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Reducing air pollutant emissions of inland waterway transport in Europe

Technical Assistance for the impact assessments to reduce emissions of inland waterway transport

Strassbourg, 8 October 2013,
Roundtable Greening IWT, CCNR

Martin Quispel

Contents

- Introduction
- Technologies to reduce emissions
- Options for new emission limits
- Evaluation of policy options
- Next steps

Study to support the Impact Assessment

- Technical assistance provided under the Marco Polo accompanying measure by a consortium consisting of Panteia/NEA (lead), EICB, Planco, via donau and CCNR.

- Study started in October 2012 and was finalised in June 2013

- 5 meetings during September 2012 and March 2013 with the Common Expert Group with representatives from European Commission, Member States, international organisations, associations and individual companies

- Reference studies:
  - IA report on revision of 97/68/EC by TML and Arcadis (2009)
  - Medium and Long Term perspectives of IWT in the EU (2012)
  - PLATINA (2008-2012)

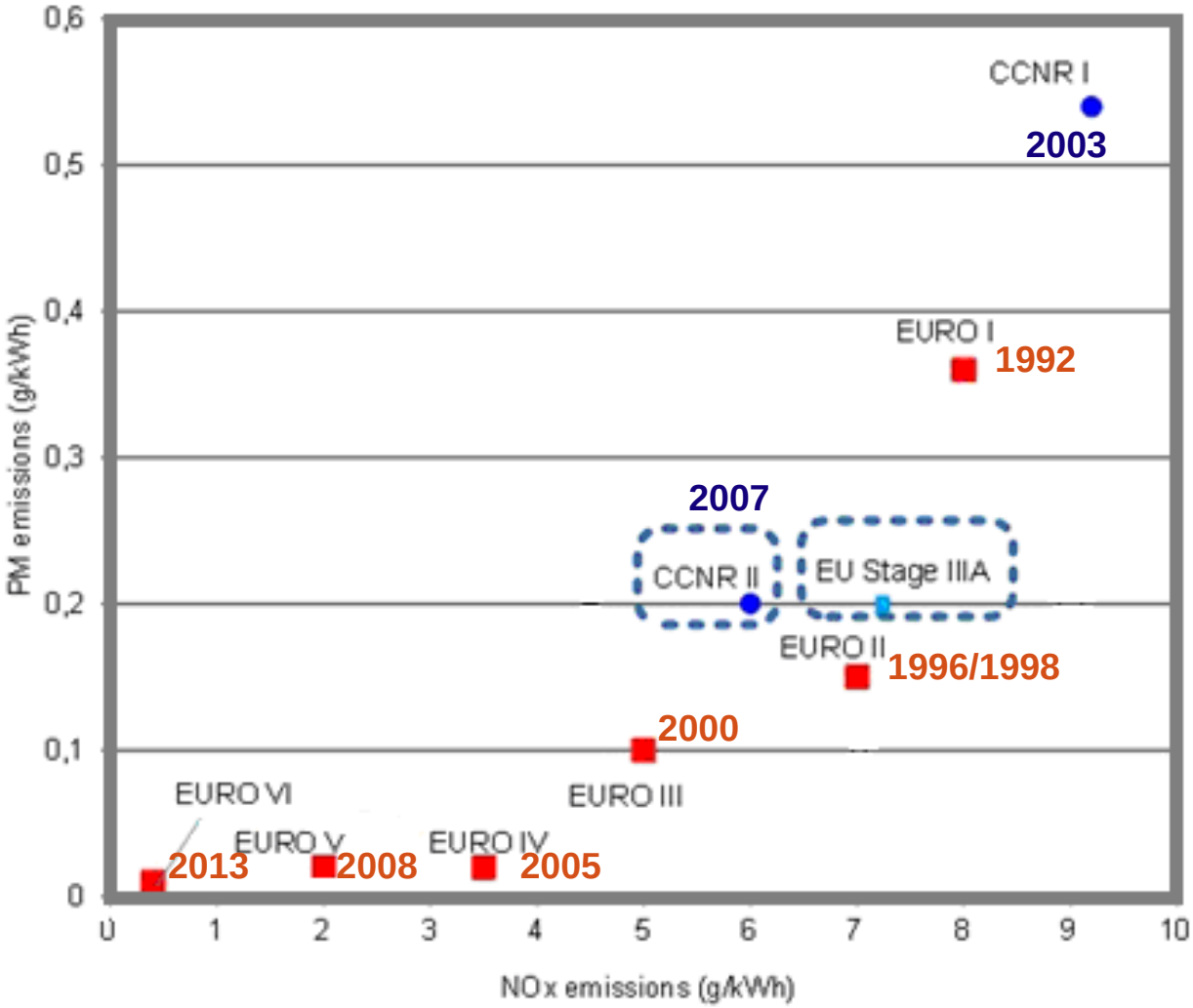
Sense of urgency

Despite the economies of scale of IWT, the external costs of air pollutant emissions of IWT is higher than road haulage and the gap is increasing quickly.

Underlying drivers:

- Compulsory emission standards in IWT are lagging behind
- Small size of the market for engines in IWT
- Long service time of engines in IWT
- Lack of incentives for vessel operators/owners

Emission standards in IWT lagging behind



Limit value NOx:
IWT: 6.0 gram/kWh
Road: 0.4 gram/kWh
=> Factor **15** difference

Limit value PM:
IWT:0.2 gram per kWh
Road: 0.01 gram per kWh
=> Factor **20** difference

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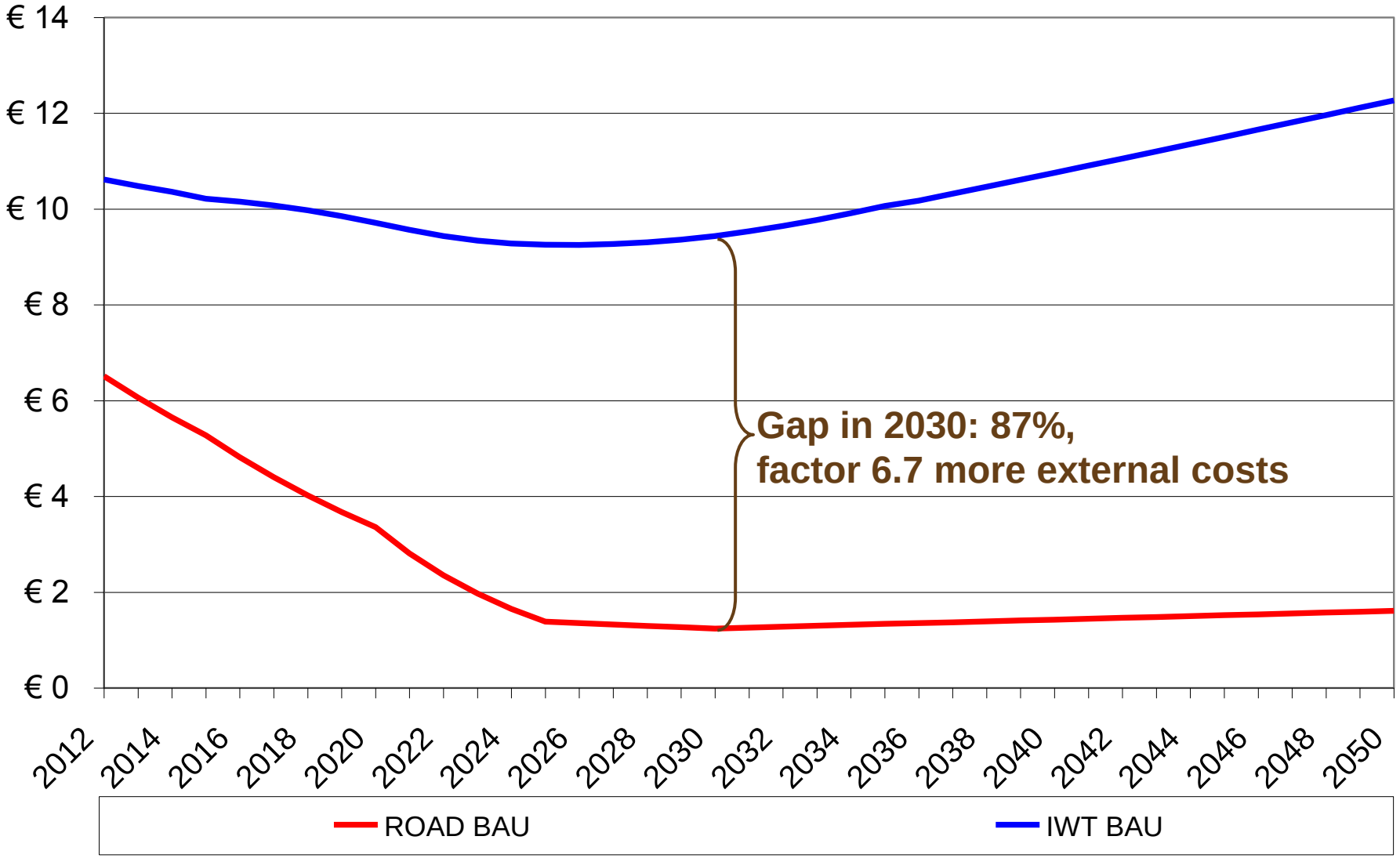
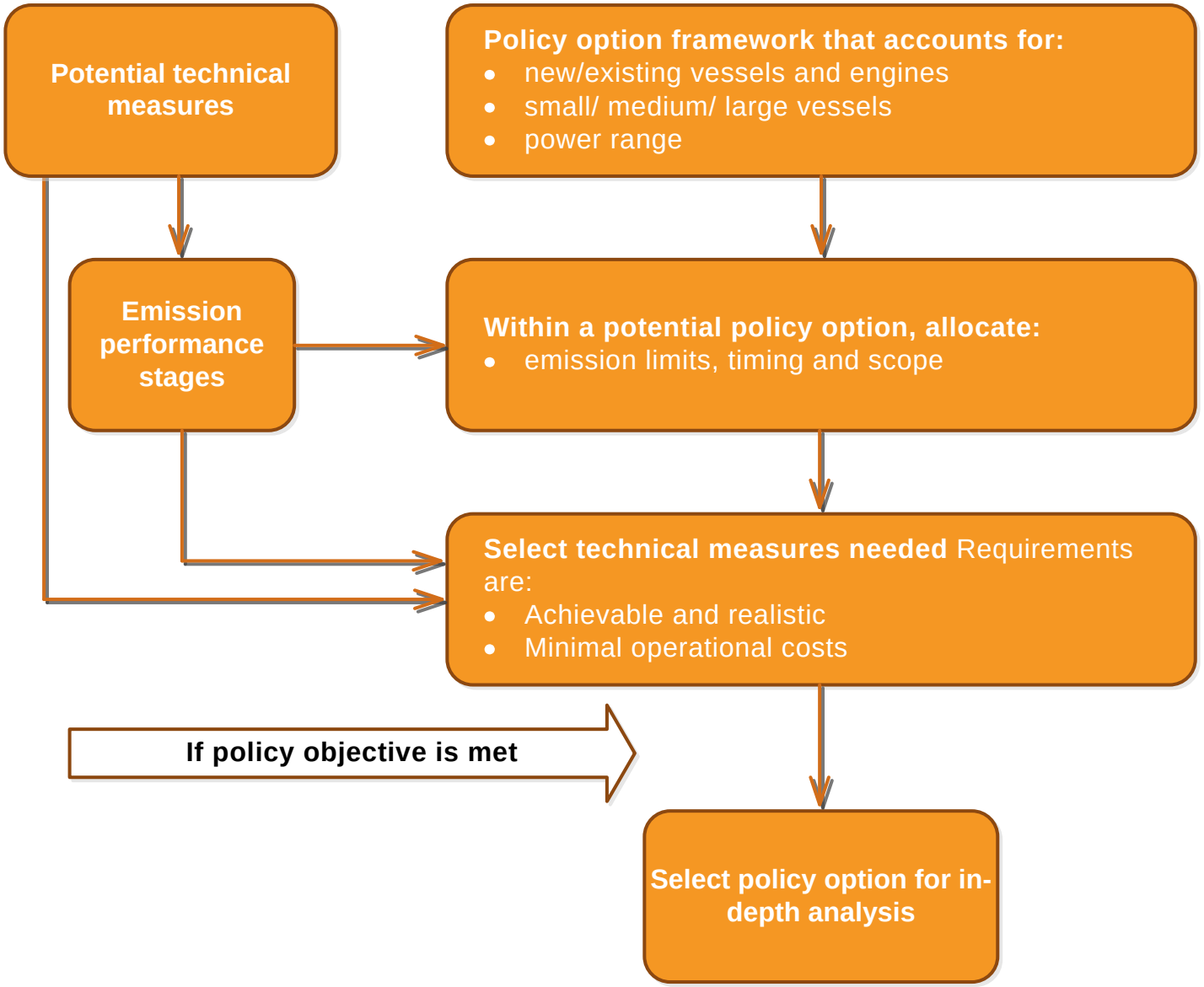
Evolution of external cost of air pollutant emissions in euro per 1,000 tonkm, based on Marco Polo external cost calculator for business as usual scenario (BAU)



EC policy goal: close gap of air pollutant emissions external costs by the year 2030



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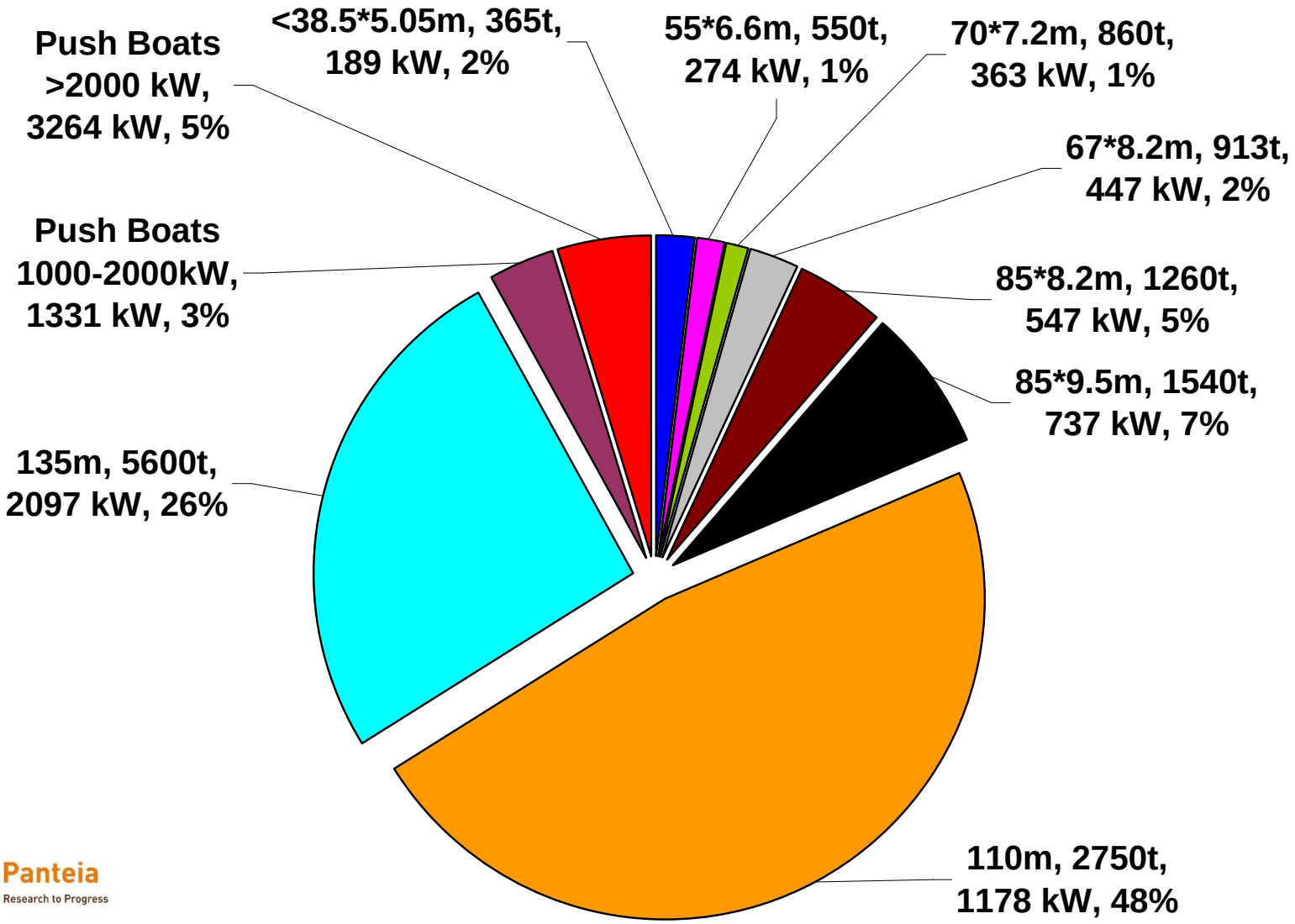
Main technical measures to reduce emissions in IWT

- **SCR** to reduce NOx according to REC principles, reduction -80%:
  - 6 gram NOx per kWh engine out → 1.2 gram NOx per kWh exhaust
  - 9 gram NOx per kWh engine out → 1.8 gram NOx per kWh exhaust
- **DPF** to reduce PM according to REC principles, reduction -90%:
  - 0.3 gram PM per kWh engine out → 0.03 gram PM per kWh exhaust
  - 0.2 gram PM per kWh engine out → 0.02 gram PM per kWh exhaust
- **LNG Dual Fuel** to reduce NOx and PM
  - Expected to reach 1.8 gram NOx and 0.04 gram PM per kWh
- Others: Fuel Water Emulsion, Hydrogen injection, Gas or Diesel-electric configurations (monofuel LNG), Methanol

Focus on largest vessels to reduce external costs:



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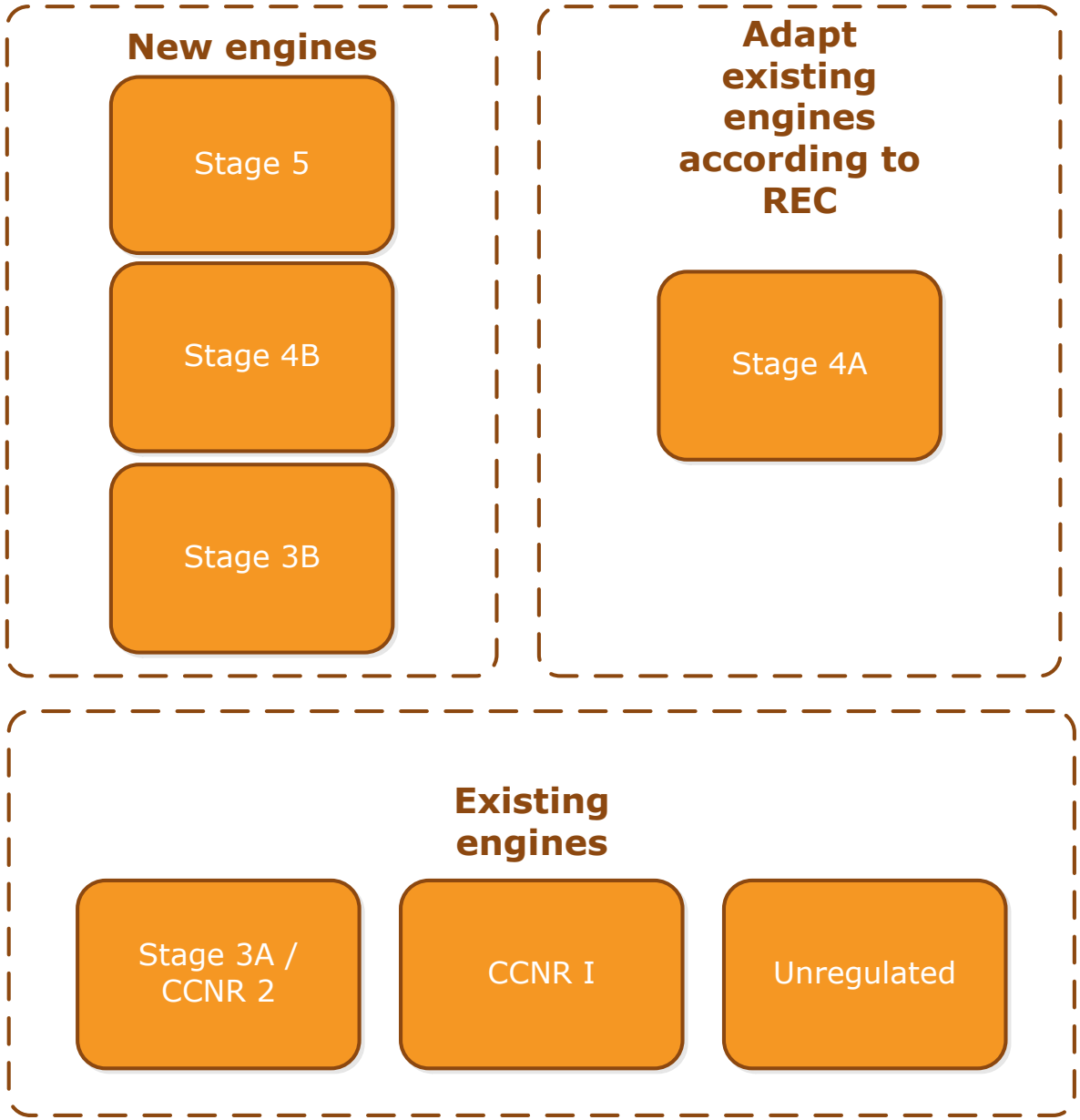
Identified emission stages



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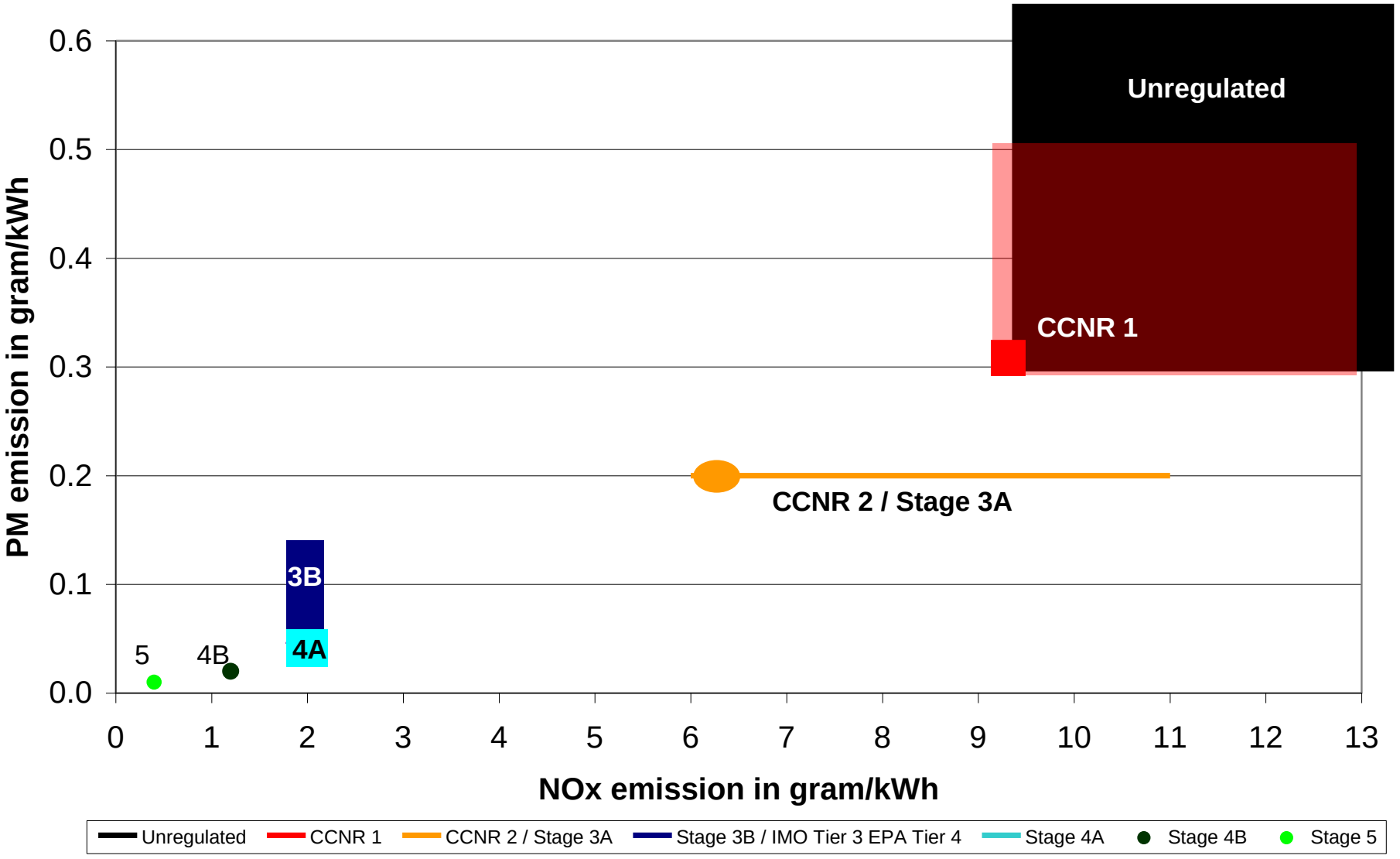
Emission stages and limit values for NOx and PM



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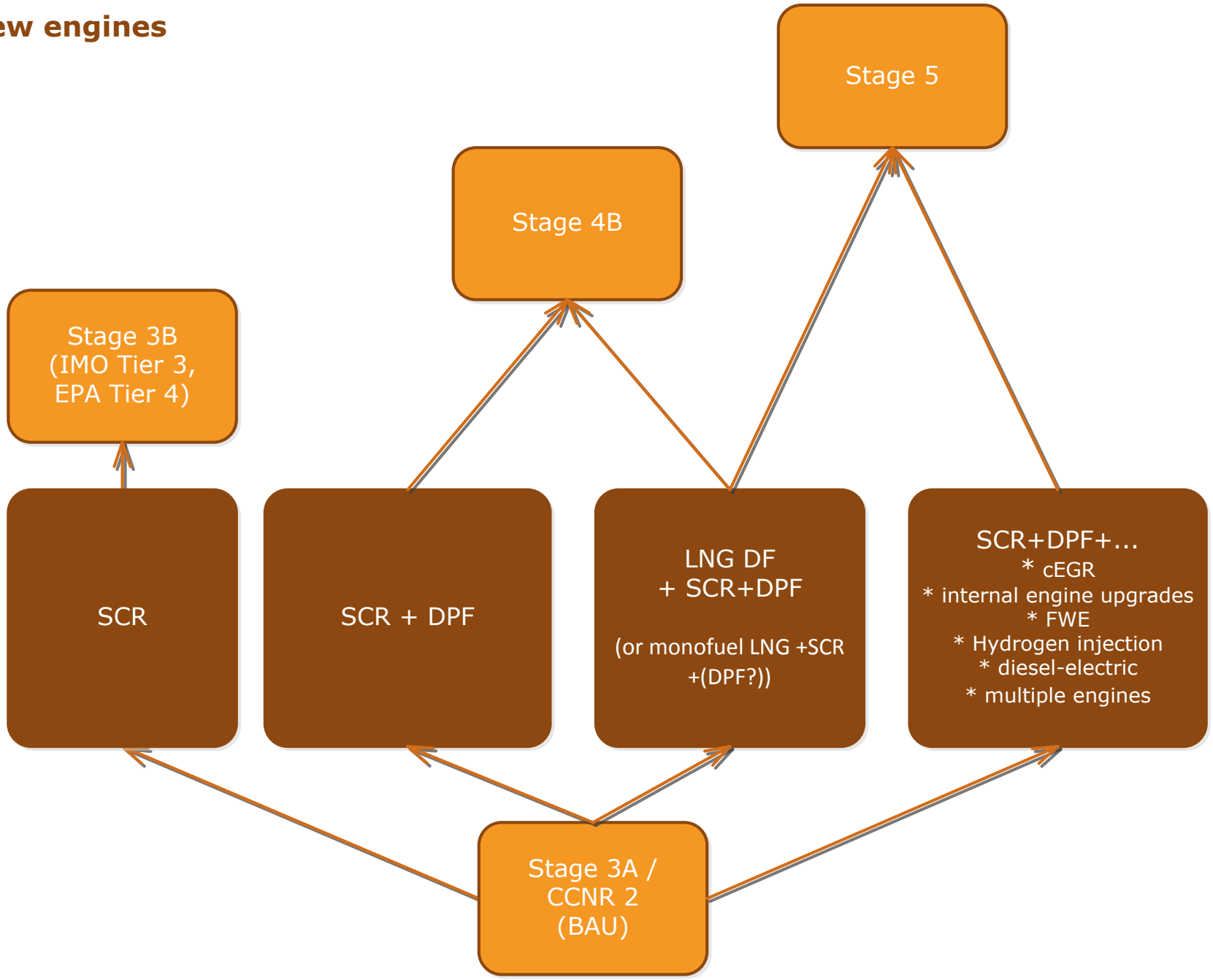
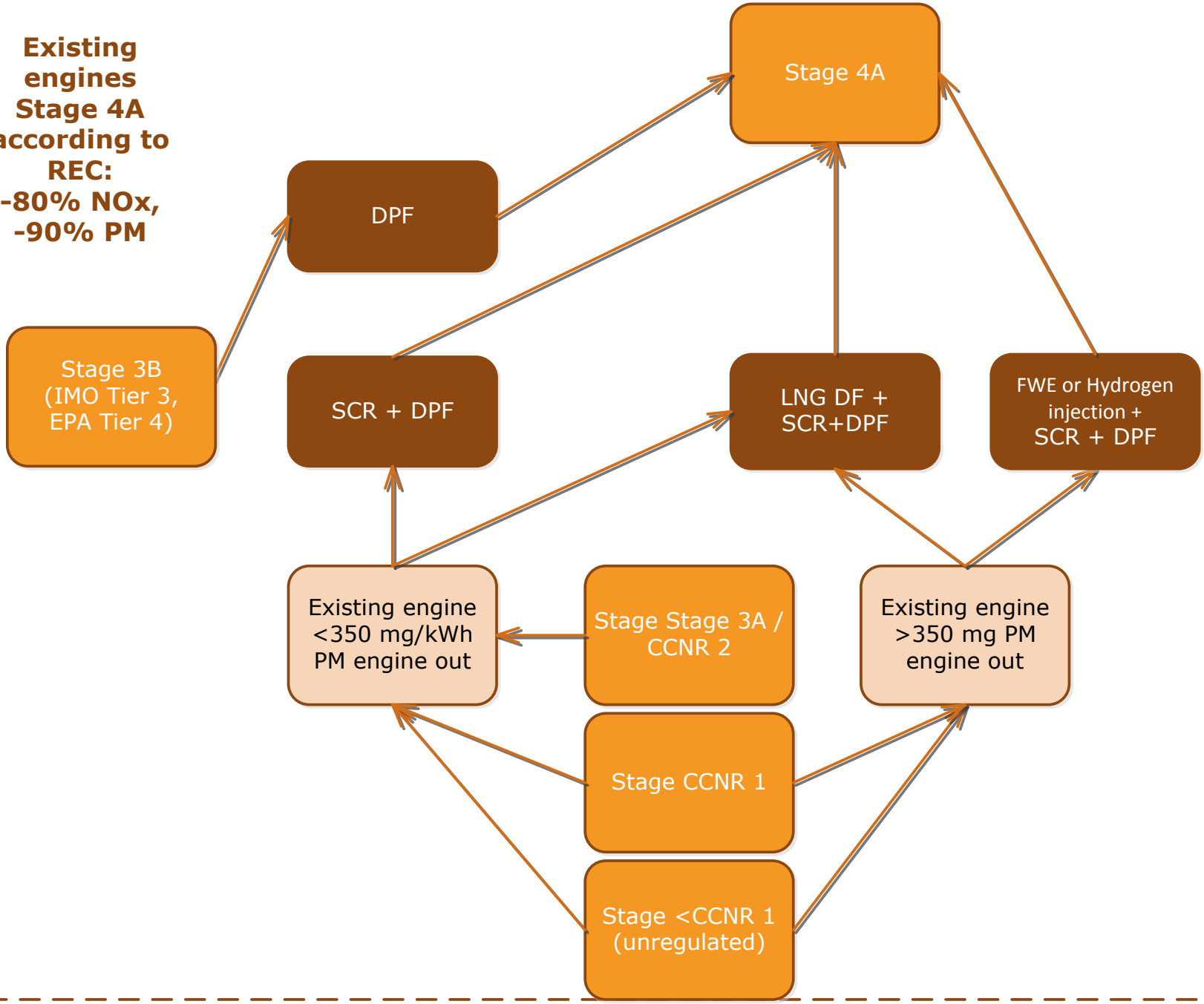
New engines


Stage 5
Stage 4B
Stage 3B
(IMO Tier 3,
EPA Tier 4)
SCR
SCR + DPF
LNG DF
+ SCR+DPF
(or monofuel LNG +SCR
+(DPF?))
SCR+DPF+...
* cEGR
* internal engine upgrades
* FWE
* Hydrogen injection
* diesel-electric
* multiple engines
Stage 3A /
CCNR 2
(BAU)

Existing engines Stage 4A according to REC: -80% NOx, -90% PM



Main variation in options

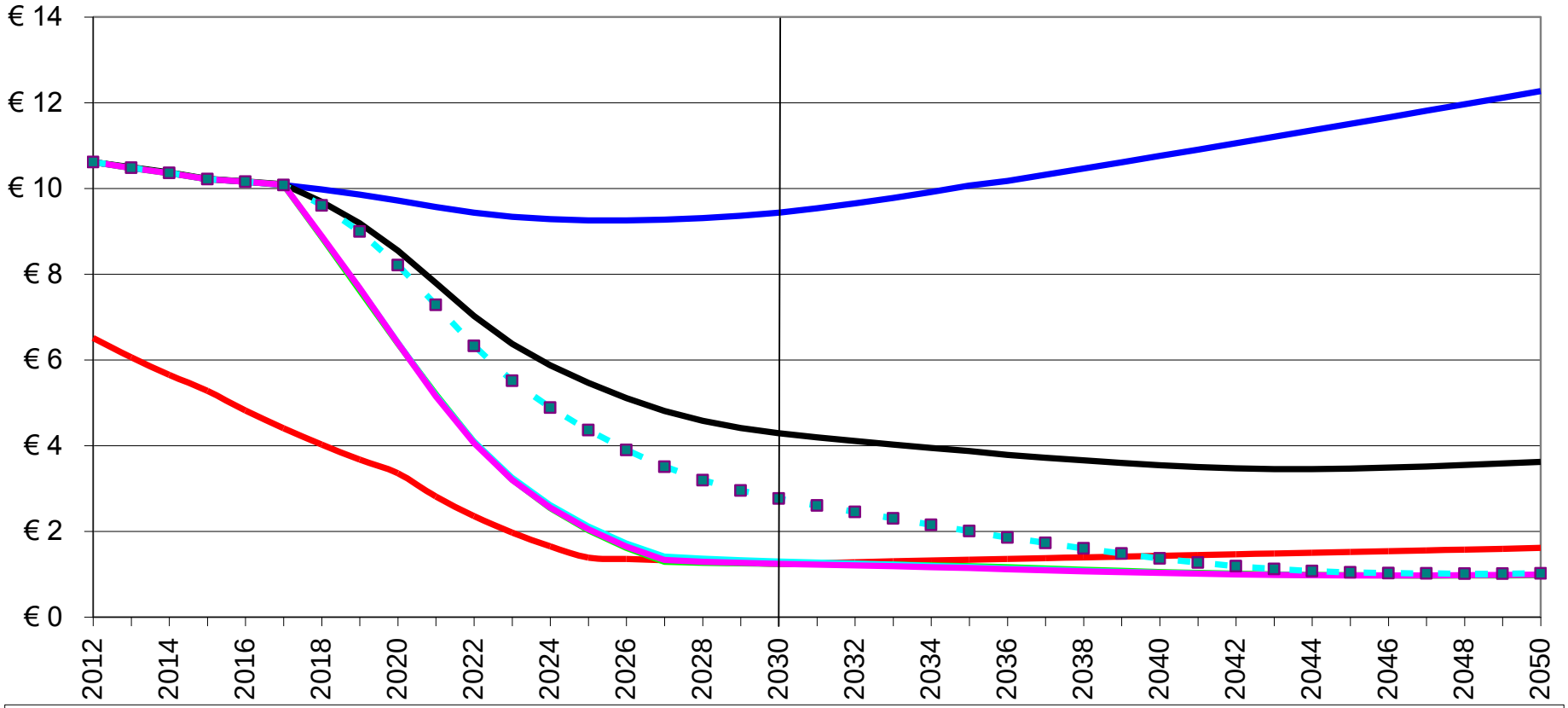
- **Leadtime** needed to develop **stage 5** performance for LNG and diesel
  - Introduction by the year **2022: Option 1**
  - Introduction by the year **2020**: **Options 2 and 3**

- Technical and financial challenges for **smaller vessels** to install SCR and DPF on the **existing engines**:
  - No exemptions: Option 1
  - Exempt class up to 55 metres, 304 kW installed power: Option 2
  - Exempt class up to 38 metres, 220 kW installed power: Option 3

Policy options for main propulsion engines

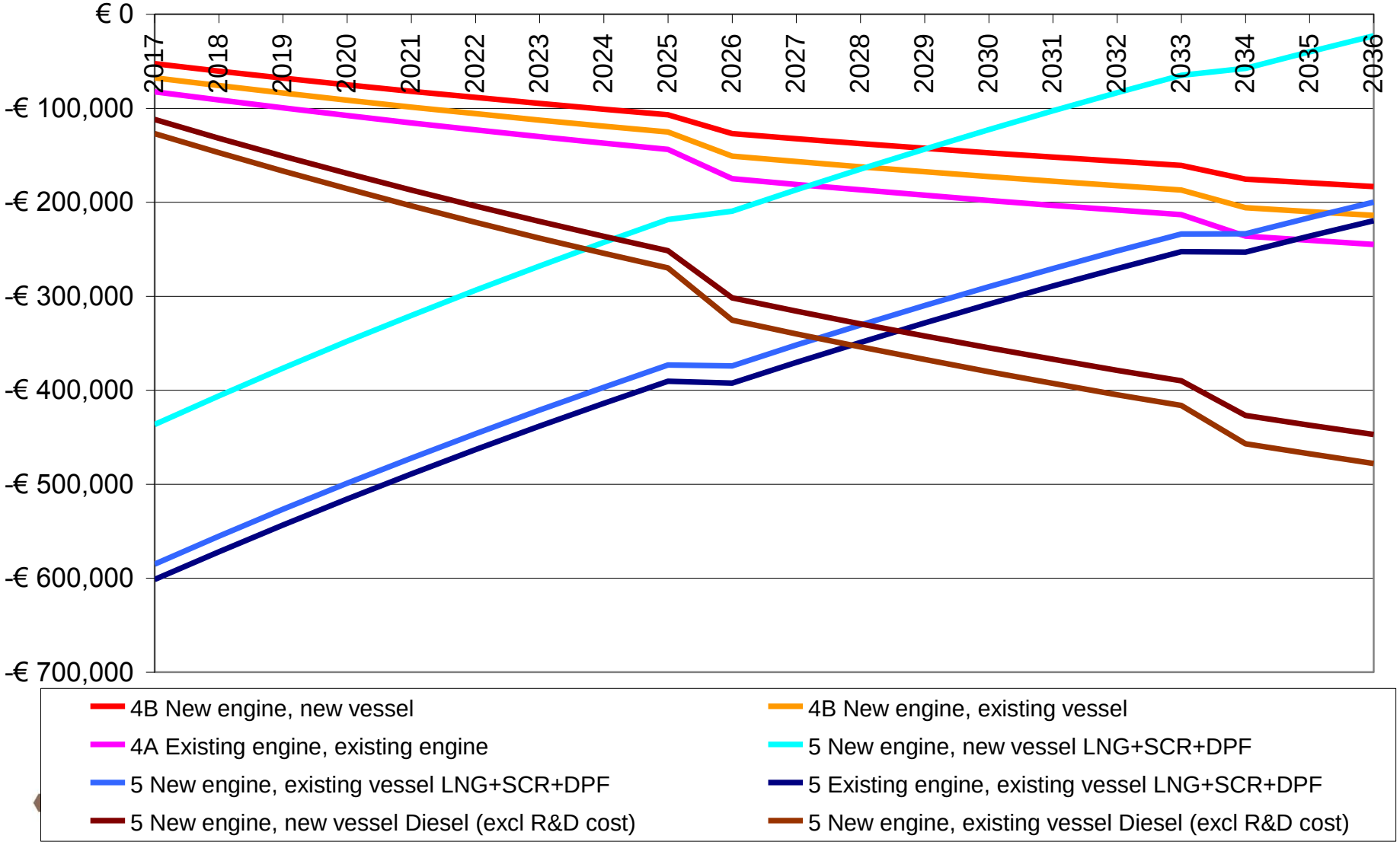
		Option 1 ***Maximised time to develop Stage 5 engine combined with level playing field***	**Option 2** ***Optimised cost effectiveness***	**Option 3** ***Mix between cost effectiveness and level playing field***
New Engines:				
75 ≤ P ≤ 220 kW	L ≤ 38	4B by 2017	3B by 2017	3B by 2017
220 < P ≤ 304 kW	38 < L ≤ 55	4B by 2017	3B by 2017	4B by 2017
304 < P < 981 kW	55 < L < 110	4B by 2017	4B by 2017	4B by 2017
P ≥ 981 kW	L ≥ 110	4B by 2017, **5 by 2022**	4B by 2017, **5 by 2020**	4B by 2017, **5 by 2020**
Existing engines:				
75 ≤ P ≤ 220 kW	L ≤ 38	4A between 2017-2027	-	-
220 < P ≤ 304 kW	38 < L ≤ 55	4A between 2017-2027	-	4A between 2017-2027
P > 304 kW	L > 55	4A between 2017-2027	4A between 2017-2027	4A between 2017-2027

Effectiveness: external costs of air pollutants, in euro per 1000 tonkm, Marco Polo external cost calculator values

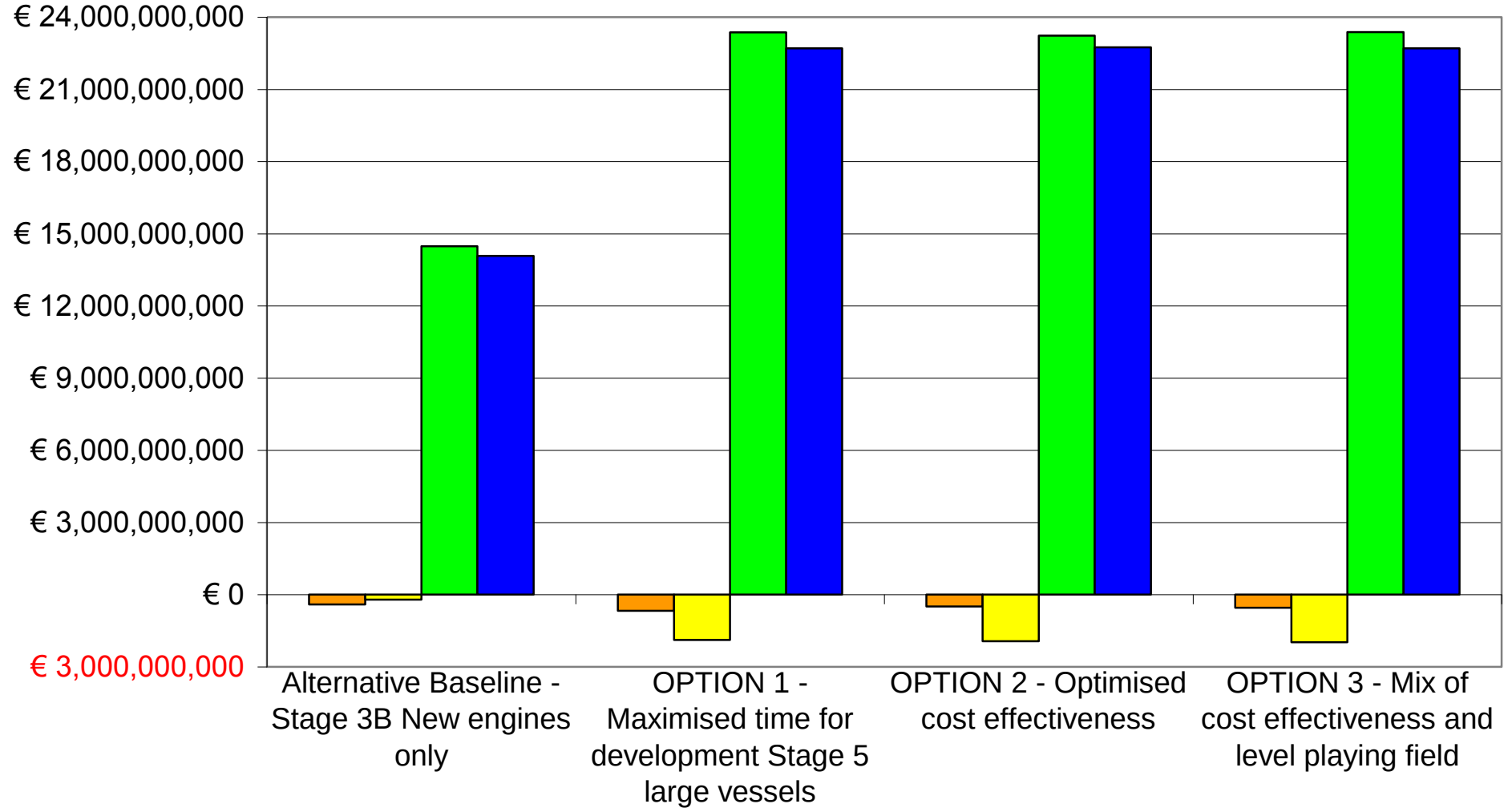


LNG application for larger freight vessels

Cumulative discounted cash flows for 110 metre vessel length (1178 kW), semi-continuous operation, for the relevant emission standards/technology



Overview of main CBA results freight vessels: net present value for period until year 2050



CBA results: new and existing engines

Option 2: Optimised cost effectiveness, breakdown new engines and existing engines			
	Part A New engines (NRMM)	Part B Existing engines	Part A+B Total impact
Reduction of external costs	€ 19,943 m	€ 3,290 m	€ 23,233 m
Relative saving compared to BAU	38.7%	6.4%	45.1%
Impact for IWT industry	-€ 278 m	-€ 214 m	-€ 492 m
Net impact for society	€ 19,665 m	€ 3,076 m	€ 22,741 m
Investment costs for IWT Industry	€ 1,681 m	€ 254 m	€ 1,935 m
Benefit/ cost ratio	70.6	14.4	46.2
Benefit / investment ratio	11.7	12.1	11.8

MULTI CRITERIA SCORES	Option 1	Option 2	Option 3
Technical feasibility			
new engines stage 5 introduction	-	--	--
retrofit existing engines	---	-	--
Effective?	yes	yes	yes
Additional environmental effects			
PM/NOx reduction	+++	++	++
CO2 reduction	+	+	+
PN/HC/CO reduction	+++	+	++
CH4 reduction	0/-	0/-	0/-
Efficiency			
Benefit/investment ratio	12.4	12.0	11.9
Benefit/cost ratio	33.9	46.2	41.6
Financing feasibility	---	-	--
Labour market effects	+++	++	++
Side effects			
Level playing field vessel classes	+	+++	++
Level playing field existing/new engines	+++	+	++
Level playing field IWT vs road	+++	+	++
Stimulation of new investments	+++	+	++
Modal shift towards IWT	0/-	0	0
Legal issues			
LNG development before 2017	-	-	-
Retrofit existing engines before 2017	---	-	--
Certification and enforcement efforts	--	0/-	-
Reduction of administrative burden	--	0/-	-

Next steps

- **Development of financing instruments to overcome investment barriers**

- **Need to strengthen R&D:**
  - LNG technology and the actual emission performance (NOx, PM, CH4)
  - Low cost retrofit modules for SCR + DPF
  - Stage 5 diesel based engine and further research on other techniques (FEW, hydrogen, …)

Next steps

- **Legal framework**
  - New engines: revision of Directive 97/68/EC on emissions from non-road mobile machinery engines
  - Existing engines: include procedure and requirements in Directive 2006/87/EC on technical requirements for inland waterway vessels regarding after treatment systems
  - LNG
    - Safe use of LNG in vessels (2006/87/EC, 2008/68/EC)
    - Safe bunkering and deployment of bunkering stations
  - Procedure on exemptions for existing vessels / engines
  - Training and education

Thank you for your attention

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