

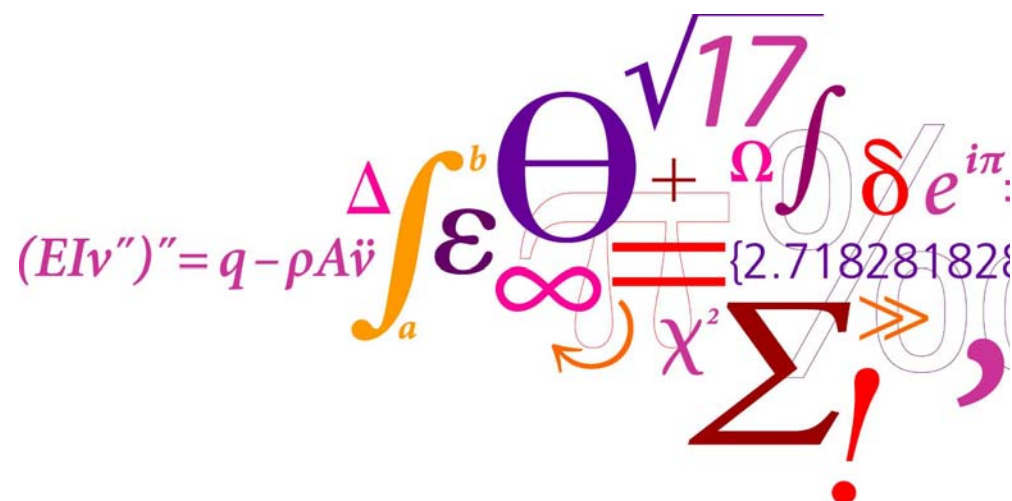
Nærskibsfart med bundlinieeffekt:

Klima og miljø

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Sidste nyt vedr. TEMA 2010 ang. lastbiler

Effekt og fartafhængighed for skibe

Baggrund for DTU nye skibs beregningsmodel

Eksterne omkostninger

Kommende krav og udfordringer fra IMO

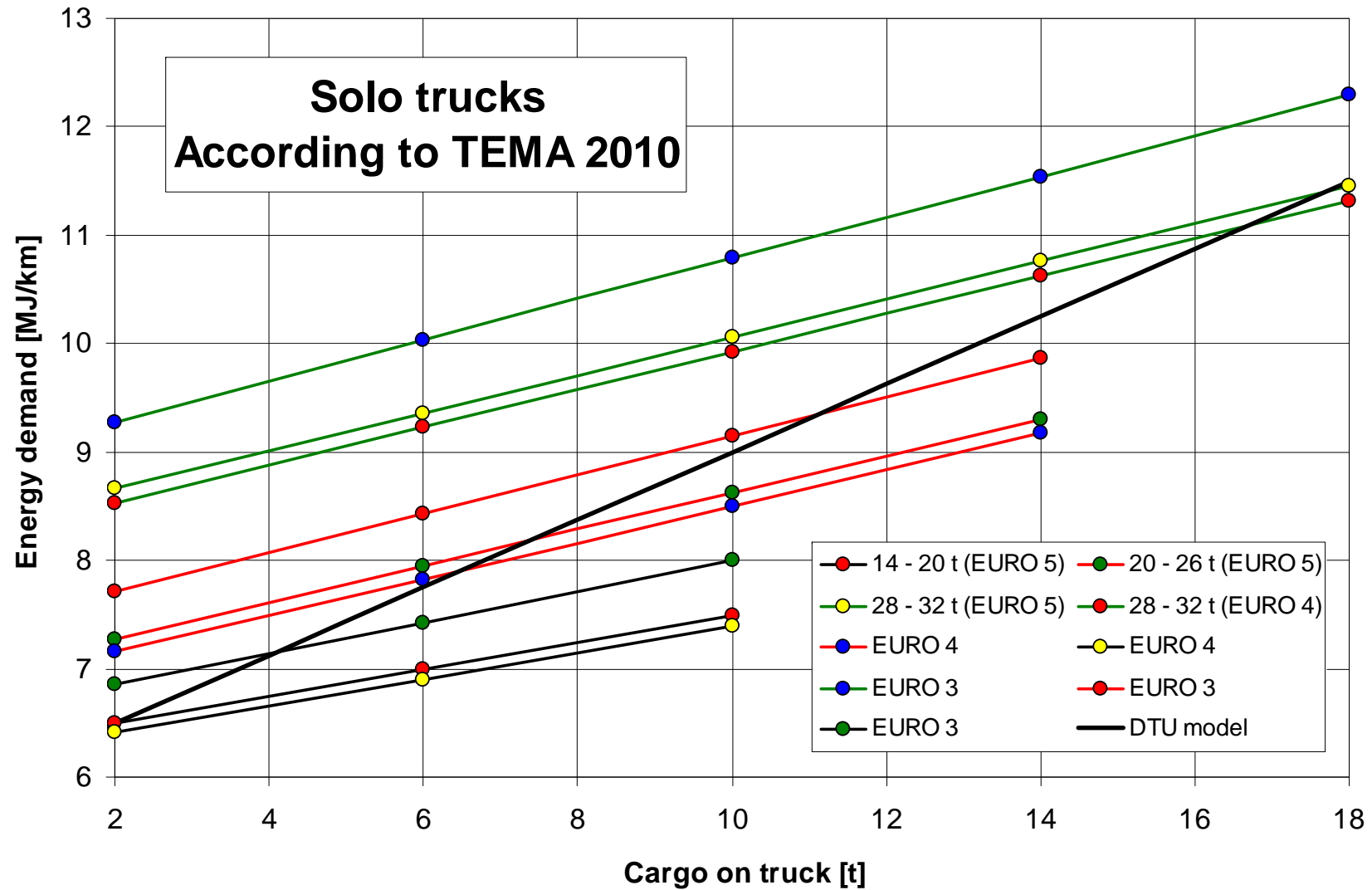
Mindre lastskibe versus landtransport med lastbiler

Ro-Ro lastskibe versus landtransport med lastbiler

Konklusion og et kig ind i fremtiden

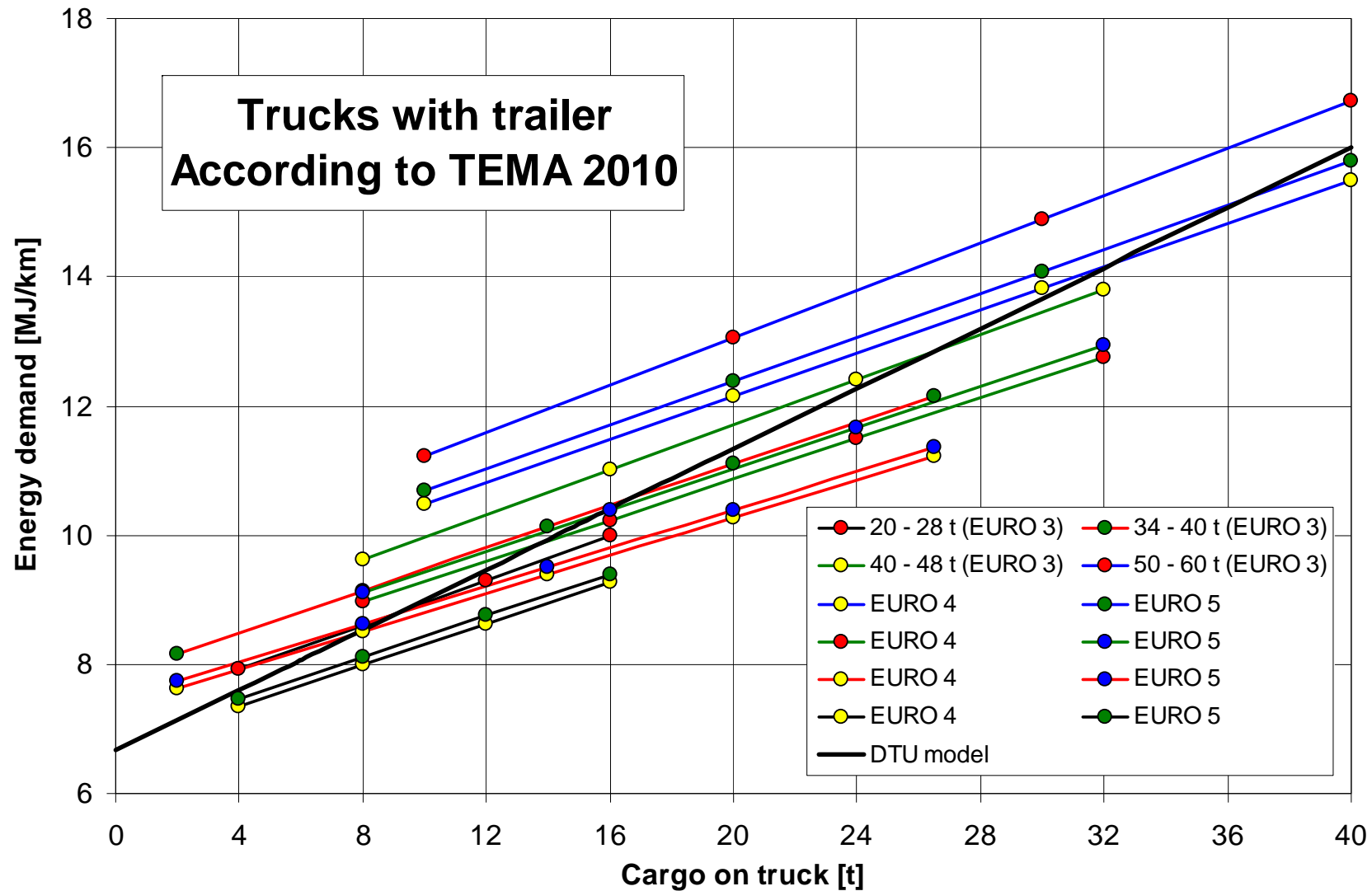
Lastbildata beregnet med TEMA 2010 modellen

Energiforbrug per kørt km (1 kg olie ~ 43 MJ)



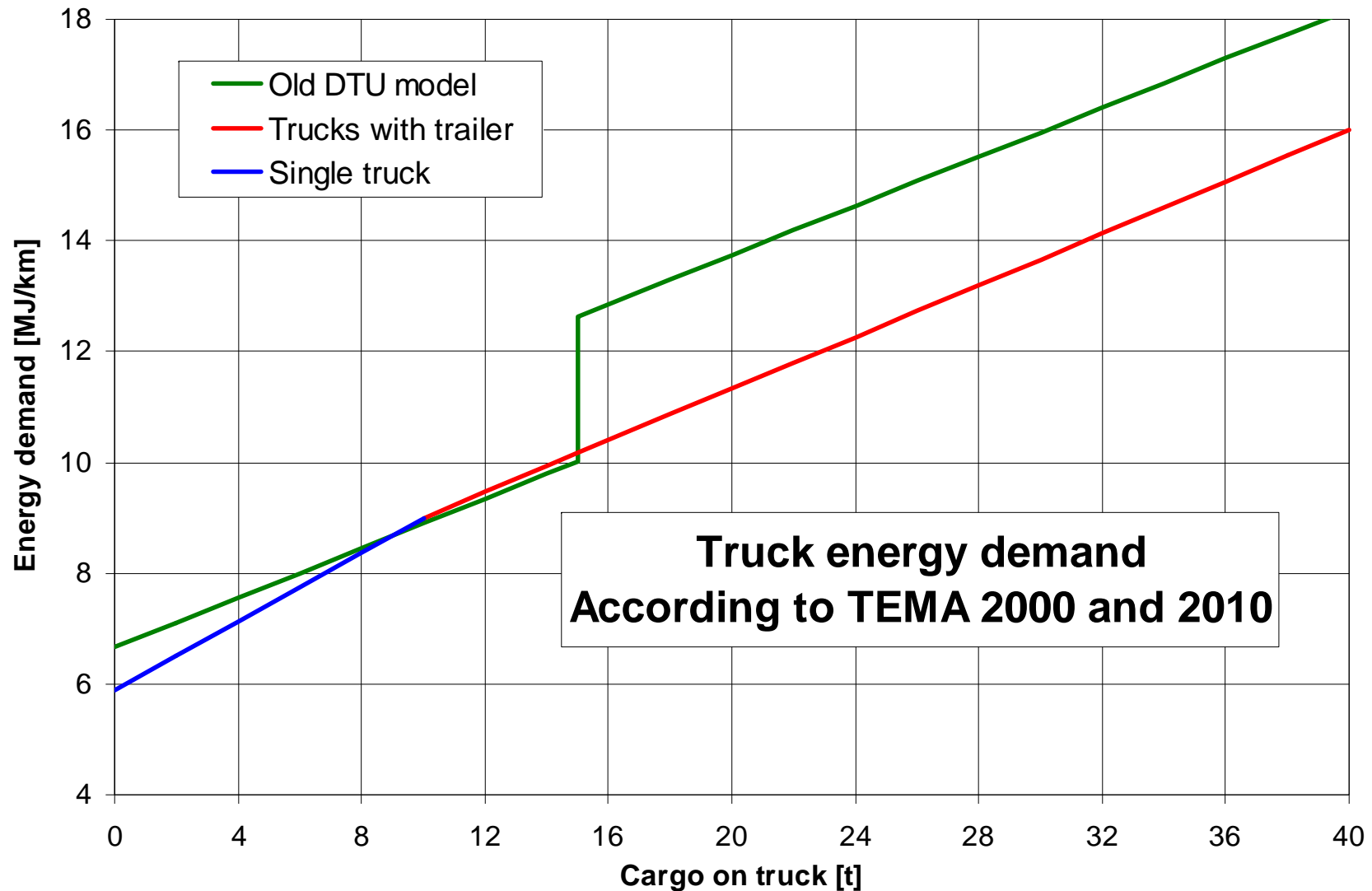
Lastbildata beregnet med TEMA 2010 modellen

Energiforbrug per kørt km (1 kg olie ~ 43 MJ)

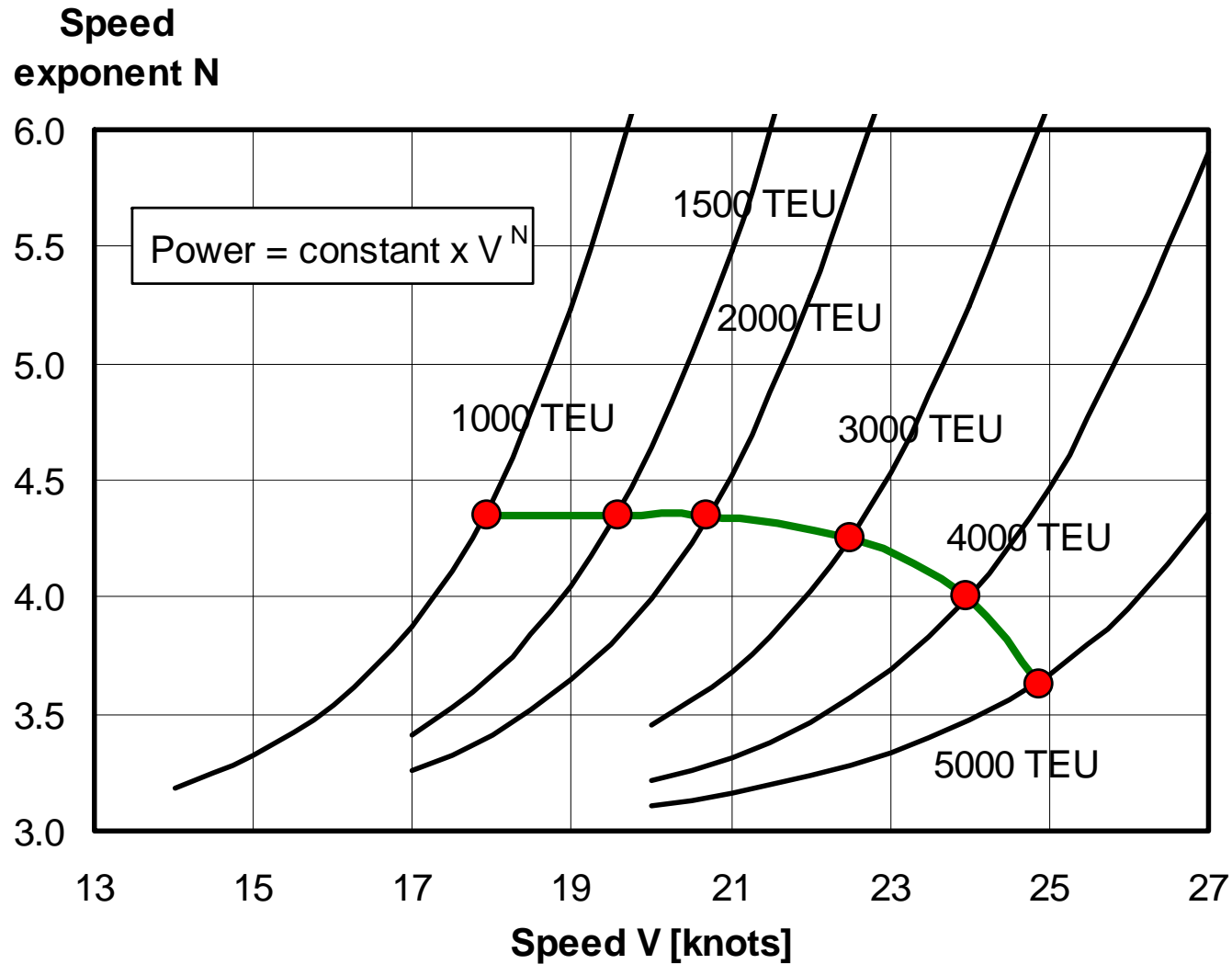


Lastbildata beregnet TEMA 2010 modellen

Energiforbrug per kørt km (1 kg olie ~ 43 MJ)

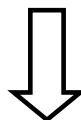


Fremdrivningseffektens fartafhængighed: Effekt = konstant x fart^N Fejlopfattelse: N = 3 !



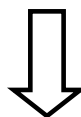
On basis of statistical data calculate the ship's dimensions as functions of ship length, L

Beam = $B = f_1(L)$
 Draft = $T = f_2(L)$
 Depth = $D = f_3(L)$
 Light ship weight = $M = f_4(L)$
 Service speed = $V = f_5(L)$
 Auxiliary machinery power = $P_a = f_6(L)$



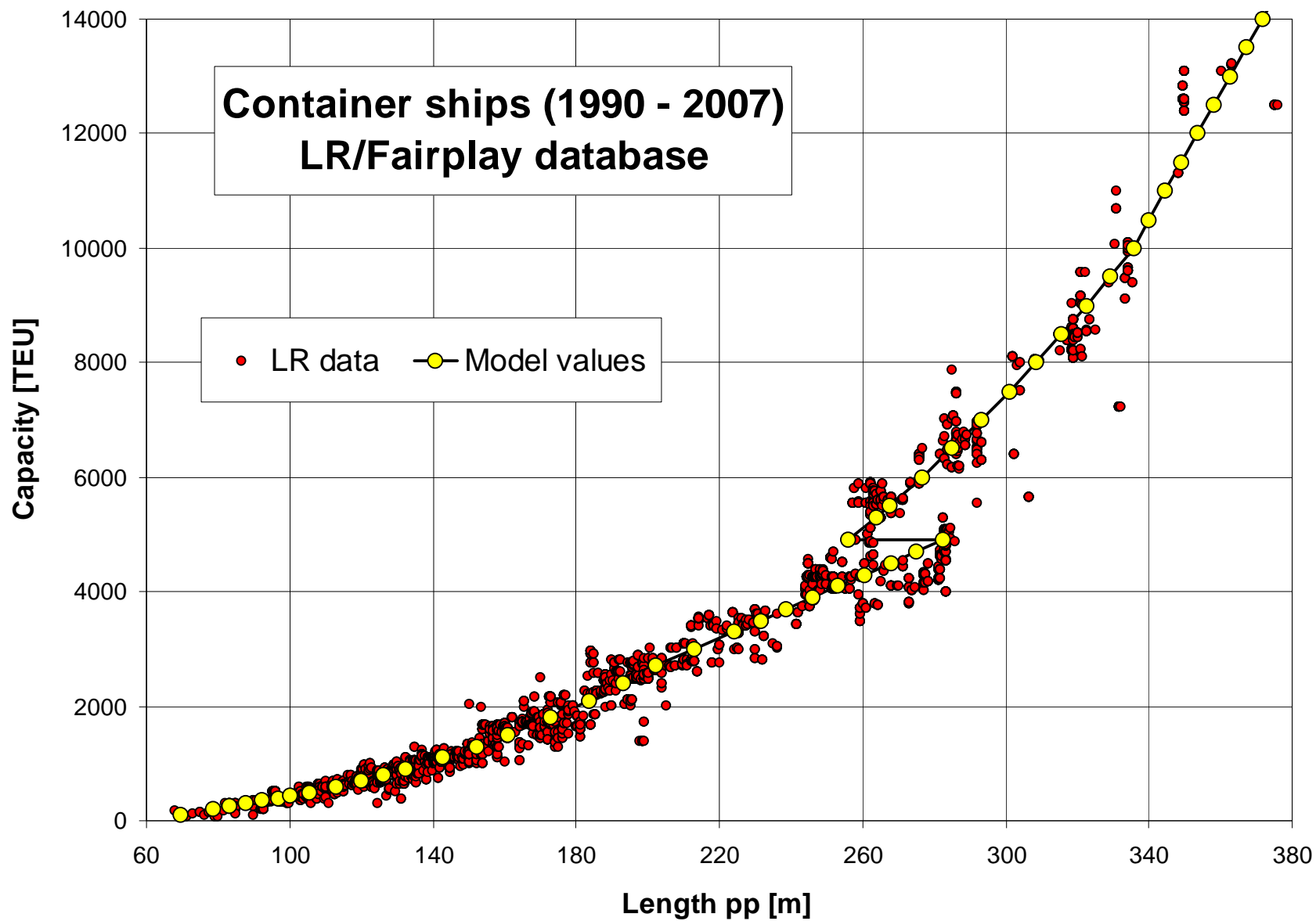
Propulsion power, P_f , is calculated on the basis of main dimensions, cargo capacity, C, and utilization fraction, U (actual cargo/maximum cargo capacity)

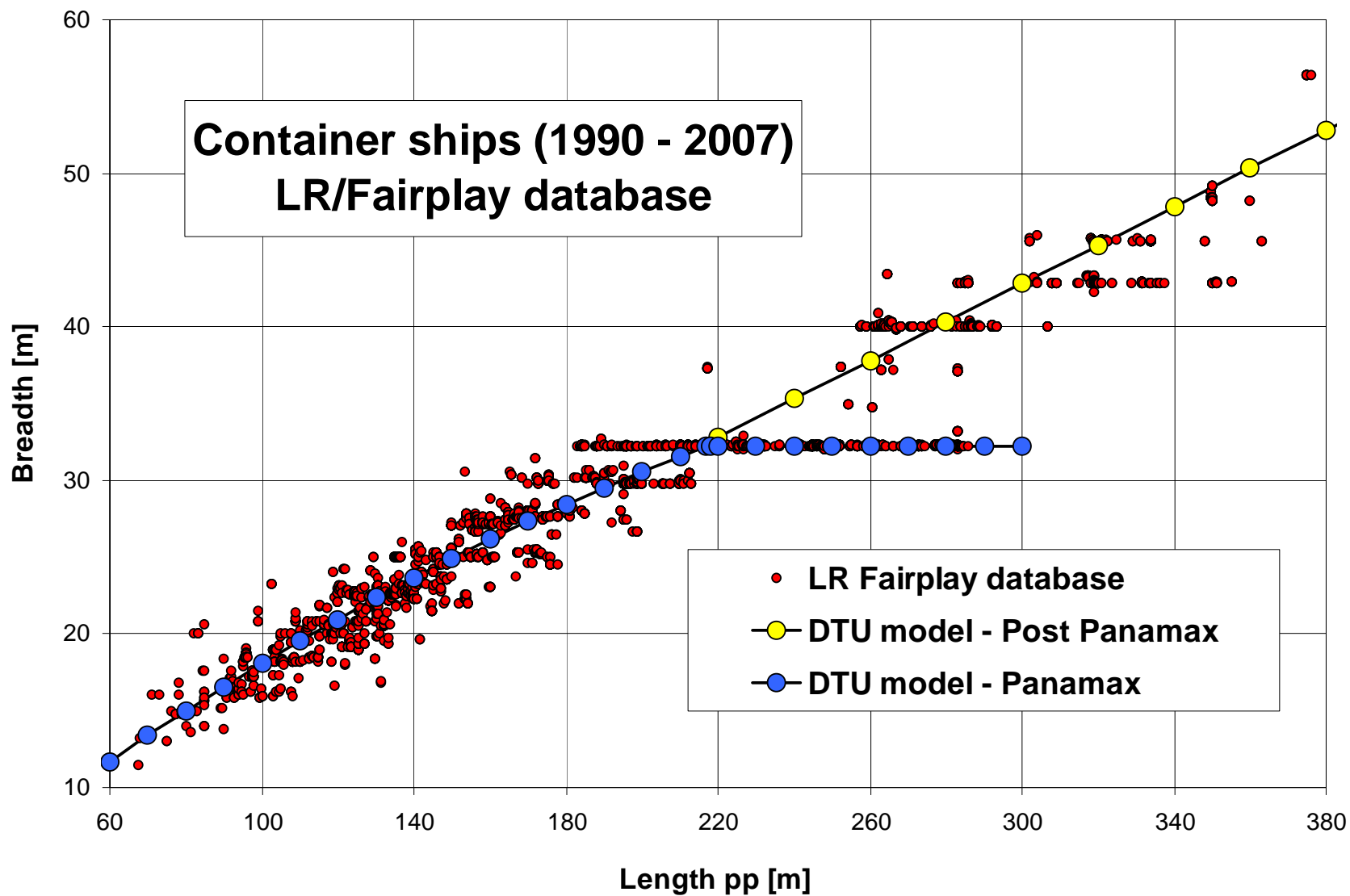
$P_f = f_7(L, B, T, D, M, V, C, U)$



Energy consumption and emissions are calculated on the basis of the propulsion and auxiliary power P_f and P_a

Finally, main dimensions can be modified and their influence on propulsion power and energy consumption can be determined





Miljøfaktorer – hvilke er vigtigst ?

Emissioner og energiforbrug:

- CO₂
- NO_x
- SO_x
- Particulates

Andre miljøfaktorer/negative konsekvenser af transport

- Støj
- Kødannelse
- Ulykker
- Udgifter til infrastruktur

Miljøfaktorer – hvilke er vigtigst ?

Hvorledes evalueres et transportmiddels miljøpåvirkning ?

Emissioner

- Opvarmning af jordkloden
- Forsuring af naturen og ødelæggelse af bygninger
- Sygdom/dødsfald

Andre miljøfaktorer/negative konsekvenser af transport

- Støj: Irritation
- Kødannelse: Tabt arbejdstid
- Ulykker: Tabt arbejdstid – mistet forsøgelse
- Udgifter til infrastruktur: Højere skatter

Eksterne omkostninger – DTU Trafik data 2009



CITY

	DKK/kg		
	Low	Mean	High
CO ₂	0.15	0.22	0.44
Particulates	567	1,827	9,941
NOx	9	18	71
SOx	41	72	220
CO	0	0.017	0.034
HC	4	5	8

EURO/kg

	Low	Mean	High
CO ₂	0.0196	0.029	0.059
Particulates	76	244	1325
NOx	1.22	2.45	9.44
SOx	5.422	9.620	29.384
CO	0	0.00227	0.00455
HC	0.525	0.700	1.049

NON CITY

	DKK/kg		
	Low	Mean	High
CO ₂	0.15	0.22	0.44
Particulates	140	388	1,898
NOx	10	20	80
SOx	16	39	177
CO	0	0.003	0.005
HC	4	5	8

EURO/kg

	Low	Mean	High
CO ₂	0.0196	0.029	0.059
Particulates	19	52	253
NOx	1.40	2.62	10.67
SOx	2.10	5.25	23.61
CO	0	0.00035	0.00070
HC	0.525	0.700	1.049

16 t truck

	DKK/km		
	Low	Mean	High
Noise	0.16	0.30	0.62
Accidents	0.19	0.90	1.17
Congestion	0.15	0.59	1.61
Infrastructure	0.23	0.95	1.41

EURO/km

	Low	Mean	High
Noise	0.0210	0.0403	0.0824
Accidents	0.0252	0.119	0.156
Congestion	0.0195	0.078	0.215
Infrastructure	0.0308	0.126	0.188

Beregnings scenarier

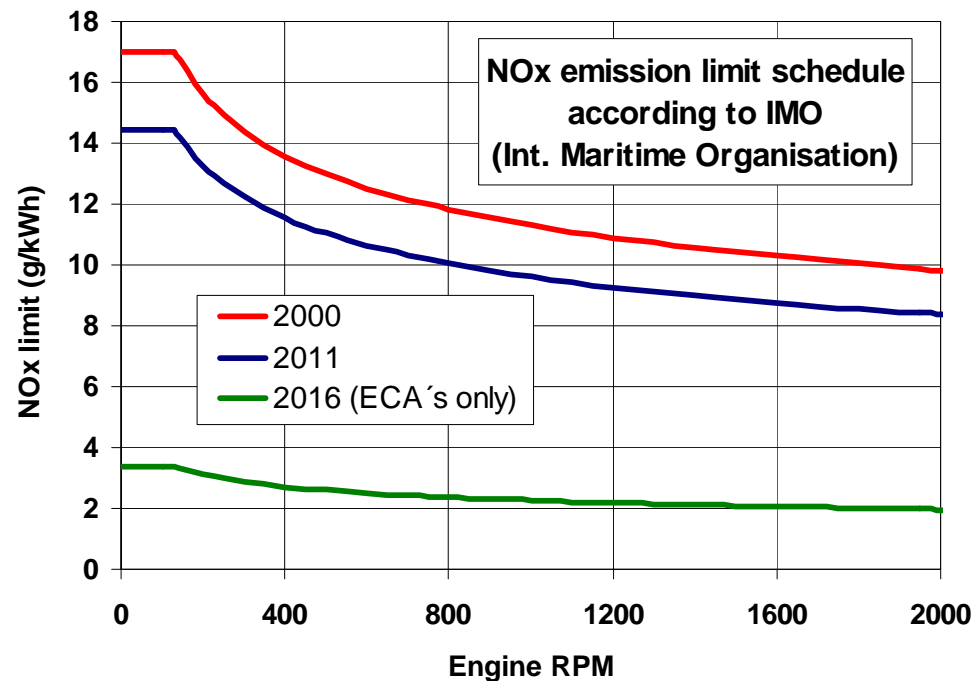
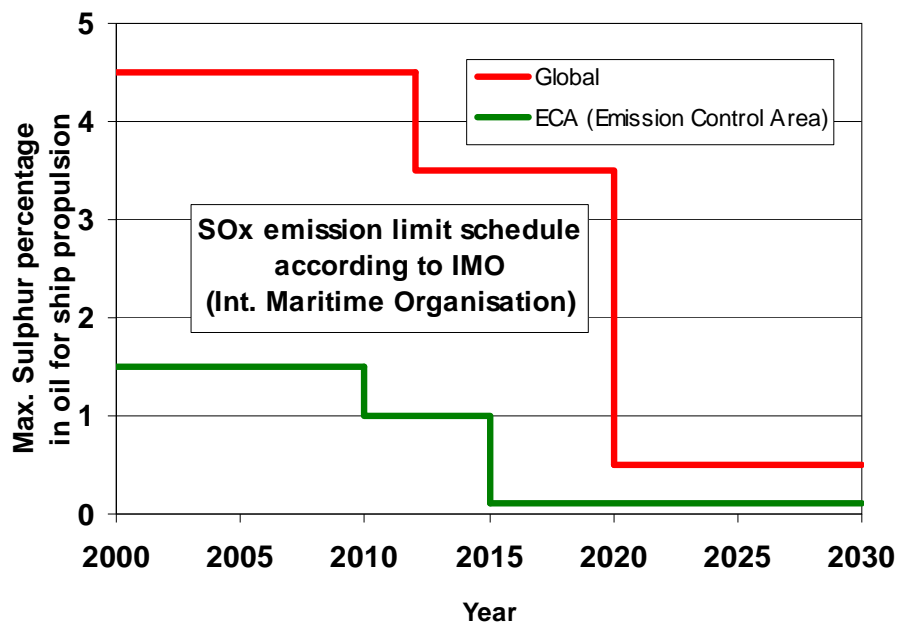
Skib (1000 – 6000 dødvægt svarende til 900 – 5400 t last)

- 3 % svovl indhold i brændolien, motorer opfylder IMO Tier I NOx krav og normal servicefart (baseret på statistiske oplysninger)
- 1 % svovl indhold i brændolien, motorer opfylder IMO Tier I NOx krav og normal servicefart (baseret på statistiske oplysninger)
- 0,1 % svovl indhold i brændolien, motorer opfylder IMO Tier I NOx krav og normal servicefart (baseret på statistiske oplysninger)
- 0,1 % svovl indhold i brændolien, motorer opfylder IMO Tier I NOx krav og 10 % fartreduktion i forhold til normal servicefart (baseret på statistiske oplysninger)

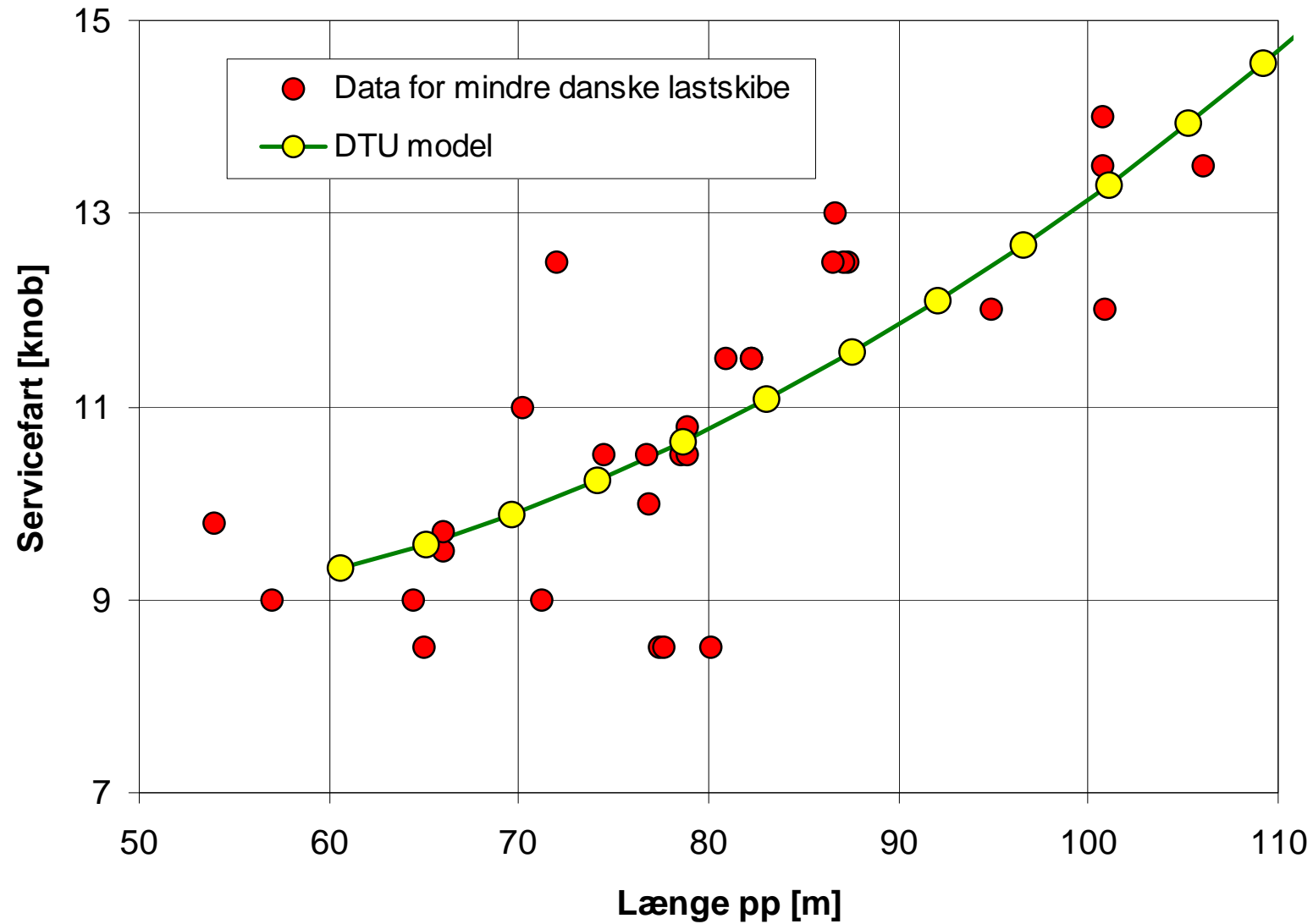
Lastbil

- EURO norm 4 (2006)
- 0,001 % svovlindhold
- 25 t last

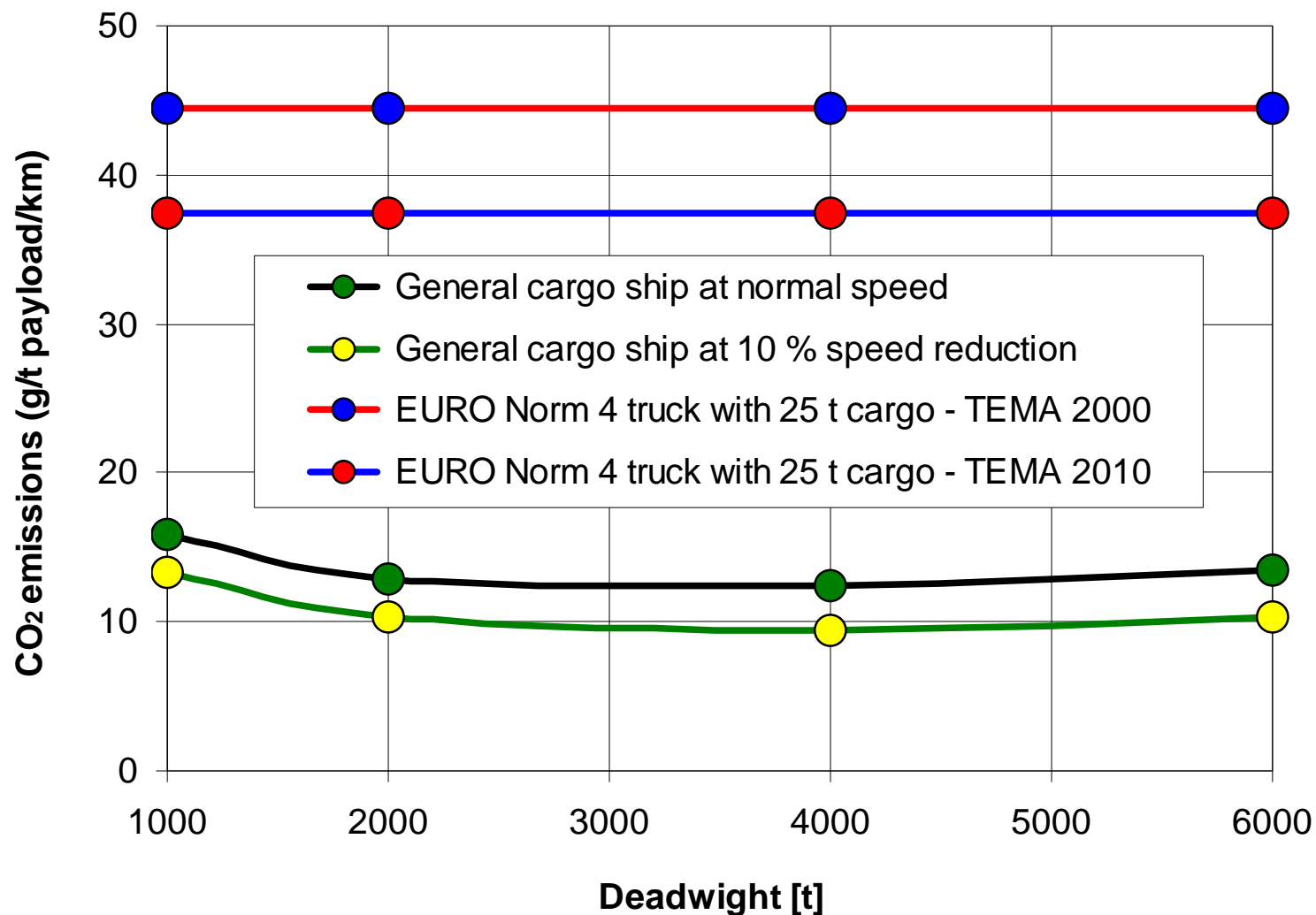
Kommende IMO krav vedr. SOx og NOx emissioner



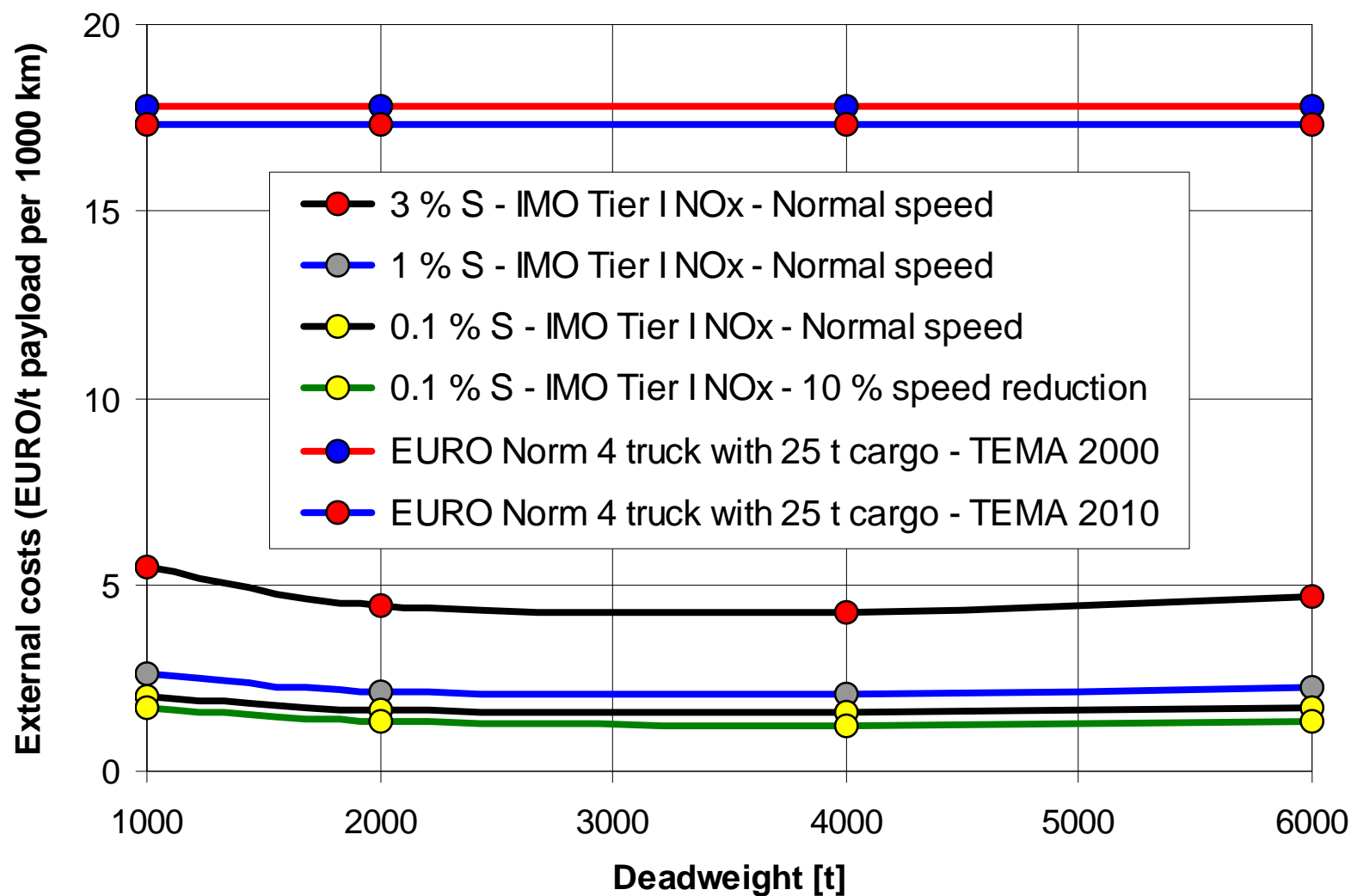
Service fart modellering



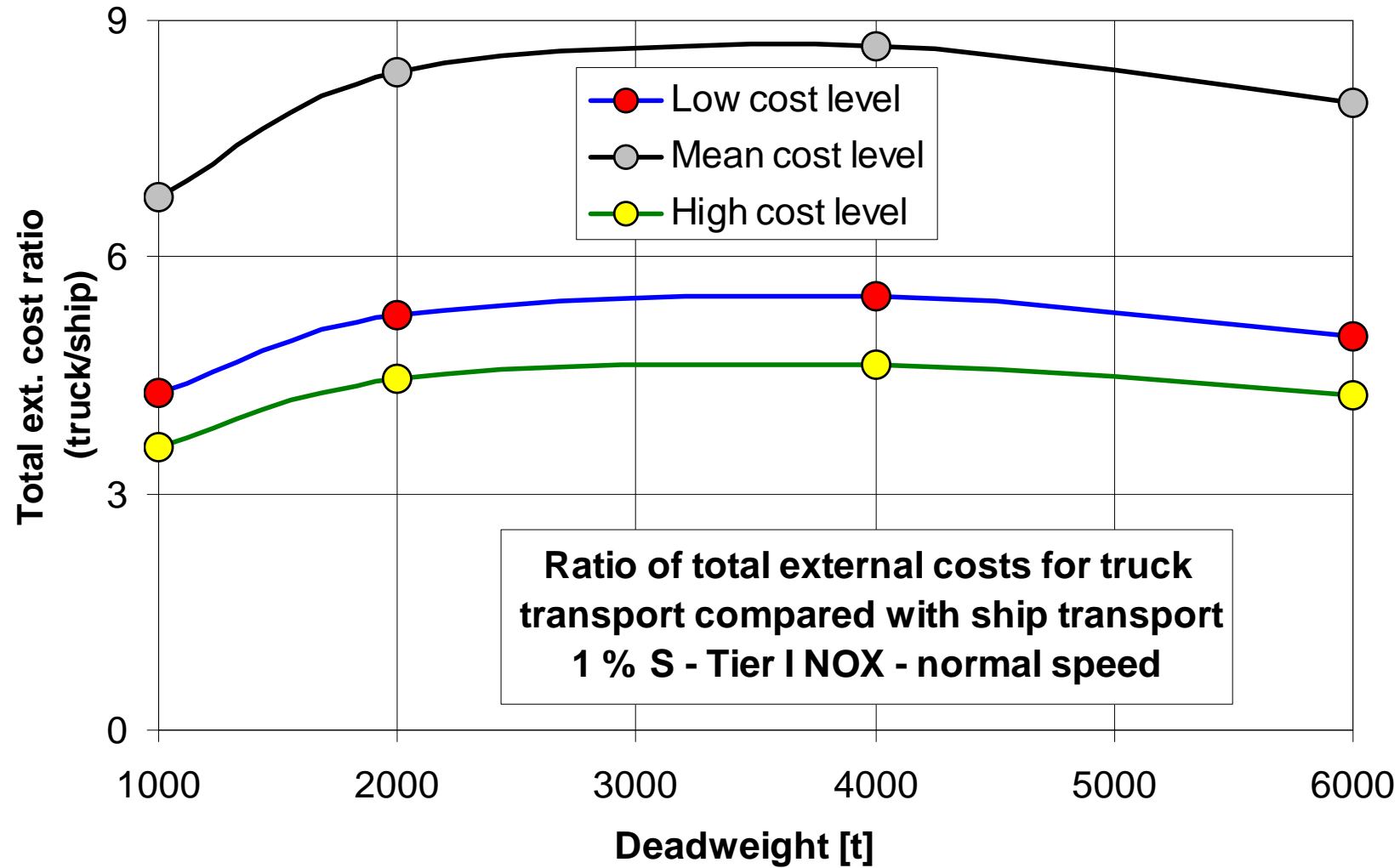
CO₂ emissioner per transportenhed



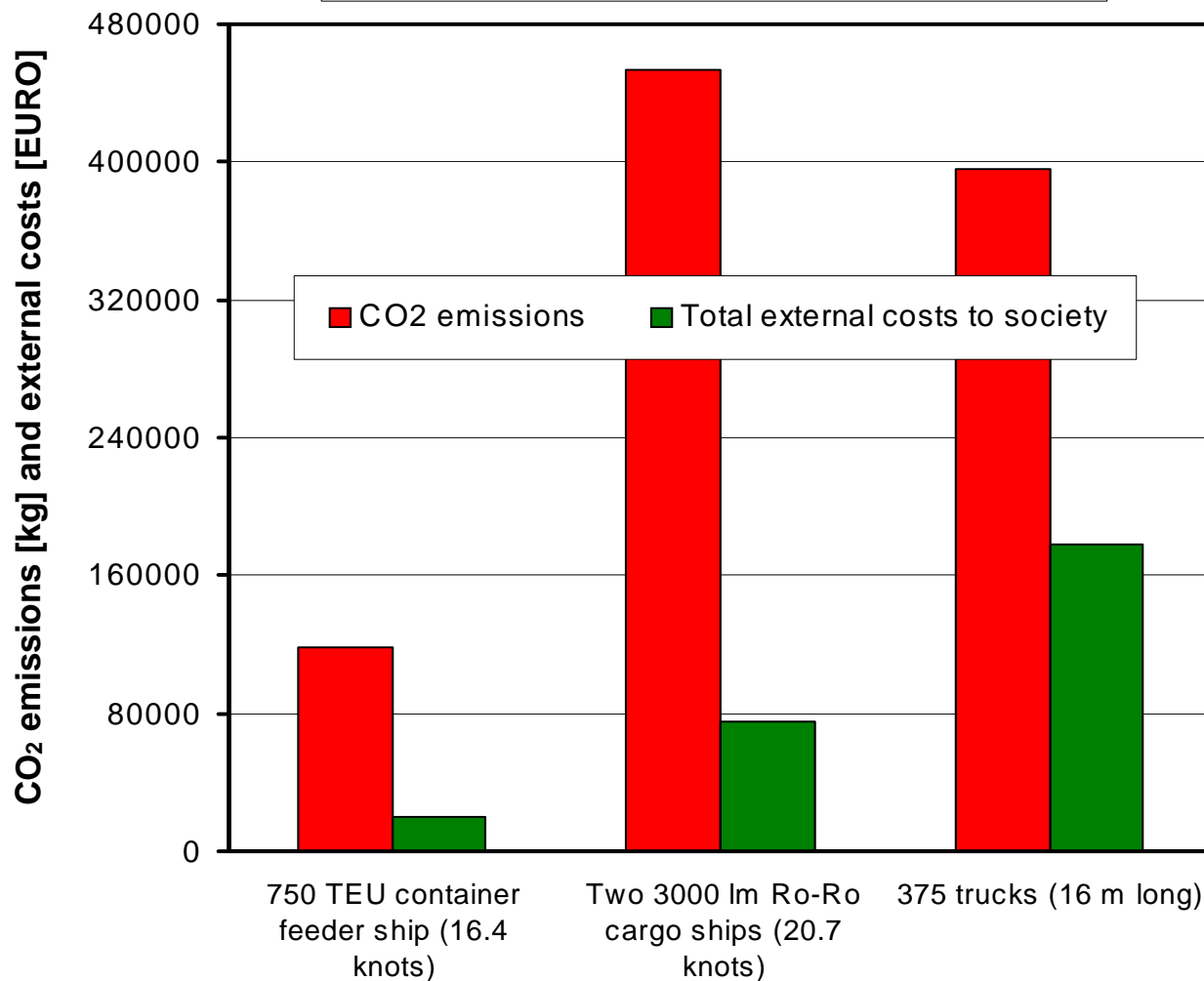
Totale eksterne omkostninger per transportenhed

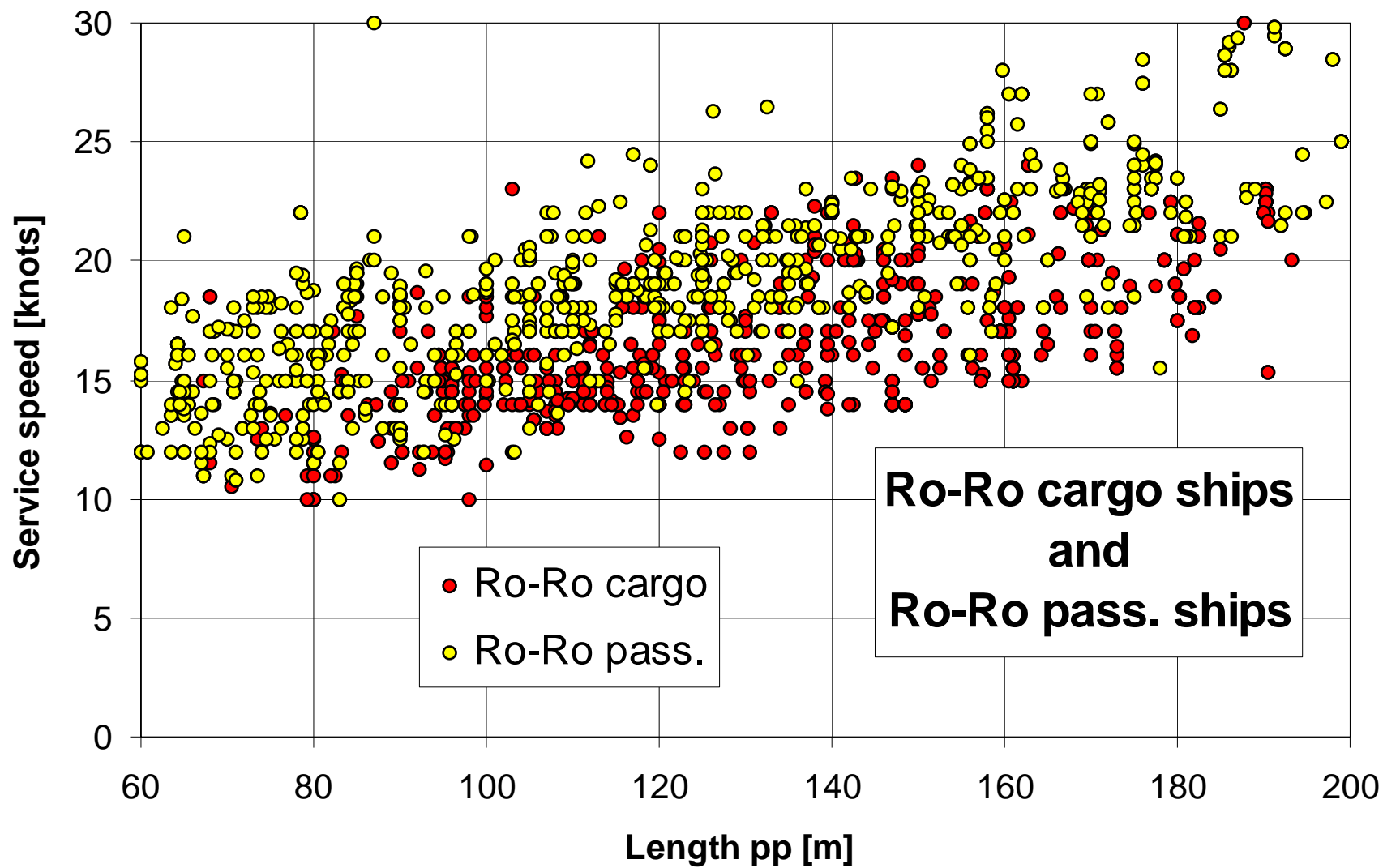


Totale eksterne omkostninger Skib i forhold til lastbil

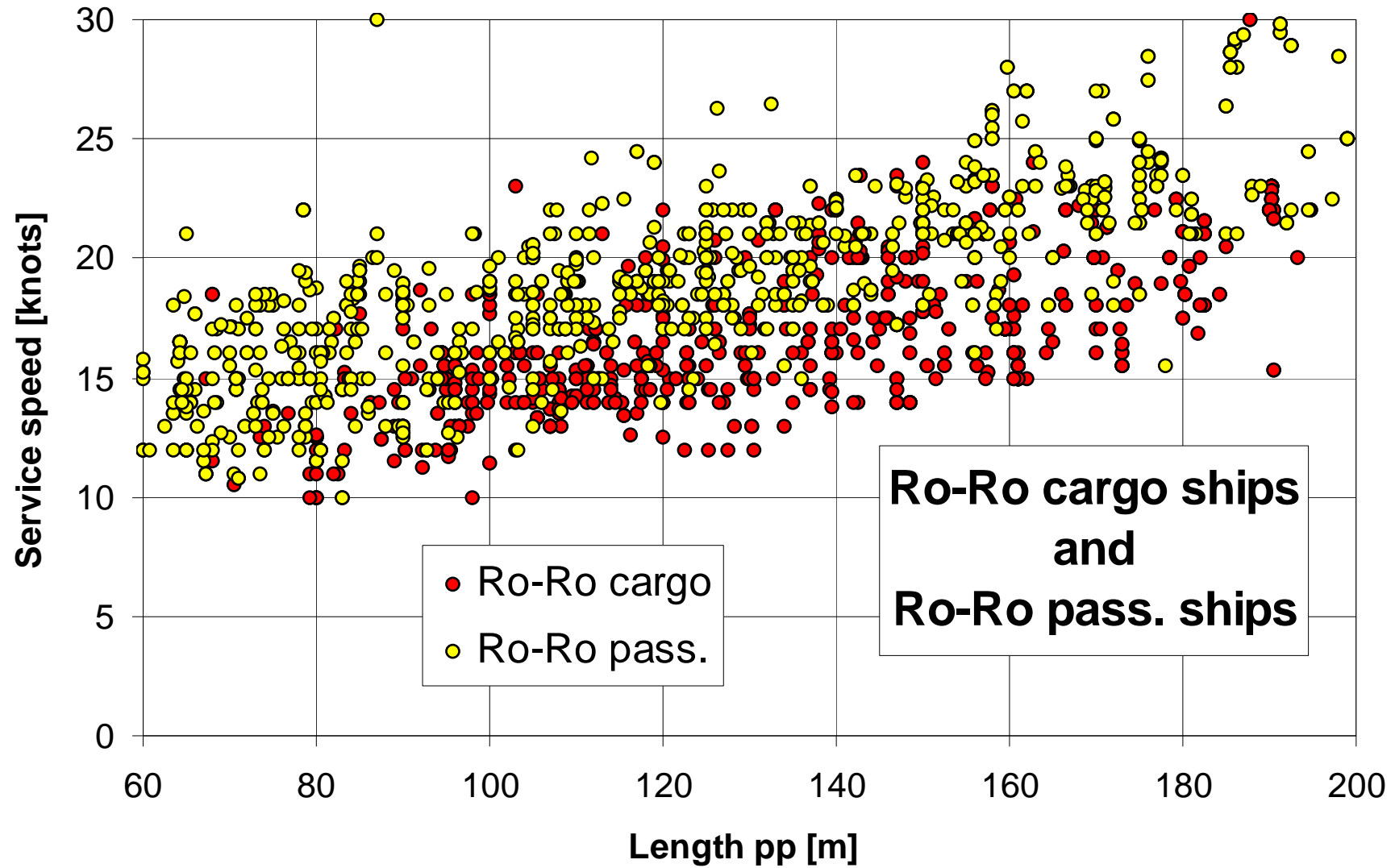


**Total CO₂ emissions and external costs to society for transport of 750 TEU from Gothenburg to Rotterdam
Total truck (16 m) on Ro-Ro ship
TEMA 2000**

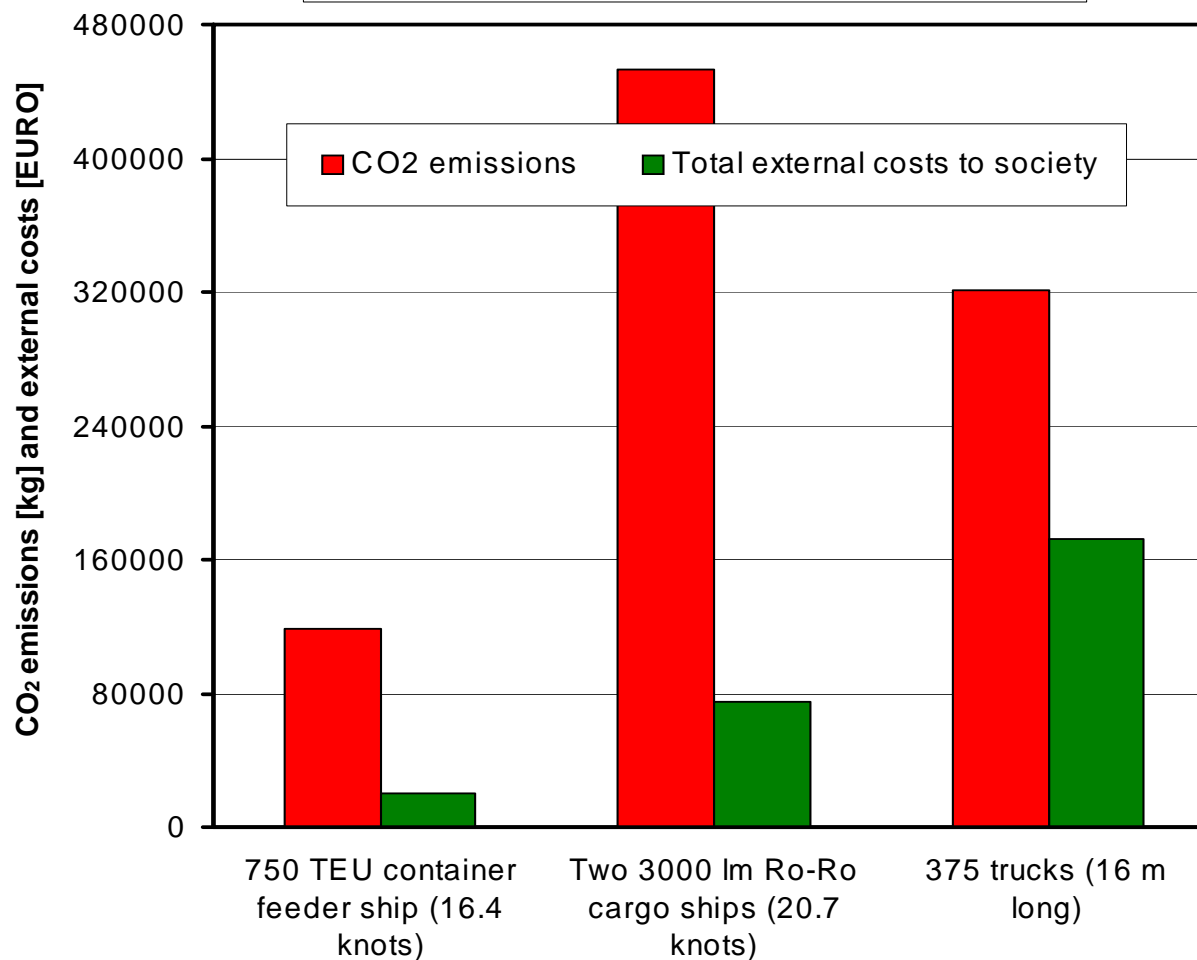




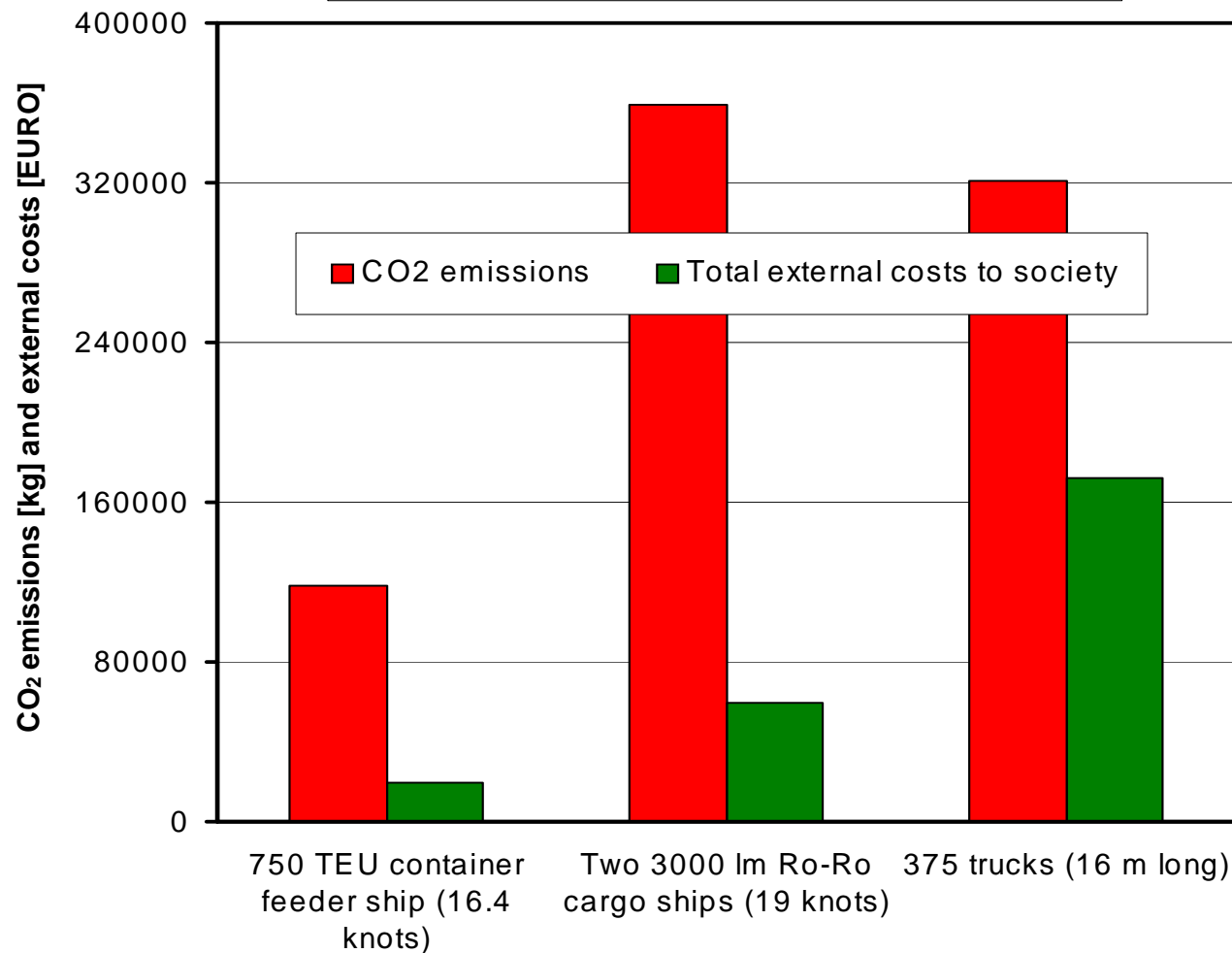
Service fart for Ro-Ro skibe



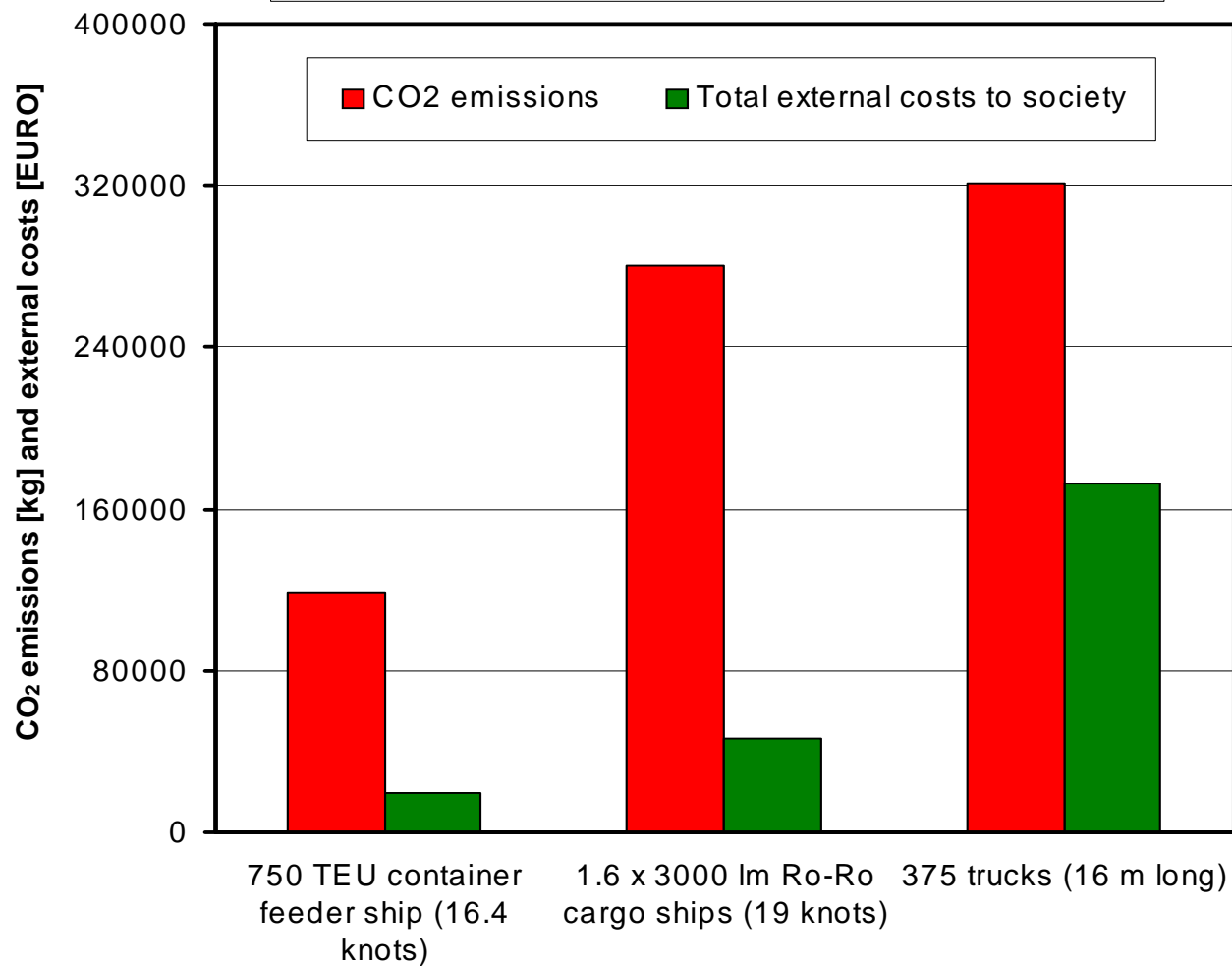
**Total CO₂ emissions and external costs to society for transport of 750 TEU from Gothenburg to Rotterdam
Total truck (16 m) on Ro-Ro ship
TEMA 2010**



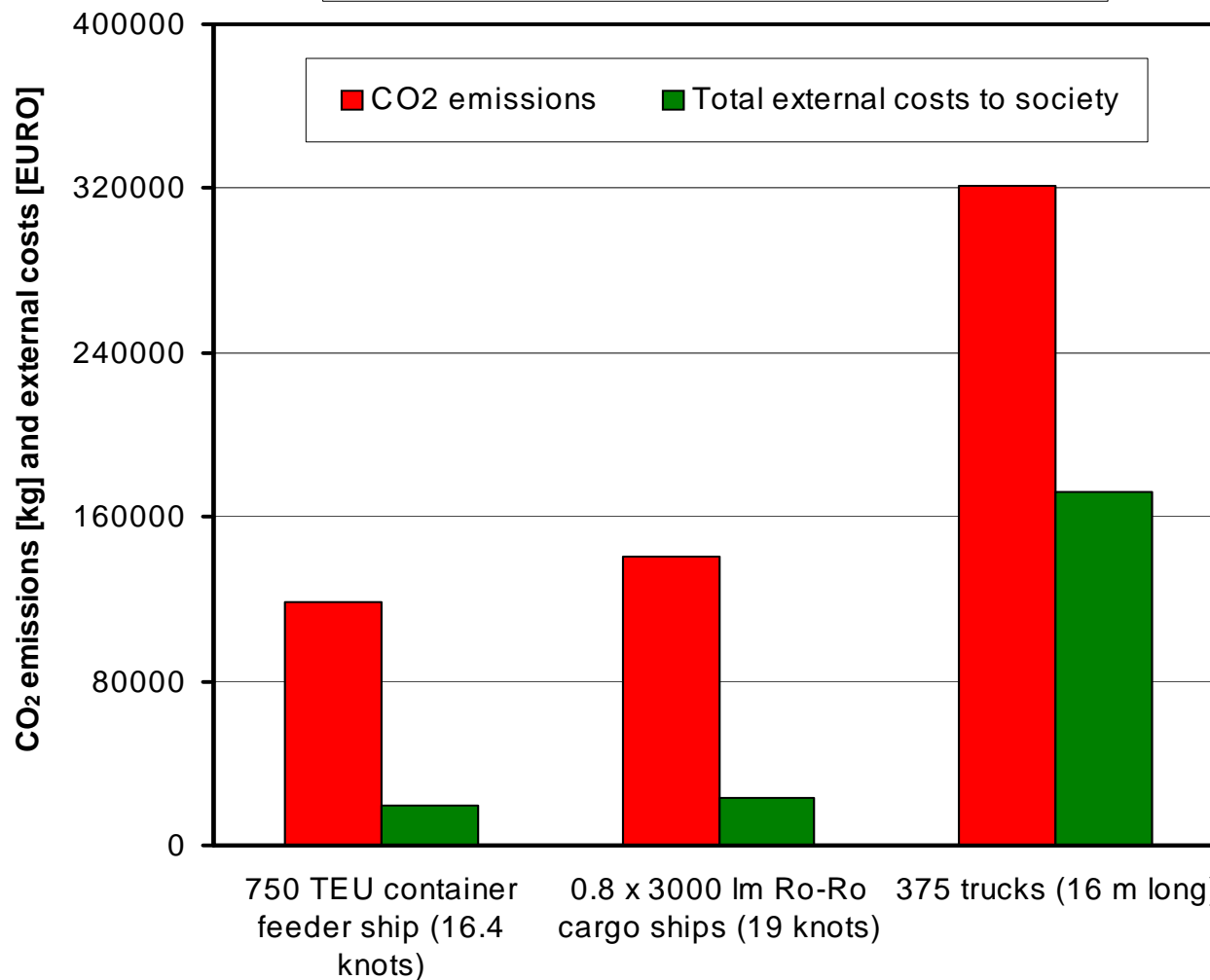
**Total CO₂ emissions and external costs to society for transport of 750 TEU from Gothenburg to Rotterdam
Total truck (16 m) on Ro-Ro ship
TEMA 2010**



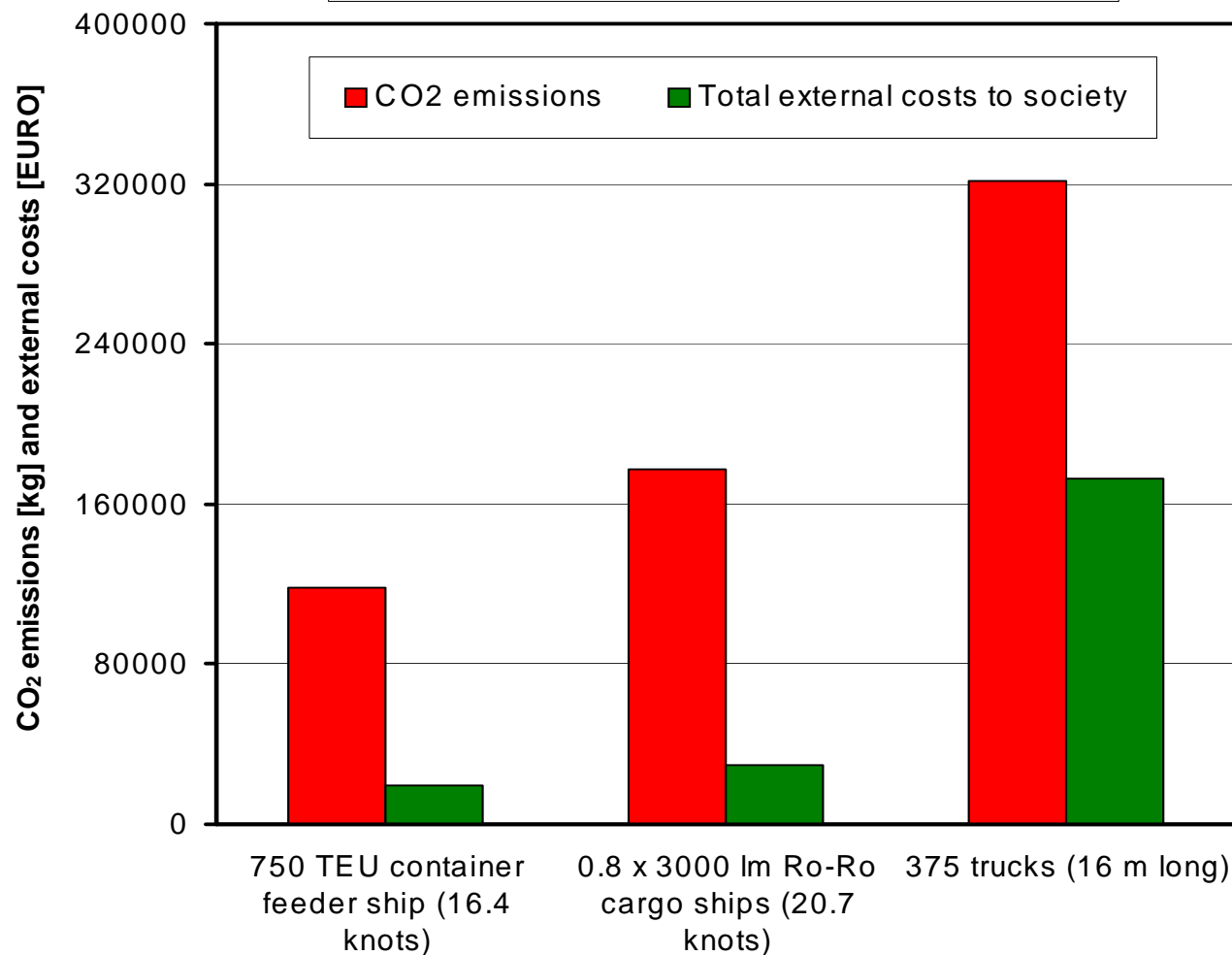
Total CO₂ emissions and external costs to society for transport of 750 TEU from Gothenburg to Rotterdam Containers on mafi trailers on the Ro-Ro ship TEMA 2010



**Total CO₂ emissions and external costs to society for transport of 750 TEU from Gothenburg to Rotterdam
Double stacking of containers on mafi trailers on the Ro-Ro ship**



**Total CO₂ emissions and external costs to society for transport of 750 TEU from Gothenburg to Rotterdam
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