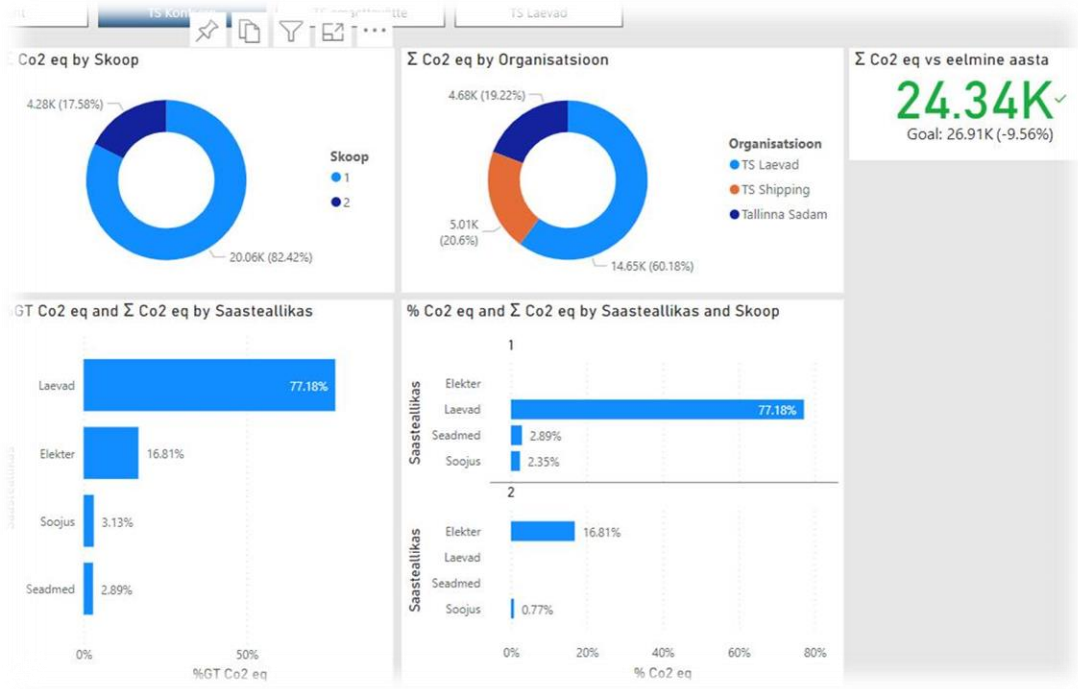


MASTER QUERY

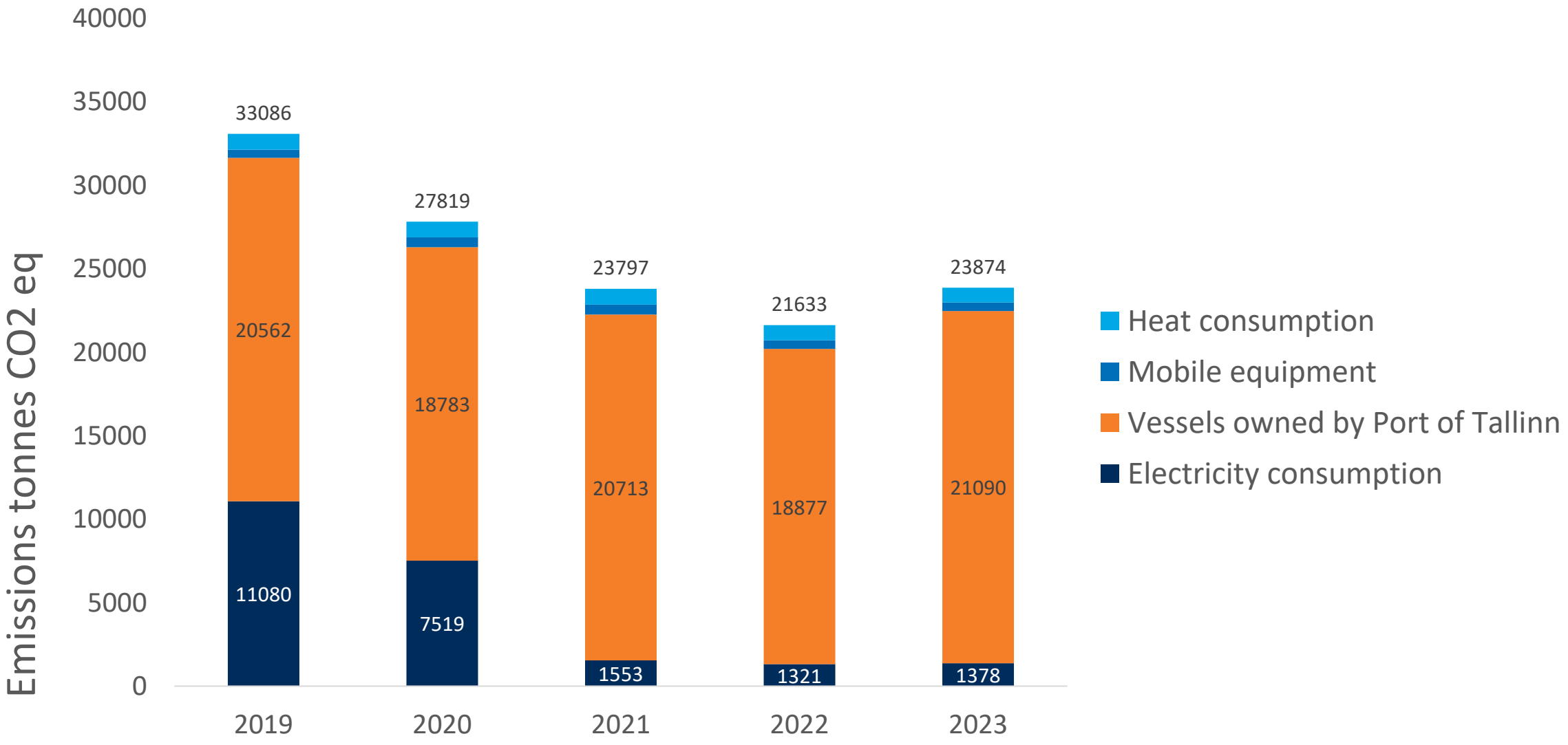
```
---- FUEL.CONSUMPTION_AXAPTA accountnum != 4211 - not aux fleet, other, marked as PC

SELECT
	1 as scope
	,mt.YEAR as year
		,mt.MONTH as month
		,'fuel.consumption_axapta - accountnum != 4211' as datasource
		,(select alias_name from aliases where field_name = 'machinery' and lang = @language) as source
		,'' as VesselID
		,(select alias_name from aliases where field_name = 'mobile_equipment' and lang = @language)  as
source_category_1
		,(select alias_name from aliases where field_name = 'PC' and lang = @language) as
source_category_2 --- ???
		,(CASE
				WHEN mt.SADAM = 'Sadamavalitsus'
				THEN (select alias_name from aliases where field_name = 'Vanasadam' and lang =
@language)

				ELSE (select alias_name from aliases where field_name = mt.SADAM and lang =
@language)
				END) as port
		,'' as terminal
		,(select alias_name from aliases where field_name = 'ts_group' and lang = @language) as
organization
		,'Tallinna Sadam' as organization_2 -- TS Sadam?
		,'Tallinna Sadam AS' as company -- TS Sadam?
		,'' as consumption_type
		,(select alias_name from aliases where field_name = lower(mt.FUEL) and lang = @language) as
fuel_type
	,mt.SUMMA/prices.price as energy_consumption
		,SUBSTRING([SEI_unit],CHARINDEX('/',[SEI_unit],0)+1,LEN([SEI_unit])-
CHARINDEX('/',[SEI_unit],0)+1) as consumption_unit
		,ft.SEI_unit as energy_consumption_unit
		,'' as oper_line
		,'' as vvv_count
	,0 as co2
		,(mt.SUMMA/prices.price) *
				ft.SEI_coefficient * 0.001 as co2eq
FROM [fuel.consumption_axapta] as mt
left outer join fuel_types_SEI as ft on
	lower(ft.fuel_type) = --lower(mt.FUEL)
```


Tallinn Port Emission DB Application
PERFORMING OPERATORS' SURVEYS
EDITING MAIN TABLES
OPERATORS' SURVEY TABLES
electricity consumption
heat production
heat consumption
machinery
SYNC
SYNC
SYNC
SYNC
MAIN TABLES
electricity consumption
heat production
heat consumption
machinery
other vessels
Blue Flow
Smart Port
Tallinn Port electricity consumption
Tallinn Port fuel consumption
Tallinn Port heat consumption
Tallinn Port machinery
visiting vessels
workfleet
yachts
AUXILIARY TABLES
aliases
vehicle types
fuel types
ports
vehicle frequency distributions
fuel prices
emission sources
emission parameters
gate parameters
AIS
THETIS-MRV
MASTER QUERY
MASTER TABLE
Emission reports by Power BI
Tables managed by Tallinn Port
Tables generated by scripts
Tables generated by operators app
Parameter tables

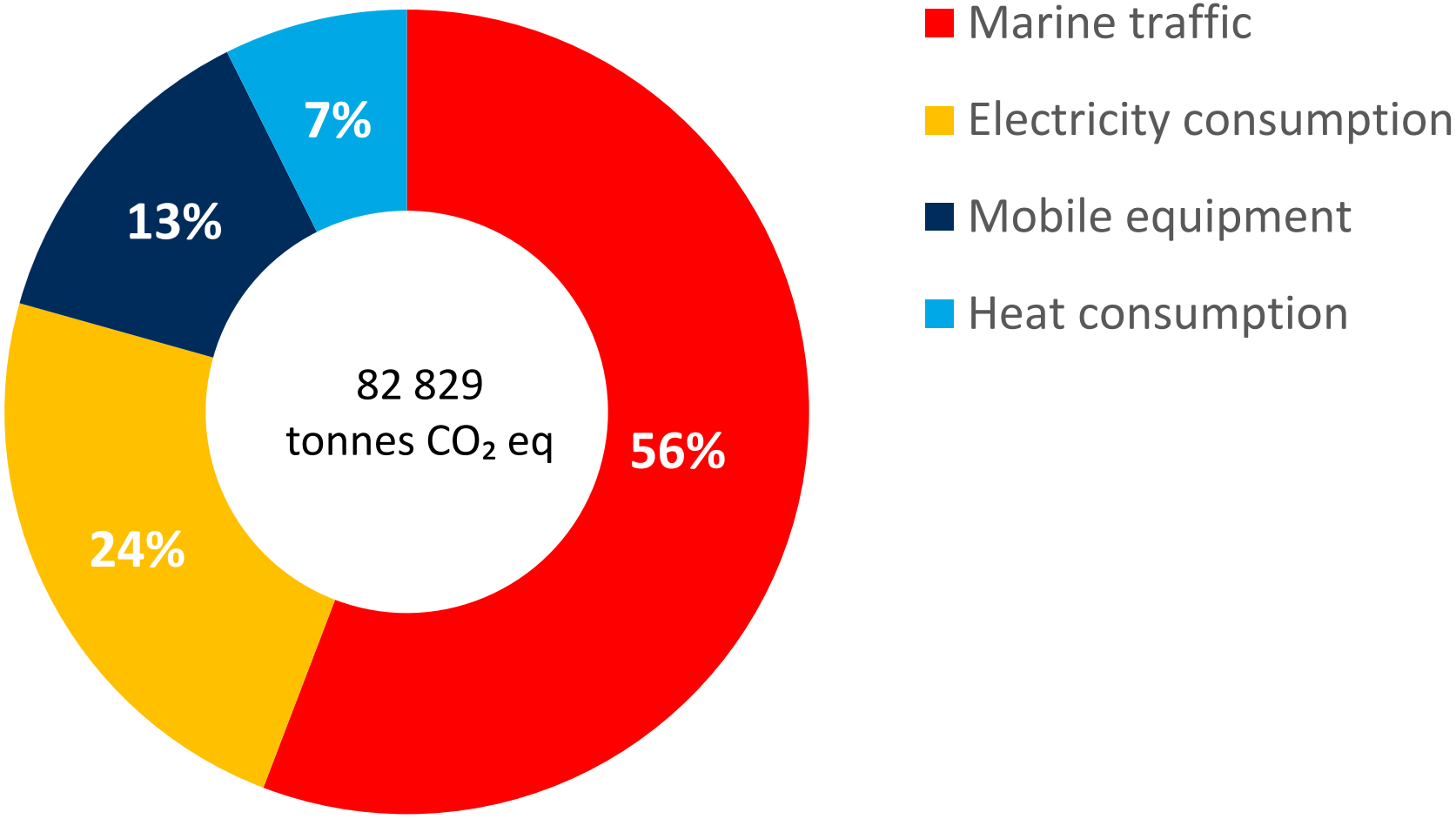
POWER BI

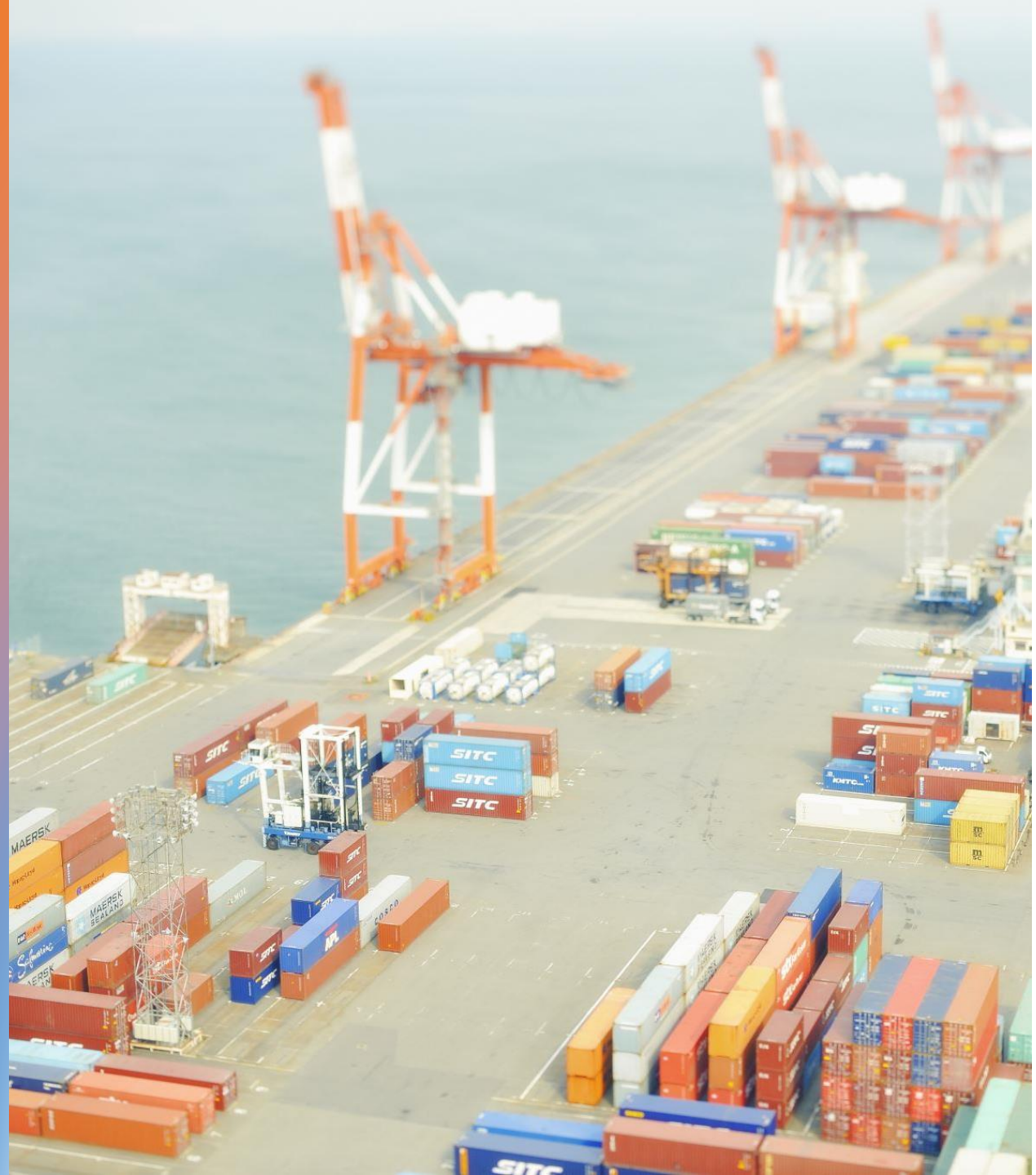

Co2 eq by Skoop
4.28K (17.58%)
20.06K (82.42%)
Skoop
1
2
Σ Co2 eq by Organisatsioon
4.68K (19.22%)
5.01K (20.6%)
14.65K (60.18%)
Organisatsioon
TS Laevad
TS Shipping
Tallinna Sadam
Σ Co2 eq vs eelmine aasta
24.34K
Goal: 26.91K (-9.56%)
GT Co2 eq and Σ Co2 eq by Saasteallikas
Laevad
77.18%
Elekter
16.81%
Soojus
3.13%
Seadmed
2.89%
0%
50%
%GT Co2 eq
% Co2 eq and Σ Co2 eq by Saasteallikas and Skoop
1
Saasteallikas
Elekter
Laevad
77.18%
Seadmed
2.89%
Soojus
2.35%
2
Elekter
16.81%
Laevad
Seadmed
Soojus
0.77%
0%
20%
40%
60%
80%
% Co2 eq

REPORTING (SCOPE 1-2)



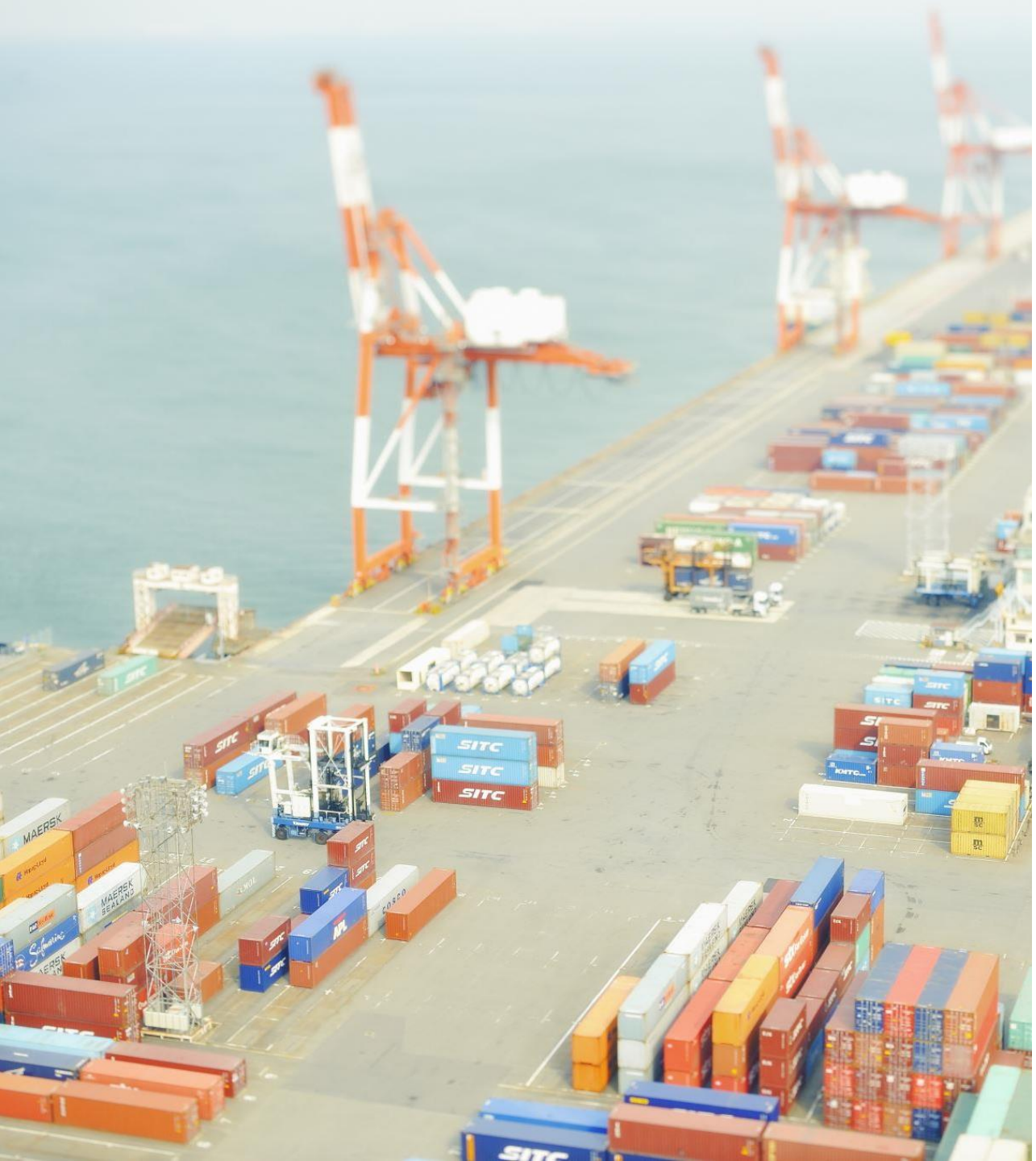
REPORTING 2022 (SCOPE 1-3)





Key messages

- Hybrid approach combining existing methodologies
- Using direct inventories wherever possible
- Data collection and validation is the most time consuming phase → need to automate this process
- Strong focus on visiting ships as shipping is important source of GHG
- Efficient GHG emission assessment



Future challenges

- Sophisticated emission calculation algorithms are required to account for Scope 3 emissions from the inception to termination of materials, including those beyond a port's territorial boundaries. These algorithms should go beyond the localised approach and incorporate **Life Cycle Assessment** (LCA) methodologies.
- **Ports must standardize their calculation methodologies for GHG emissions**. This requires the development of IT tools that can integrate diverse databases, enabling meaningful comparisons of emissions across ports.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