



Decarbonation

• Timeline Reminder

• **2030** : **40%** Reduction GHG (Greenhouse Gases) compared 2008 (**IMO goal**) and **55 % reduction** (according European Regulation) compared 1990.

• **2050** : **70 %** Reduction GHG compared 2008 (**IMO goal**) and **Carbon neutrality in 2050 (Accord de Paris)**.

• **IMO : from now (June 2022): EEXI (Energy Efficiency Existing Ship Index) calculation for vessels > 400UMS**

Adoption of corrective measures (Engine power limitation: ≈37%, change MDO to GNL = 25% Installation of a shaft generator = 5.6%, Installation of rotor sails: 3.8%, etc.) before final classification.

Approval by expert of the measures adopted and establishment of an **IEEC Class** certificate (**International Energy Efficiency Certificate**)

30/06/2024: All ships must have this classification certificate (**notation from A to E**) and be able to show it to Authorities

Then, every year, the permitted class will be lowered and as with real estate, ships in the not anymore permitted class will be denied access to ports.

Waiting for the CII (2023)

- The CII (**Carbon Intensity Index**) will be much more restrictive than the EEXI.
- The CII requirements will take effect from 2023 (all ships above 5000 GT)
- An enhanced **SEEMP (Ship Energy Efficient Management Plan)**, with an implementation plan for achieving the required CII needs to be approved and kept on board.
- At the end this CII will be the reference for the implementation of a target for reducing the carbon emissions of every ship.
- It can not be exceeded but, and in addition, its annual review must reflect the efforts made to lower it. The objective is to reduce emissions by 40% for 2030.

In **2020**, the FFPM launched a
Eco-Energetic Transition Commission

The goal was to federate the knowledge of the various stations in order to reduce our carbon footprint.

Carbon assessment of the French pilot

Already the first result of the 6 test station permit to realize that:

The total emission of the pilotage = **10 768t**

A truck doing 120 000km/year with 35ltr GO/100km = **133t**

French pilotage is equivalency of 81 trucks!!!

70% carbon print is our boarding equipment (boats, helicopter, cars...)

Le Havre carbon production is around 1872t/year (Marseille 1700t / Sete 204t)

At 81€/t the carbon tax today would be 151 632€ for LH

•GHG Production 2020

- 6 Pilot stations had completed their BEGES (GHG Emission statement) to calculate their emissions for 2020.
- **Dunkerque**/la Seine River/**le Havre**/la Loire River/Sète and **Marseille**. (60% of the french trafic)
- They produced 7333 Tons GHG.
- This represent **16T** produced by employees and pilots.
- 85 % of their emissions coming from hydrocarbons.
- 1.8 million liters of GO** used for nautical service.
- 2020 with the pandemic is not very representative of our real Production of GHG
- 2008 reference for OMI was also an international crises year and not really representative

1	STATIONS		DUNKERQUE	LE HAVRE	SEINE	LOIRE	SETE	MARSEILLE	TOTAL STATIONS PILOTES	RAPPORT EMISSIONS
2	N°	Postes d'émissions								
3	1	Sources Fixes de Combustion	39,0	0,0	12,0	17,0	5,0	42,9	115,9	1,58 %
4	2	Sources mobiles à moteur thermique	667,0	1251,2	948,0	756,7	137,0	1161,2	4921,1	67,10 %
5	3	Emissions directes des procédés (hors énergie)								
6	4	Emissions directes fugitives	En rouge : les valeurs non encore calculées par les Stations							
7	5	Emissions issues de la biomasse (soit et forêts)								
8	Sous total 1		706,0	1251,2	960,0	773,7	142,0	1204,1	5037,0	68,68 %
9	6	Consommation d'électricité	10,0	18,8	11,0	7,0	2,0	16,0	64,8	0,88 %
10	7	Consommation de vapeur, chaleur ou froid	20,0	0,0	0,0	0,0	0,0	0,0	20,0	0,27 %
11	Sous total 2		30,0	18,8	11,0	7,0	2,0	16,0	84,8	1,16 %
12	8	Exploitation Amont non incluses	143,0	311,8	179,0	198,0	30,0	308,1	1169,9	15,95 %
13	9	Produits et services	52,0	105,9	109,0	0,0	16,0	39,0	321,9	4,39 %
14	10	Immobilisations	63,0	92,5	108,0	47,0	6,0	5,0	321,5	4,38 %
15	11	Déchets	1,0	1,6	0,0	0,0	1,0	0,0	3,6	0,05 %
16	13	Missions Externes	0,0	0,0	0,0	0,0	1,0	0,0	1,0	0,01 %
17	21	Déplacement Domicile Travail	45,0	90,2	112,0	35,0	6,0	105,7	393,9	5,37 %
18								0,0		
19								0,0		
20								0,0		
21	Sous total 3		304,0	602,0	508,0	280,0	60,0	457,8	2211,8	30,16 %
22	TOTAL EN EQUIVALENT TONNES DE CO2		1040,0	1872,0	1479,0	1060,7	204,0	1677,9	7333,6	100,00 %
23										
24	Nombre d'employés		67	96	99	64	11	120	457	
25	Indicateur Emission BEGES annuel/nombre employés		15,5	19,5	14,9	16,6	18,5	14,0	16,0	

2021 Results:

8/30 pilots stations did the calculation.
Final result expected for end of 2022

ANNEE 2021

STATIONS				DUNKERQUE	BOULOGNE CALAIS	LE HAVRE	SEINE	LOIRE	GIRONDE	SETE	MARSEILLE	MAYOTTE	TOTAL STATIONS PILOTES	% PAR RAPPORT EMISSIONS TOTALES		
				STATION PILOTE	Premier relevé	STATION PILOTE	STATION PILOTE	STATION PILOTE	Premier relevé	STATION PILOTE	STATION PILOTE	Premier relevé				
	Caligon ou d'émis- sions	N°	Postes d'émissions													
SCOPE 1	Emissions directes	1	Sources Fixes de Combustion	47,1	0,0	0,0	16,4	19,9	42,1	5,1		0,0	130,6	1,94 %		
		2	Sources mobiles à moteur thermique	816,6	109,2	1334,9	885,7	701,3	231,7	112,2		158,2	4349,8	64,64 %		
		3	Emissions directes des procédés (hors énergie)													
		4	Emissions directes fugitives	En rouge : les valeurs non encore calculées par les Stations												
		5	Emissions issues de la biomasse (sols et forêt)													
		Sous total 1				863,7	109,2	1334,9	902,1	721,2	273,8	117,3		158,2	4480,4	66,58 %
SCOPE 2	Emissions indirectes associées à l'énergie	6	Consommation d'électricité	13,0	0,2	19,9	12,1	6,5	5,3	2,0		0,1	59,1	0,88 %		
		7	Consommation de vapeur, chaleur ou froid	20,7	0,9	0,0	0,0	0,0	0,0	0,0	0,0		0,0	21,6	0,32 %	
		Sous total 2				33,7	1,1	19,9	12,1	6,5	5,3	2,0		0,1	80,7	1,20 %
SCOPE 3	Autres émissions indirectes	8	Emissions Amont non incluses	210,8	28,1	334,9	231,5	184,5	65,4	29,6		40,7	1125,5	16,73 %		
		9	Produits et Services	54,6	0,0	177,0	112,9	29,3	38,2	15,9		0,0	427,9	6,36 %		
		10	Immobilisations	60,8	0,9	92,5	53,2	46,8	30,5	5,1		0,0	289,8	4,31 %		
		11	Déchets	0,7	0,0	1,6	0,0	0,0	0,8	0,0		0,0	3,1	0,05 %		
		13	Missions Externes	0,0	0,0	0,0	5,3	0,0	5,8	3,2		0,0	14,3	0,21 %		
		23	Déplacement Domicile Travail	50,4	10,7	90,0	110,4	34,3	5,3	6,4		0,0	307,5	4,57 %		
														0,0		
															0,0	
															0,0	
Sous total 3				377,3	39,7	696,0	513,3	294,9	146,0	60,2		40,7	2168,1	32,22 %		
TOTAL EN EQUIVALENT TONNE & DE CO2				1274,7	150,0	2050,8	1427,5	1022,6	425,1	179,5		199,0	6729,2	100,00 %		
Nombre d'employés				66	6,5	92	100	68,3	38	11		6,5	388,3			
Indicateur Emission BEGES annuel/nombre employés				19,3	23,1	22,3	14,3	15,0	11,2	16,3		30,6	17,3			

6 lines of approaches were quickly put forward:

- **Biofuels** with Oleo 100 in Rouen
- **less polluting carburant** like GTL (Gas To Liquid) which equips a pilot boat in Nice.
- **E fuels**
- **Hydrogen propulsion** with an ongoing project in Le Havre
- **100% electric propulsion** with the e-Maguelone which was inaugurated on April 13, 2022 in Sète.
- **Foils**

	OBJECTIFS INTERNATIONAUX	DUNKERQUE	BOULOGNE CALAIS	LE HAVRE	SEINE	LOIRE	GIRONDE	SETE	MARSEILLE	MAYOTTE
		STATION PILOTE	Premier relevé	STATION PILOTE	STATION PILOTE	STATION PILOTE	Premier relevé	STATION PILOTE	STATION PILOTE	Premier relevé
2008				2247,0	1588,0	1201,0	877,0	200,0	1919,0	162,0
2020		985,0	150,0	1941,0	1479,0	1088,0		210,0	1618,0	192,0
2021		1274,0	171,0	2051,0	1427,0	1022,0	425,0	177,0	???	199,0
2022										
2023										
2030	40 % de réduction/2008	2008 ?	2008 ?	1348,0	953,0	720,0	526,0	120,0	1152,0	96,0
2050	70 % de réduction /2008	2008 ?	2008 ?	674,0	476,0	360,0	263,0	60,0	576,0	48,0
	PLUS DE MOTEURS THERMIQUES DANS LES STATIONS (hors trajets domicile-Station) EN 2021	200	14	380	294	117	87	31	165	0
	UTILISATION DES BIO CARBURANTS AVEC 70 % DE REDUCTION DE GES EN 2021	522	74	881	634	389	189	97	619	60

• **IMMEDIATE ACTION :**

- Known by everybody and simple: **speed reduction**
- Not a new concept. Done in 1970 for tankers and in 2008 for containers vessels
- Cubic relationship between the speed and power used:
10% speed reduction = 27% consumption and GHG reduction
- Consumption reduction maximum at high speed.
Reducing speed from 20 knts to 17 is saving more than from 14 knts to 11...
- ***LE HAVRE : trial since one month: speed reduced to 18 knts and to 15 knts for return of the launch***

•long term (2030 is in 8 years):

- Think about alternative propulsion way:
- **Bio diesel.**
- **E diesel**
- **Electric pilot boat (using batteries).**
- **Electric pilot boat (using H2 and batteries).**
- **Gaz powered pilot boat.**
- **Foil pilot boat**

“E MAGUELONNE” GENESIS

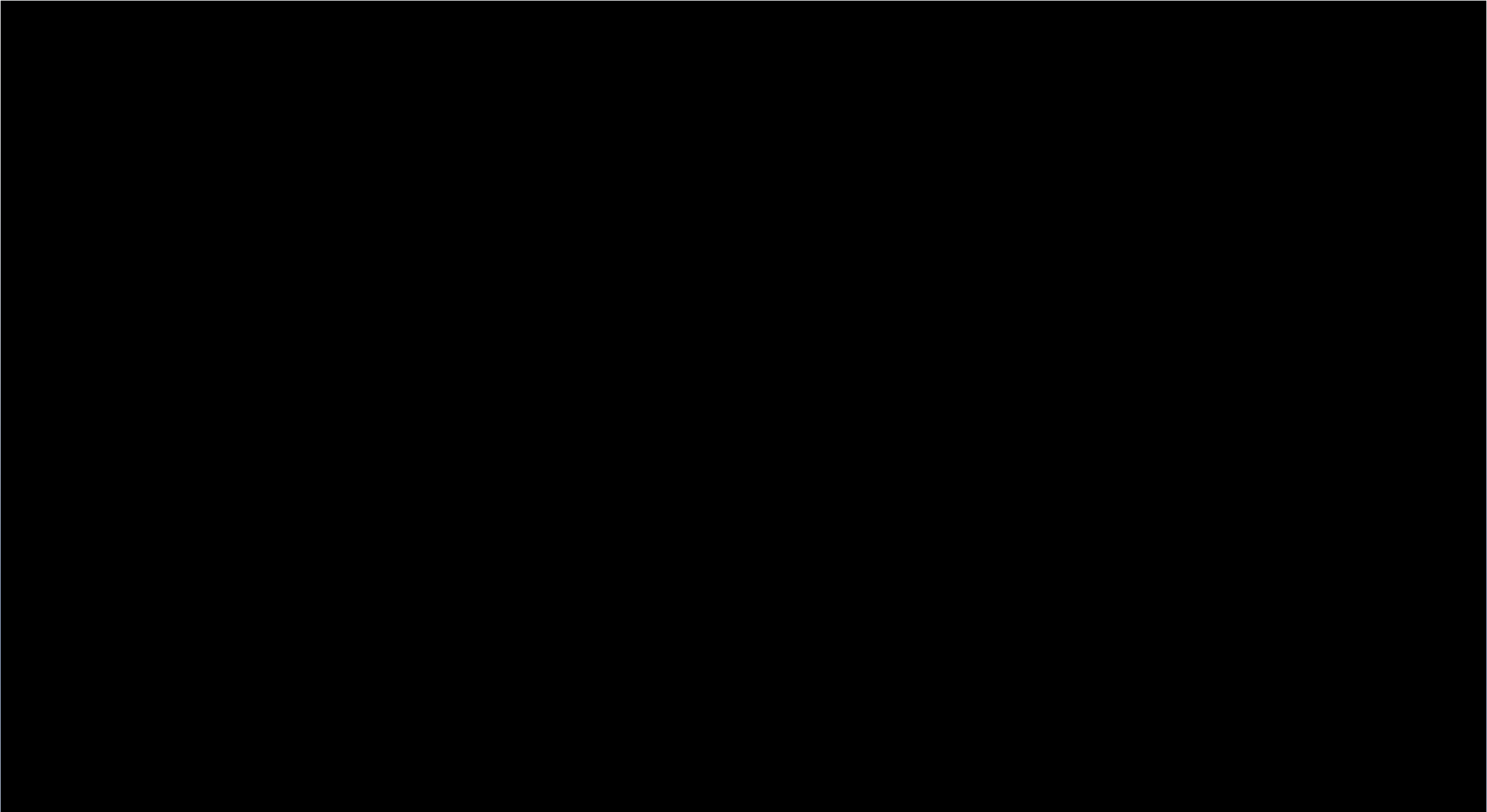
*A project “**Green Pilot**” born in **2013** on the initiative of **Marine Green Horizon** and the **FFPM** with the aim of producing a demonstrator proving the relevance of electric propulsion adapted to port service vessels.

*An MGH/**Pilotage de Sète/Pilotage de Marseille**/Port Sud de France/Région Occitanie **partnership**

“E MAGUELONNE”

*4 years studies and development

*A 12 meter pilot boat from 1980 completely converted (engine, tanks removed, 200kw electrical engine, batteries,...fitted) by the **Marseille pilots shipyard** from 2018 to 2020.



- *Pilot boat owned by MGH and chartered by the station for 18 months in addition to the fleet (request for exemption from the Maritime Administration for the armament permit).
- ***On Service** “for testing” by nice weather conditions only
- *Charging station located in the port.
- ***Target:** minimum 2 ship services before recharging, minimum operating speed 12 knots

8.2.3 Devis des masses

Nous avons établi un prévisionnel

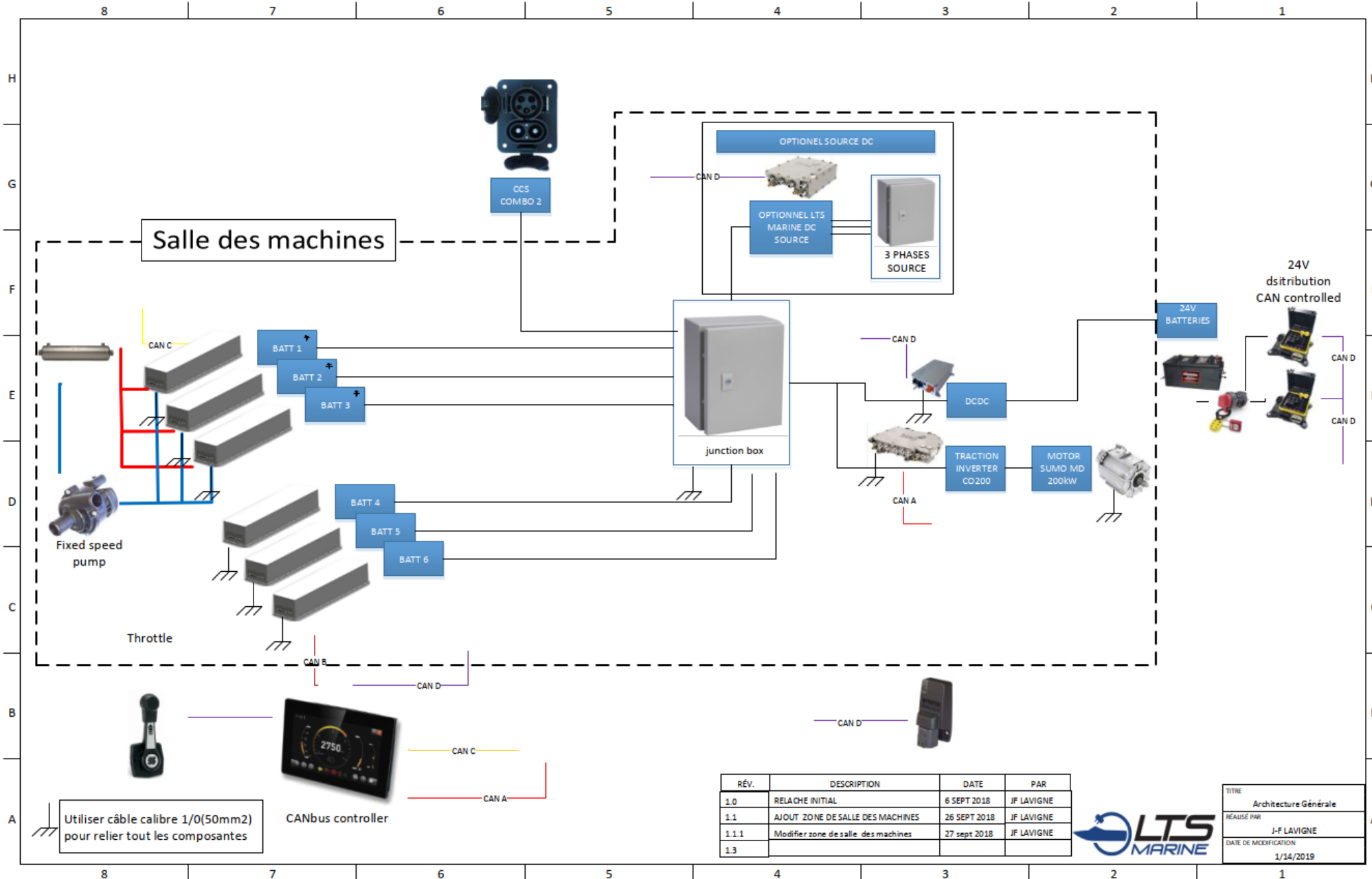
	Masse	LCG
	kg	m
PILOTINE DIESEL		
Navire pleine charge mesuré	8 275	5.48
Navire léger mesuré	7 215	5.40
Masses déposées Moteurs, réservoirs ...	1127	4.28
Pilotine sans moteur, réservoirs	6 088	5.61
PILOTINE ELECTRIQUE		
Batteries (LTS)	1 872	4.91
Distribution	85	7.51
Propulsion (1 moteur)	731	5.11
Provision structure Isolation	182	4.36
Total Masses Ajoutées	2 870	5.00
Marges	344	5.00
Total léger margé	9302	5.40
Equipage-	225	7.55
Total Full Load	9 530	5.45

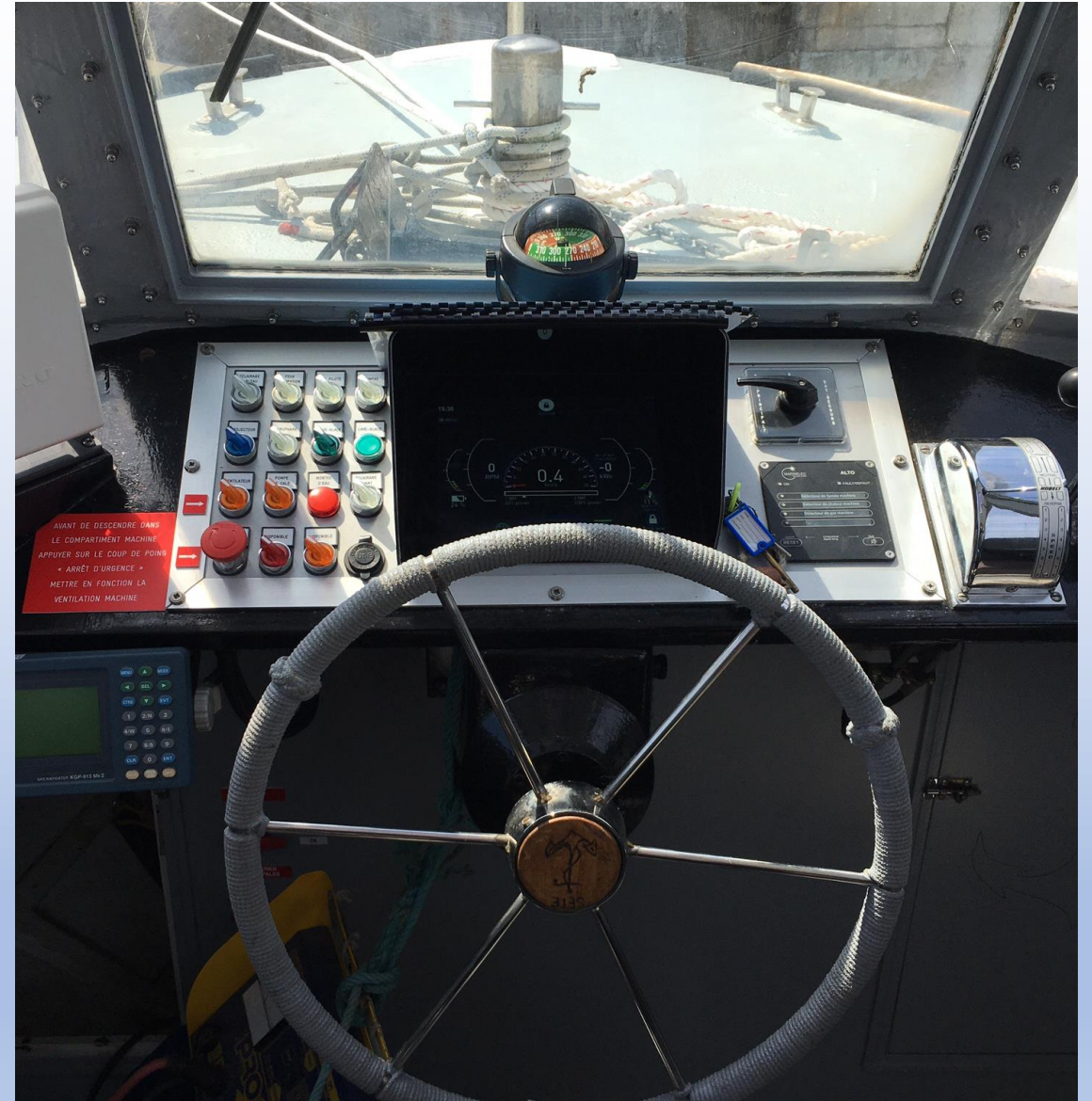
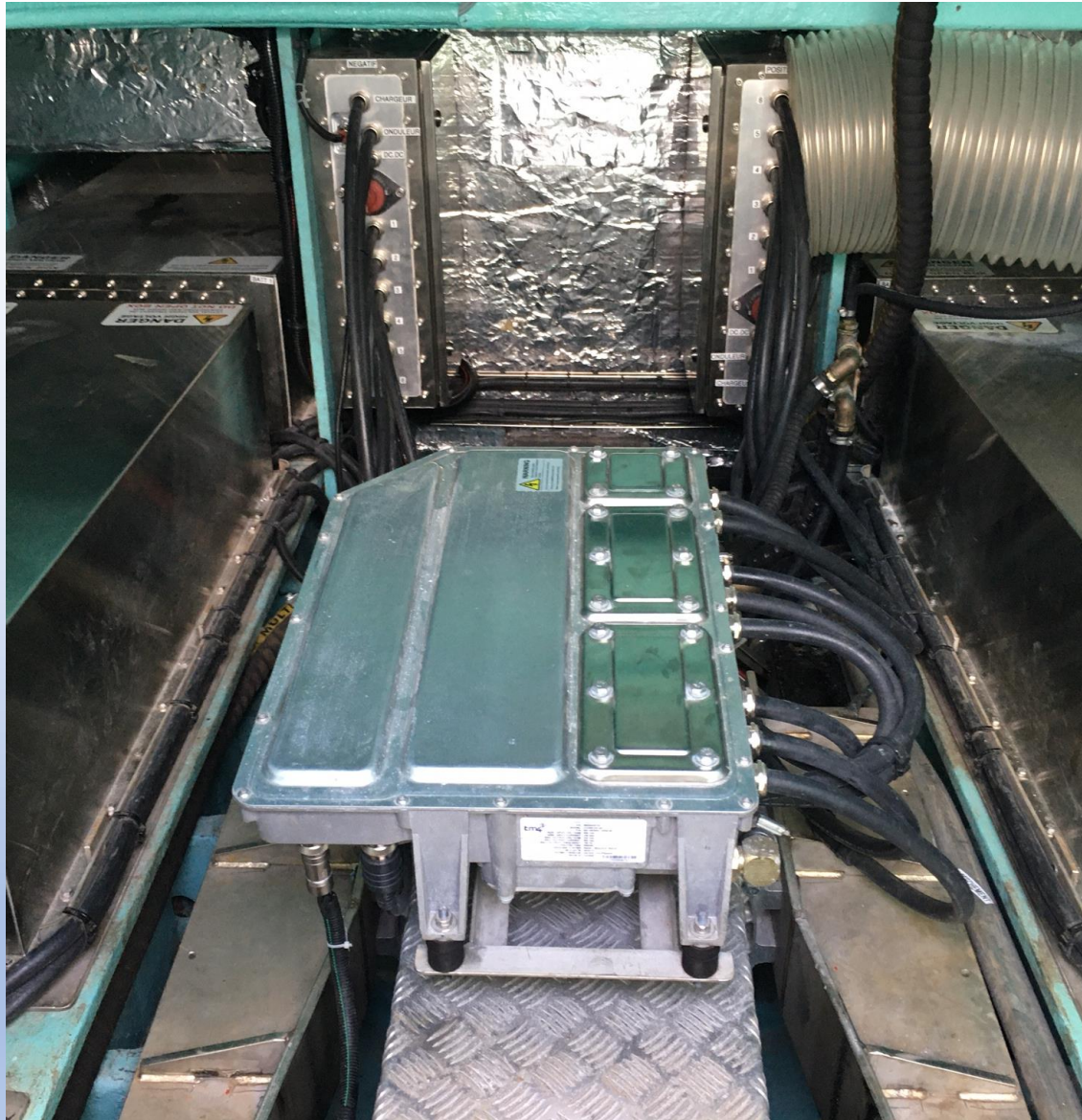
Fig 11- Devis des masses prévisionnel

Nous avons comparé la vedette électrique au cas pleine charge de la vedette diesel, la vedette électrique s'alourdit de 1250 kg, et le centre des masses recule de 3 cm

Principe de propulsion

- 6 batteries Li-Ion 700 V/186 kWh 1,8 t
- Motor 200 kW
- Reducting gear + propeller shall original
- Load 120 kW/H
- 24V for control.
- 4 cooling systems
- Max Speed : 19 kts





- Pilot launch weight increase of 1,3t (6 batteries = 1,8t)
- Problem of loading connection at the beginning
- Max speed 17 knt (40mn autonomy)
- 2 mouvements possible if speed limited to 12knt
- 1h30 service is followed by 1h30 loading
- 50t carbon saved/year
- Less noises, vibrations, and particule emissions decreased
- 50% saved on the running costs

FINAL CONCLUSIONS:

- Ship owners are working hardly on that. We can not stay on the pier and look at them acting
- Ferries /cruises / CMA CGM ... companies are going through GNL
- Maersk : 100 people working on the decarbonation (ammonia...)
- Be open: Pilot boat fleet will probably be a mixing of e-fuel, electric and hydrogen, foil...
- We must share our experience and knowledge





Thanks your your attention !