

Economic impact of the European Towage sector

Client: European Tugowners Association

Rotterdam, 29 October 2019



Economic impact of the European Towage sector

Client: European Tugowners Association

Marten van den Bossche
Rick Janse
Onno de Jong
Umair Mehmood

Rotterdam, 29 October 2019

Table of contents

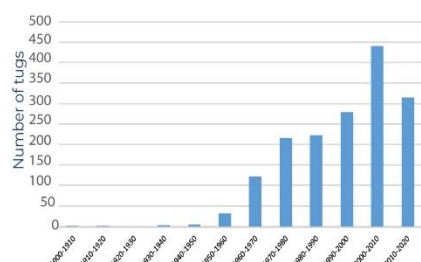
1	Introduction	4
1.1	Request from the European Tugowners Association	4
1.2	Outline of the study	4
2	Methodology	5
2.1	Introduction	5
2.2	Data sources	5
2.3	Economic indicator approach	6
2.4	Limitations and further research	8
3	European Tugboat Fleet	9
3.1	Geographical concentration of the European tugboat fleet	9
3.2	Age structure of the European tugboat fleet	11
4	The total amount of jobs supported in Europe	12
4.1	Introduction	12
4.2	Employment indicators	12
5	Economic indicators of the European towage sector	14
5.1	Introduction	14
5.2	Total European turnover in the towage sector	14
5.3	Profit margin	15
5.4	Gross Value Added	15
6	Investments in the towage industry	18
6.1	Introduction	18
6.2	Investments in the towage industry	19
6.3	Investment outlook	21
7	Cargo assisted by European tugs in European sea ports	22
7.1	Introduction	22
7.2	European major sea ports	22
7.3	Tug utilization in European sea ports	23
7.4	Cargo moved by tugs in European sea ports	25
8	Strategic outlook European towage sector	28
8.1	The future of the towage industry	28
	Annex I: Tug characteristics	30
	Annex II: New built tugs, period 2010 – 2018	31
	Annex III: Investments	32



Economic impact of the European Towage sector



TUGFLEET AGE STRUCTURE



Number of tugboats

1.595 tugs

Average age of wider European tugs

25 years



INVESTMENTS

Total investments

€ 311 Million



EMPLOYMENT



83% CREW



17% SHORE BASED STAFF



Employees per tug

7

Employees per tug (only crew)

5,7

Employees per company

86

Number of employees

11.150



VESSEL ASSISTANCE



Vessels with tug assistance

Vessels without tug assistance



ECONOMIC INDICATORS

Turnover per employee

€ 111.000

GVA (direct)

€ 708 Million

Total turnover

€ 1.2 Billion

GVA (indirect)

€ 743 Million

GVA per employee

€ 63.500

Total GVA

€ 1.45 Billion



CARGO MOVED



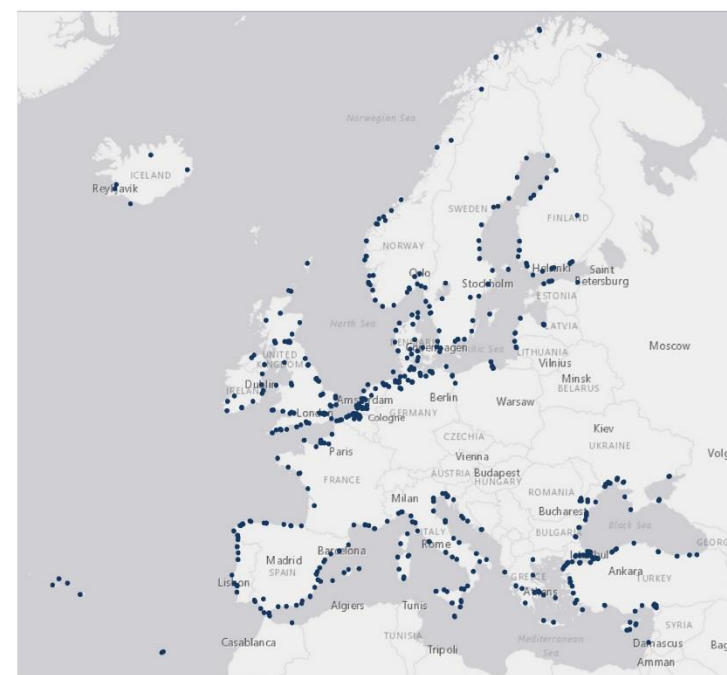
1.6 BILLION TONS MOVED WITHIN EUROPE



80%-90% CARGO ASSISTED BY TUGS



GEOGRAPHICAL DISTRIBUTION OF WIDER EUROPEAN TUGS



Source: MarineTraffic (2019)

1 Introduction

1.1 Request from the European Tugowners Association

The European Tugowners Association (ETA) is an organisation whose aim it is to unite and promote the interest of owners and operators of the towage industry. This report has been commissioned by the ETA to Ecorys. The ETA wants to have a clear view of the economic performance indicators for this important maritime and sea port activity. Towage in sea ports is indispensable for the safe navigation of sea vessels into/from the ports.

At this moment there are no statistical data readily available describing the economic performance and magnitude of the European tug sector. To determine key economic statistics on the towage sector as a whole, we have looked at the ETA membership (and beyond).

The geographical scope of this study focusses at European countries with sea ports, but also includes the following countries: Turkey, Ukraine, Iceland and Norway, since ETA has members in these countries as well. In the remainder of this study we will refer to this geographical coverage as **wider Europe**. This report answers the following main objective:

- **What is the economic impact of the Towage sector in wider Europe (i.e. EU28 + Turkey, Ukraine, Iceland and Norway)?**

This question has been further detailed in a set of six sub-questions:

1. What is the magnitude of the tug fleet operating in ETA membership countries?
2. How large is the employment in the towage sector?
3. What is the contribution to the Gross Domestic product (GDP) in ETA membership countries?
4. What are the investments made in the towage industry?
5. Provide an indication of the amount of cargo moved by EU tugs in the largest 15 European ports as a share of total goods handled in these ports
6. Which trends are relevant in the – near – future of the towage industry?

1.2 Outline of the study

This study will focus on the following economic indicators, which are outlined as follows:

- The wider European tugboat fleet (chapter 3)
- Employment in the European towage sector (chapter 4)
- Impact on the GDP in Europe (chapter 5)
- Total investments made in the towage industry (chapter 6)
- The amount of cargo moved by EU tug in the largest 15 European ports (chapter 7)
- The future of the towage industry (chapter 8)

Additionally, the collected data and approach of these economic parameters will be discussed in the following chapter, methodology.

2 Methodology

2.1 Introduction

Various studies have been conducted that estimate the economic impact of the maritime sector in more general terms. The Annual Report on the EU Blue Economy (EU, 2018) aims to describe the scope and size of the blue economy in the European Union. In the report, the direct socio-economic impact of six sectors and their contribution to the EU blue economy in terms of employment and value added (GVA) is provided. The six sectors are:

- Living resources
- Marine extraction of oil and gas
- Ports, warehousing and water projects
- Maritime transport
- Shipbuilding & repair
- Coastal tourism

A detailed breakdown to the tug sector is currently lacking. On a global level, the tugs sector is assessed in a Newsletter of Global M&A Partners, with the theme of the newsletter being towage & salvage. In the Newsletter, data is provided on the fleet count, the age profile and the new build order book.

This chapter describes the methodology of calculating the economic indicators: employment, financial indicators, investments and cargo moved. Every section will describe the approach and the steps that are taken to calculate the economic impact of the towage sector. Section 2.2 presents the data sources that have been used in this study. Section 2.3 describes our methodology on using these data to arrive at the indicators as defined in section 1.2.

2.2 Data sources

The following data sources were used to determine the economic magnitude of the towage sector, establishing key figures, benchmarking the towage sector and describe the strategic outlook of the European towage sector.

ETA survey results (2019)

The European Tugowners Association sends a yearly questionnaire to its members asking for insights on the number of tugs, tug characteristics, (distribution of) employment in the company, safety figures and costs components. With a response rate of 60% these survey results offer a representative sample of the entire European tugboat sector industry. We have established a extrapolation methodology to calculate the size and impact of the European towage sector (so including non-ETA tug operations as well).

MarineTraffic data (2019)

MarineTraffic provides useful AIS data on a number of vessel characteristics: number of vessels, vessel name, age, current port and country. In this specific research detailed data is used to determine the total number of tugs in Europe. The report has aggregated the results to a European wide scale. Additionally AIS data on the utilization of European tugs are tracked, which provides useful inputs to determine the share of sea going cargo vessels that are assisted by tugs going into/from sea ports.

Commercial databases (with financial statements)

Next to vessel data, economic data of the towage companies has been gathered. Commercial databases such as D&B Hoovers (2019)¹ and Company.info (2019)² were used to gather financial information on individual towage companies. The financial data has been aggregated to sector wide figures on total turnover, profit margins and operational costs in the European towage sector.

Literature research

Various studies have been conducted that estimate the economic impact of the maritime sector. For instance, the European Commission publishes an annual EU Blue Economy report (2018)³, which aims to describe the scope and size of the blue economy in the European Union. In addition, the yearly Dutch Maritime Monitor⁴ provides a basis for multiple key figures. These studies are also consulted as a means of plausibility check.

Eurostat database

The Eurostat database contains useful maritime transport figures and statistics. Particularly, data on cargo volume handled in main ports⁵ and vessels in main ports⁶ were used to estimate the cargo moved by European tugs.

In the following section, our methodology for calculating the economic indicators will be outlined in more detail.

2.3 Economic indicator approach

Note: as requested by ETA, this study focusses solely on tugs that practice in-and-out movements in the sea ports in wider Europe. This means that supply vessels, offshore support and inland navigation tugs are left outside the scope of this study.

2.3.1 Employment

The European Tugowners Association (2019)⁷ sends a yearly survey to its 87 members. In 2018, 52 companies responded on topics like number of tugs, employment, tug characteristics, operational costs and safety figures. These survey results (response rate 60%) offer a representative sample of the entire European tugboat sector and are used to calculate key figures. However, the sample needs to be extrapolated, as not all tugs are included in the survey data. Therefore, vessel fleet data will be extracted from MarineTraffic⁸.

$$\text{Employment: employees p. tug} * \text{number of European tugs} \quad (1)$$

2.3.2 Financial indicators

From commercial databases that contain financial sample data on towage companies, economic indicators such as turnover (see Figure 1), profit margins and approximations of Gross Value Added (GVA) have been calculated. Thereafter the sample data were extrapolated to the entire towage sector. Additionally, the distribution of operational costs relies on ETA survey results and

¹ Hoovers (2019), company-information (<http://www.hoovers.com/>)

² Company.info (2019), organisations (<https://company.info/>)

³ European Union (2018), *The 2018 annual economic report on the EU blue economy*

⁴ Ecorys (2018), *Maritime Monitor 2018*

⁵ Eurostat (2019), *Top 20 ports - gross weight of goods handled in each port, by type of cargo (main ports)*

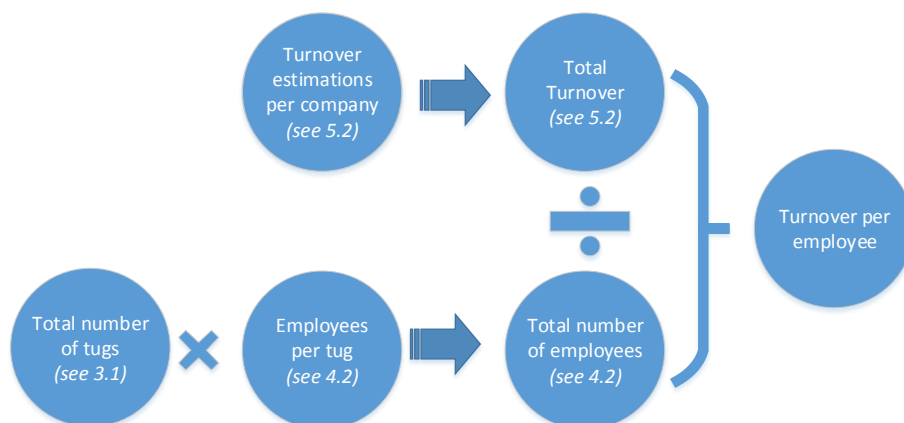
⁶ Eurostat (2019), *Vessels in main ports by type and size of vessels (based on inwards declarations) - quarterly data*

⁷ European Tugowners Association (2019), *Questionnaire*

⁸ MarineTraffic (2019), *Vessel Selection: Tugs*

will be used to calculate crew wages, social costs, training costs, repairs and maintenance, depreciation, insurance and fuel costs.

Figure 1 Methodology to determine turnover per employee



2.3.3 Investments

In addition to chapter 3, describing the basic characteristics of ‘The European Tugboat Fleet’, the investment and renewing cycle of tugs has been –partly- based on the age structure of the European fleet. The MarineTraffic database has been consulted to gather data that is needed to calculate the average yearly renewal of tugs. After determining the renewal rate, data provided by the ETA on individual tug purchase prices helped to estimate the investments in the industry. These figures were validated by means of a market search.

$$\text{Total investments: (no. new built tugs * purchase value)} \quad (2)$$

2.3.4 Cargo moved by European tugs in EU largest ports

Prior to determining tug utilization and cargo moved in EU port, data were gathered on total throughput⁹, number of vessel calls¹⁰ and number of tugs in EU ports¹¹. Thereafter we determined the total number of tug operations based on the average tug utilisation and number of tugs in European ports (see formula 3 and 4).

$$\text{Average tug utilization: n. o. tug operations started / n. o. tugs} \quad (3)$$

$$\text{EU tug operations: average tug utilization * n. o. tugs in EU ports} \quad (4)$$

A number of additional assumptions were needed in order to calculate the share and volume of cargo moved by European tugs. The first two assumptions were used to estimate the number of vessels with tug assistance.

Assumption 1: The number of tug operations involves incoming and outgoing journeys.

⁹ Eurostat (2019), *Top 20 ports - gross weight of goods handled in each port, by type of cargo (main ports)*

¹⁰ Eurostat (2019), *Vessels in main ports by type and size of vessels (based on inwards declarations) - quarterly data*

¹¹ MarineTraffic (2019), *Vessel Selection: Tugs*

A vessel will sometimes need tug assistance, dependent on factors such as the length, width and draft of the vessel, deadweight tonnage and external factors. We assume that every vessel needs incoming tug assistance, will also need outgoing tug assistance.

Assumption 2: Vessels will (sometimes) require two tugs instead of one

A vessel will sometimes need assistance of two tugs, dependent on manoeuvrability of the vessel (i.e. length, width and draft of the vessel), port accessibility or extreme external factors (i.e. weather circumstances). According to the tug operation data gathered by MarineTraffic, we estimate that in 20% of the tug operations the services of two tugs are required.

To determine the number of vessels with tug assistance, the following formula will be used.

$$\text{Number of vessels with tug assistance} = \text{EU tug operations} / \text{assumption 1} - (\text{tug operations} * \text{assumption 2}) \quad (5)$$

Assumption 3: Larger vessels will require tugs over smaller vessels

As a next step the number and size of sea seagoing vessels should be known. In general, larger vessels will require tug assistance over smaller vessels. The difference in vessel size and corresponding cargo moved has been based on a detailed dataset of vessel calls in Dutch ports.

2.4 Limitations and further research

Prior to discussing the results of the economic impact of the European towage sector a few limitations of this study are pointed out. Also, we have added a couple of options for further research.

The main limitations of the study:

- The representative results of the survey have been used to extrapolate to sector wide key statistics on employment and financials. We were not able to execute a real representative test.
- As a first research, the economic importance of the towage sector has been measured at a specific point in time (i.e. 2019 data). We could thereby not yet assess the *economic development dynamics of the tug sector*.
- In-depth interviews with key stakeholders could provide a more detailed understanding of the main challenges faced by the towage sector.
- The future economic outlook is in this study based on a mainly qualitative assessment of trends that will influence the towage sector the coming years. A quantitative approach is still lacking.

Options for further research:

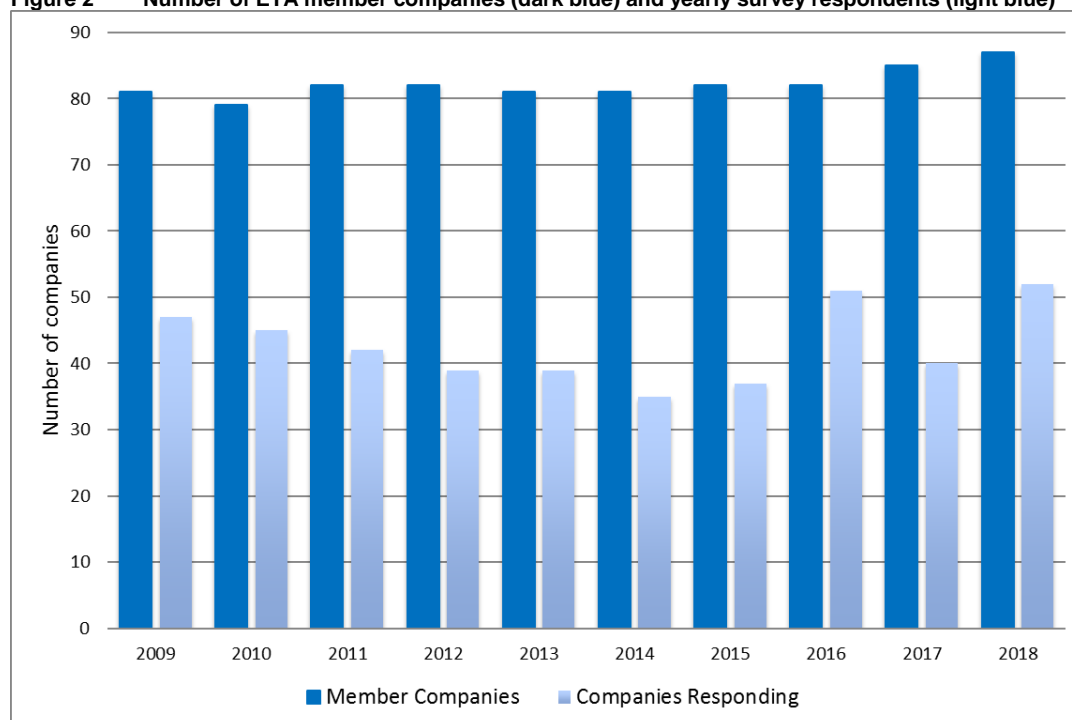
- A comparison between North and South European towage operations could provide additional information on the operation structure, efficiency, and even outlook to the future.
- The yearly questionnaire could be enriched with a number of questions, which could lead to additional (data) analysis.
- The future economic outlook could be enriched with a quantitative approach. With previous experience on forecasting the development of the container fleet and data from MarineTraffic, a more solid outlook of the towage sector can be made.
- By repeating this study regularly, we will gain insight in the economic dynamics of this important maritime sector.
- Based on feedback on this first explorative impact methodology, we might be able to add methodological improvements.

3 European Tugboat Fleet

Tugs are designed with high propulsion power for pulling and pushing heavy floating objects at relatively low speed. They are equipped with high engine power and are highly manoeuvrable. Tugs are primarily used to assist ocean-going vessels in ports. The towage industry plays a key role in the Blue economy. Ports could not operate safely and 24/7 without tugs and the vast majority of Europe's imports and exports would be severely hampered without the availability of tug assistance. In this study we concentrate on so-called harbour tugs, that operate to assist vessels to navigate safely to, from and within European sea ports.

At present ETA has 87 full members in 25 countries. These members own or operate a combined fleet of over 800 tugs in European ports. The membership encompasses family businesses and port authorities with small to medium size tug fleets as well as the major towage companies operating well over 100 tugs in geographical Europe and worldwide. We have used the annual survey results of ETA under its members to support our analysis of the economic impact of the sector (chapter 4 and onwards).

Figure 2 Number of ETA member companies (dark blue) and yearly survey respondents (light blue)



Source: European Tugowners Association (2019), *Questionnaire*

In order to derive economic indicators for the tug sector as a whole, we have looked beyond ETA membership. In this chapter, we assess the tug sector as a whole, so we will also include non-member tug companies and their fleet. The scope of this study stretches to a wider geographical Europe (incl. ETA member countries Turkey, Ukraine, Iceland and Norway).

3.1 Geographical concentration of the European tugboat fleet

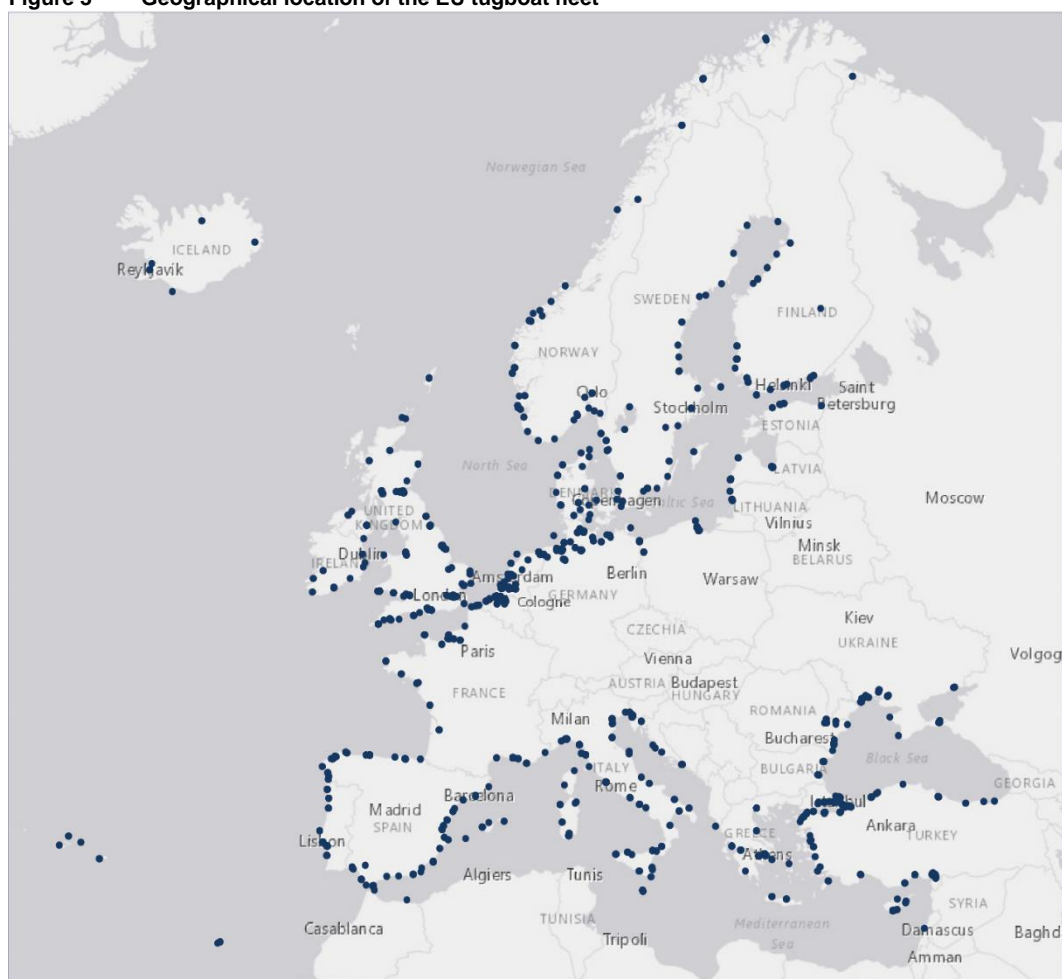
The tugboat fleet active in ports consists in June 2019 of **1.595 tugs**, which are widespread located across geographical Europe. We arrived at this number by running a dedicated query in

MarineTraffic, a well-known AIS-data tool. As this study focusses solely on tugs active in ports, we have excluded inland-, offshore and pusher tugs from this study. According to MarineTraffic data the entire tugboat fleet is divided as follows:

- Tugs (**1595 tugs**)
- Tug supply vessel (22 tugs)
- Pusher tug (31 tugs)
- Inland tug (605 tugs)

The largest concentration, approx. 250 tugs, is found in the ports in the Hamburg – Le Havre range (i.e. Germany, the Netherlands, Belgium and France). Member states with the largest fleet are the United Kingdom (196 tugs) and Spain (161 tugs), while the smallest fleet is active in Slovenia (4 tugs). The geographical location of tugs and thereby scope of this study is presented in Figure 3. It is safe to conclude that any sea port of any importance has at least the assistance of tug services readily available.

Figure 3 Geographical location of the EU tugboat fleet



Source: MarineTraffic (extracted June 2019)

Figure shows the geographical distribution of the European tugboat fleet. The following European ports have the largest tug concentration:

- Antwerp, BE (40 tugs)
- Rotterdam and surrounding, NL (37 tugs)
- Constanta, RO (29 tugs)
- Hamburg, DE (24 tugs)

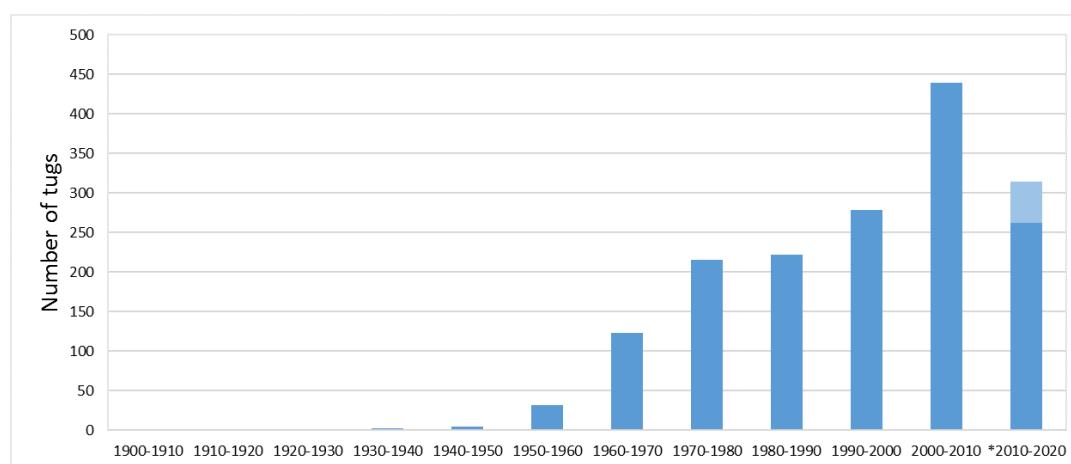
- Venice, IT (18 tugs)
- Bremerhaven, DE (22 tugs)

Additionally, there are more than 450 defined 'port locations'¹² which have at least one active tug located in the port. This clearly shows that having tug services is more or less a prerequisite of operating a port.

3.2 Age structure of the European tugboat fleet

Tugs have extremely long lives as mentioned in the market report of Sea Europe (2018)¹³. The average age of the European tugboat fleet is **25 years** old. Figure 4 shows the age structure of the current tug fleet. Almost one quarter of the fleet is built before 1970 (and thus more than 50 years old). Almost a third has an age between 20 and 50 years, and almost half of all European tugs is relatively young, with an age of 20 years or less.

Figure 4 Age structure of the European tugboat fleet



Source: MarineTraffic (2019)

* The unknown years', 2019 and 2020, are extrapolated based on the average of 25 tugs per year (light blue)

The "youngest" tug fleet is active in Slovenia (4 tugs), Iceland (6 tugs) and Italy (141 tugs), which are on average respectively 16, 17 and 18 years old. The oldest active tug fleets are located in Finland (50 tugs), Sweden (48 tugs), Ukraine (76 tugs) with an average age of respectively 44, 36 and 33 years. The detailed age characteristics per country are presented in Annex I.

The renewal cycle of tugs will be described in chapter 6 as it partly determines the yearly investments in the industry.

¹² MarineTraffic defines the current port location of tugs and sometimes divides multiple areas in the port. To give an example, Rotterdam is divided into Rotterdam, Rotterdam Maasvlakte, Rotterdam Waalhaven, Rotterdam Botlek.

¹³ Sea Europe (2018), *Market Forecast Report*

4 The total amount of jobs supported in Europe

4.1 Introduction

ETA gathers data (by means of a questionnaire) on employment (shore and land based) active in its member companies. Table 1 shows the employment statistics of the 52 member companies that responded to the ETA questionnaire.

Table 1 Employment statistics of ETA member companies

Employee category	Percentage	Number of employees
Crew (local)	79,6%	3.608
Crew (EU national)	1,5%	70
Crew (non EU national)	0,9%	39
Shore based Staff	9,6%	434
Shore based administrative staff	8,5%	384
Total	100%	4.535

Source: European Tugowners Association (2019), *Questionnaire*

These data indicate that around **83%** of the employees (equal to 3.717 employees) are crew based and approximately **17%** are considered to be shore-based staff (equal to 818 employees). Almost all employment of the sector stems from within the EU. This is clearly different from the shipping industry as a whole, which has a more international staffing of vessel crews.

The following section (4.2) will make a distinction between crew and shore based employment indicators.

4.2 Employment indicators

The data presented in table 2 reflects the outcome of the 52 member companies, which operate a tug fleet of 651 tugs. This leads to an average total employment of 7 employees per tug¹⁴. When excluding the shore-based staff, the number of employees per tug equals **5,7**¹⁵. These key employment figures are summarised in the table below.

Table 2 Employment indicators

Employment indicator	Key employment statistics
Crew	83% (= 3.717 employees)
Shore based staff	17% (= 818 employees)
Employees per tug (only crew)	5,7
Employees per company	86
Employees per tug	7

A remark on these key employment statistics is that there is a large diversity of either tug utilization and number of employees per company, port and country. Therefore, the ETA obtained additional

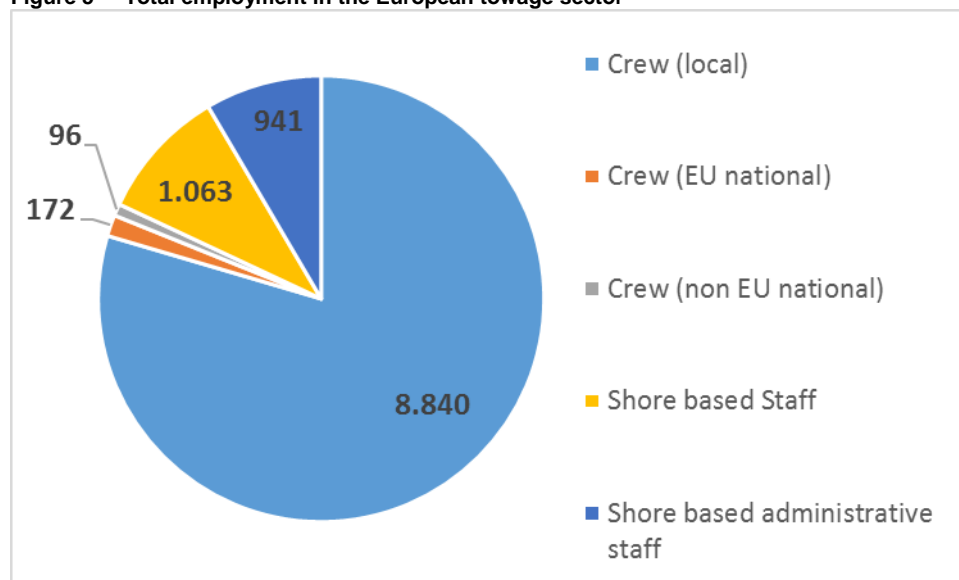
¹⁴ *Employees p. tug: 4.535 employees/651 tugs = ± 7.0*

¹⁵ *Employees p. tug (only crew): 3.717 employees/651 tugs = 5.7*

information on the operation in Finnish ports to further detail our findings¹⁶. In larger ports, a tug is manned with six employees, which work in multiple crews (for instance 2 crews a day). In the smaller port, tugs are unmanned with shore power. In major European ports, tug services are a 24/7 hour operation and approximately 3 to 4 crews (with 3 employees per tug) are working per day.

Since the total size of the European tugboat fleet equals **1.595 tugs**, these key employment indicators are extrapolated to the wider towage sector. The total number of employees is equal to approximately **11.150**. Whereas considering only crew employees¹⁷, tug related employment equals roughly **9.000** employees¹⁸. Figure 5 shows the employment in the European towage sector divided by different categories.

Figure 5 Total employment in the European towage sector



Source: European Tugowners Association (2019), *Questionnaire* & Marine Traffic (2019), adaptation by Ecorys

¹⁶ European Tugowners Association (2019), *Questionnaire* - Additional information

¹⁷ *Employment in the towage sector: 7 employees p.tug * 1.595 tugs = 11.165 employees*

¹⁸ *Employment in the towage sector as crew members: 5,6 employees p.tug * 1.595 tugs = 8.932 crew employees*

5 Economic indicators of the European towage sector

5.1 Introduction

Towage activities have a central role in maritime activities as ports could not operate without tugs and moving the vast majority of Europe's imports and exports in and out of the European ports would become much more unsafe. This means that the operational impact of tugs is thus self-evident, but what is the impact of the tug sector in economic terms?

This chapter will define key economic figures: **total turnover**, **profit margin** and **gross value added (GVA)**. The first two have been determined by consulting the D&B Hoovers database¹⁹. The third, GVA, is an approximate derivative from these known financial indicators in combination with the ETA survey results. Finally, an indication of the **indirect effects** of the sector has been derived using external literature sources.

5.2 Total European turnover in the towage sector

Turnover statistics have been assessed by analysing financial data of 40 ETA member companies (using D&B Hoovers database, since ETA had asked Ecorys not to burden the sector with extra questionnaires). These turnover estimations combined with the total number of employees result in a key financial indicator: turnover per employee (see Methodology, Figure 1).

Turnover data were analysed for these 40 ETA member companies, which resulted in an average turnover of € 13.7 million per company. This leads to a total turnover equal to **€ 520 million**.

The total number of tugs of these 40 companies equals **668** tugs, which results in roughly **4.700 employees**²⁰.

Dividing the amount of total turnover and number of employees results in an average turnover per employee of **€111.000**²¹.

Considering the total employment in the industry, over 11.150 employees, and the total turnover per employee, roughly €111.000, European turnover in the towage sector equals more than **€ 1.2 billion** based on 2018 financial data of 40 tug companies, and June 2019 employment figures.

The EU Blue Economy report (2018)²² referred to the labour productivity per employee of maritime transport in the European blue economy is equal to €117.000 per employee in 2016. Thereby, the average turnover (i.e. productivity) per employee is similar to turnover per employee in the towage sector. With a total number of direct employment equal to 235.000 persons, the labour productivity of maritime transport equals €27,5 billion. The towage sector yields approximately 4% of the turnover of the European maritime transport market.

¹⁹ Hoovers (2019), company-information (<http://www.hoovers.com/>)

²⁰ *Employment in the towage sector: 7 employees p. tug * 668 tugs = 4.676 employees*

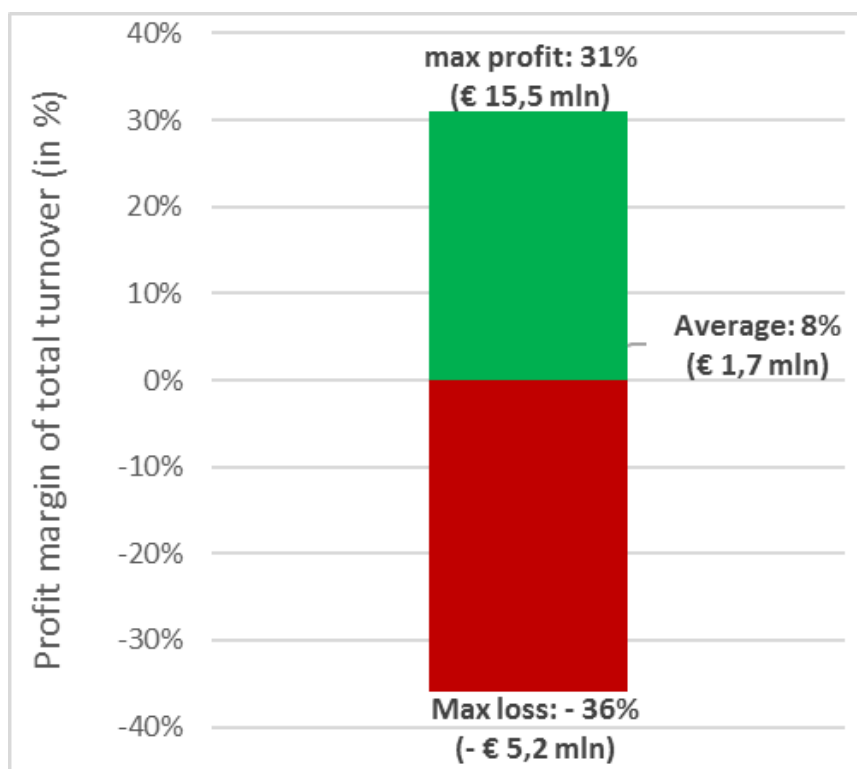
²¹ *Total turnover per employee: € 520 mln turnover / 4.676 employees = € 111.206*

²² European Union (2018), *The 2018 annual economic report on the EU blue economy*

5.3 Profit margin

Net profit statistics are found in the D&B Hoover database for 23 towage operators. The vast majority (17) of these companies were profitable in 2018 and had an average net income of €3.5 million. However, the remaining 6 operators had an average net loss of €2.6 million. Overall, the average profit margin, with a bandwidth of +31% and -36%, was **8%** of the total turnover (see Figure 6).

Figure 6 Profit margin of the total turnover of 23 towage operators



The overall average profit margin in the towage sector was **8%** of the total turnover.

5.4 Gross Value Added

5.4.1 Direct GVA

The Gross Value Added (GVA) is a measure to determine the economic value added of goods and services produced in an area, industry or sector. Adding the GVA of various sectors results in the European GDP. The following equation has been used to calculate the GVA of the tug sector:

$$\text{Gross Value Added (GVA)} = (\text{Turnover} - \text{Operational Costs}) + \text{Crew Wages} + \text{Depreciation}$$

European turnover

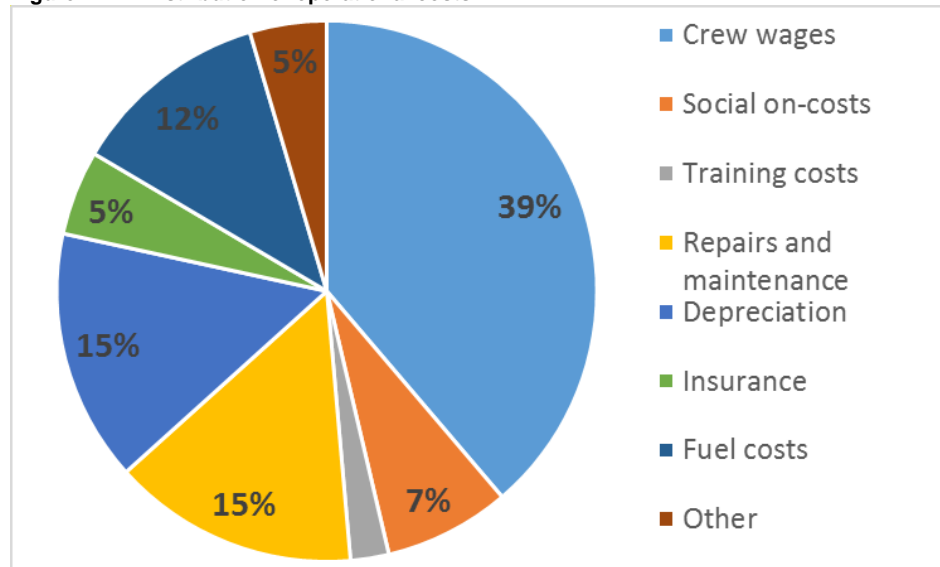
In order to calculate the wider European turnover of the towage sector, the 1% of staff without an EU nationality (96 employees, see Table 1) are excluded from the turnover calculation. The remaining 11.050 employees and turnover per employee are multiplied to determine the wider European turnover.

The total EU turnover of the tug sector amounts to **€ 1.2 billion** considering 11.050 European employees and an average turnover per employee of € 111.000²³.

Operational costs

After assessing the total turnover (€1.2 billion) and related profit margin (8% of the total turnover) of the wider European towage sector, we have derived the total operational costs. The total operational costs are thereby equal to **€1.1 billion**²⁴. The detailed cost elements of a towage operation are presented in Figure 7.

Figure 7 Distribution of operational costs



Source: European Tugowners Association (2019), *Questionnaire*

Crew wages

In the EU Blue Economy report (2018)²⁵, the average annual salaries in 'port related activities' rose with 16% from 2009 to €32.500 in 2016. Assuming the trend continued the last couple of years, the current average annual salary would amount to roughly €34.800 per employee. We have also obtained information from the ETA on crew wages. The basic gross salary of a tug captain, classified for international trade, equals €3.500 per month (excl. allowances). The average wage of engineers is roughly €3.250. Resulting in an annual salary of both captains and engineers of roughly €50.000 to €60.000²⁶. However, the other crew members earn wages that are substantially lower.

The share of crew wages, as part of the operational costs, is equal to 39% (see Figure 7). Subsequently, the total crew wages are **€ 440 million**, which results in €39.500 per employee²⁷.

Depreciation

The final cost element that is needed to determine the added value of the towage sector is the estimation the annual amount of depreciations. Since the operational costs equal **€ 1.1 million**, and the share of depreciation is 15%, depreciations equal **€ 170 million**

²³ Total turnover: € 111.000 per employee * 11.165 employees = € 1.229 million

²⁴ Operational cost: € 1.229 mln – (8% * €1.229 mln) = € 1.131 million

²⁵ European Union (2018), *The 2018 annual economic report on the EU blue economy*

²⁶ European Tugowners Association (2019), *Questionnaire - Additional information*

²⁷ Average wage in tug sector: (€ 1.131 mln * 39%)/11.150 employees = € 39.500 per employee

Repair and maintenance

Additionally, repair and maintenance costs as a share in total operational costs are equal to 15% of the operational costs. Therefore, repair and maintenance consist of an additional annual investment of roughly **€170 million**.

Total wider European GVA of the tug sector

Table 3 Summary of key results

Key figures	Value
Turnover	€ 1.229 million
Operational costs	€ 1.131 million
Tug sector wages	€ 440 million
Depreciation	€ 170 million
GVA	€ 708 million
Employees	11.150
GVA / employee	€ 63.500

Based on these key results, the total (gross) added value is:

$$\text{Gross Value Added} = (\text{€ 1.229 mln} - \text{€ 1.131 mln}) + \text{€ 440 mln} + \text{€ 205 mln} = \text{€ 708 million}$$

The gross value added per employee in the European towage sector is equal to **€ 63.500**, which amount to a total GVA (and thereby contribution to European GDP) of **€ 632 million**.

The EU Blue Economy report (2018)²⁸ stated that the total gross value added (GVA) of the entire blue economy is equal to €174.2 billion. With a total number of employees of 3.5 million persons, the GVA per employee is €49.200. This is considerably lower than the average GVA per employee in the towage sector (€63.500 per employee). However, the difference is somewhat smaller when looking at the GVA in 'port related activities' in the European Blue Economy, which is equal to €70.900.

5.4.2 Indirect GVA

In addition to the direct economic impact of the European towage sector, the tug sector also generates other associated activities. The purchasing impact on the supply chain is approached with a so-called type-1 multiplier, and is calculated using input-output tables from which these multipliers can be derived (indirect effects). Due to the scope of this first impact study, these indirect effects are based on external literature and therefore only a rough approximation.

The European Community Shipowners' Associations (ECSA)²⁹ established an indicator for the indirect impact of the shipping industry as a whole. For every 54 billion of direct GVA, another 57 billion of indirect GVA was estimated. We will use the multiplier (2.05) as the best available proxy for determining the indirect effects of the towage sector.

Considering a multiplier of 2.05, the direct and indirect value added amount to respectively **€ 708 million** and **€ 743 million**. The total GVA amounts to roughly **€ 1.45 billion**.

²⁸ European Union (2018), *The 2018 annual economic report on the EU blue economy*

²⁹ European Community Shipowners' Associations (2017), *The Economic Value of the EU Shipping Industry*

6 Investments in the towage industry

6.1 Introduction

Investments are an important indicator to describe the economic impact of the European towage industry. Increasing investments could be due to more vessel movements, faster fleet renewal or innovation towards energy efficient tugs. Investments reveal the development within the sector and thereby characterize the vitality of the industry.

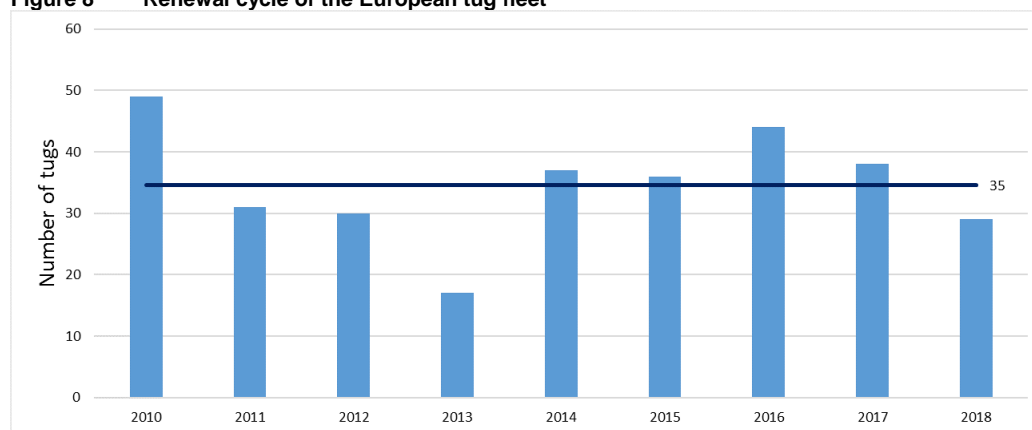
Various market studies (by Marcon International³⁰ and Sea Europe³¹) and new articles touch upon the investments made in the tugboat industry. However, comprehensive sources and clear investment figures are not available. In order to approximate the yearly European tugboat investments we have developed a four-step methodology:

1. Firstly, the renewal cycle of European tugs has been analysed.
2. Secondly, a small market search on tug investments is performed and we have summarized our findings.
3. Thirdly, the economic indicators, average age of the fleet and investments per tug, are extrapolated to the European tugboat fleet and are expressed in absolute investment figures.
4. Finally, we address the question how these investments will develop in the foreseeable future. This question is answered in the fourth and final part of this chapter.

Renewal cycle of tugs

Figure 8 presents the renewal cycle of tugs within Europe. Since 2010, on average **35 tugs** are built on a yearly basis. Annex II presents the detailed renewal cycle per country.

Figure 8 Renewal cycle of the European tug fleet



Source: MarineTraffic (2019)

Some member states are renewing or expanding their fleet quite rapidly. The last decade (from 2010 onwards), the following countries have built a large number of new tugs:

- Turkey, TR (58 new built tugs)
- Netherlands, NL (40 new built tugs)
- Great Britain, GB (40 new built tugs)
- Italy, IT (33 new built tugs)

³⁰ Marcon International Tug Boat Market Report (2018), *Tug Market Report*

³¹ Sea Europe (2018), *Market Forecast Report*

- Germany, DE (30 new built tugs)
- Spain, ES (24 new built tugs)
- Belgium, BE (17 new built tugs)

The last decade, yearly renewal or expansion of the fleet is equal to **35 tugs** per year. This yearly renewal rate is used as input to determine investments in the sector.

6.2 Investments in the towage industry

Recent investments in the towage industry

Every year port authorities, terminals, tug operators and others invest in new tugs. Especially, Turkey, the Netherlands, UK, Italy, Germany, Spain and Belgium have recently invested in renewing or expanding the current fleet. This study defines investments as the total value of newly purchased tugboats in the industry.

Investments in the industry

In 2018, Rimorchiatori Napoletani ordered a new azimuth-propelled tugboat with 75 tons bollard pull and 6.300 BHP Caterpillar engines at Sanmar. Investment will range from €5 to €6 million. The Turkish shipyard (Sanmar) also manufactured two other tugboats, *Marechiaro* and *Vivara*, with a total investment of roughly € 9 million. This is the first out of five units to be deployed before 2023³².

Mid 2019 UK's Towage Company, SMS towage, ordered two tugs at Damen Shipyards, called the Marksman and Manxman. The latter has 70-tonne bollard pull and is worth a total investment of £5 million. According to the managing director of SMS Towage, the increase of fleet capacity will enable them to utilise the fleet more efficiently³³.

Table 4 presents a number of recent investments in the towage industry. We have made a distinction between practical investments in the market and investments deducted from (market) studies.

³² Shipping & Intermodal Transport (2018), *Vivara and Marechiaro, two new ships for Rimorchiatori Napoletani*

³³ Damen (2019), SMS Towage calls on Damen for two ASD 2411 tugs

Table 4 Literature review on tugboat investments

Source	Buyer	Investment (in €)	Details
Investments			
PortSEUrope (2018)	Rimorchiatori Napoletani ordered the first out of five new tugs	The first new tug ranges from €5 to €6 million and will be larger than the previously delivered Marechiaro and Vivara (€ 4.3 à 4.5 million)	- 75 tons bollard pull, - 6,300 BHP Caterpillar engines - 24 metres in length
Press releases by SeaNews and SMS Towage	Harbour Authority Associated British Port (ABP)	Purchase price (£5 mln.) is equal to €5.6 mln.	- 4.200 BKW - Azimuth Stern Drive (ASD) technology 2411 tug - 72-tonne bollard pull
Studies and market reports			
Canadian Transportation Research Forum (2011)	Theoretical price estimate	Purchase price (\$15 mln. CAD) is equal to €10 mln.	Theoretical cost of operating a single 6,600 BHP tractor tug
Major Factors Affecting Tugboat Ship Design and Construction	Theoretical price estimate	Costs of a medium-sized ship are about \$14 mln. (\$5 mln. labor cost and \$9 mln. construction material costs) equal to €12.5 million	The completion for this kind of vessels ranges from 28 to 38 months
Marcon Market Report (2012)	Average price indication	Price of an azimuthing tug between equals €4.5 to 9 mln (ranged between \$5 - \$10 mln and 1 - 2 mln. USD per 10 tonne bollard pull)	Assumption: average bollard pull of the EU tug fleet equal 50-tonne

Additional data provided by the ETA estimates the following purchase prices³⁴:

- Pre-built tug: €8 - €9 million
- Standard tug: €10 - €11 million
- LNG or hybrid tug: €13 million

Concluding, the average (standard) investment of new-built tugs equals roughly **€10 million euro's**. However, the investments for new built tugs differ quite heavily with respect to size and type of tug. Therefore, a bandwidth with the following proportions is used:

- Minimum investment per tug: **€ 8 million**
- Average investment per tug: **€ 10 million**
- Maximum investment per tug: **€ 13 million**
-

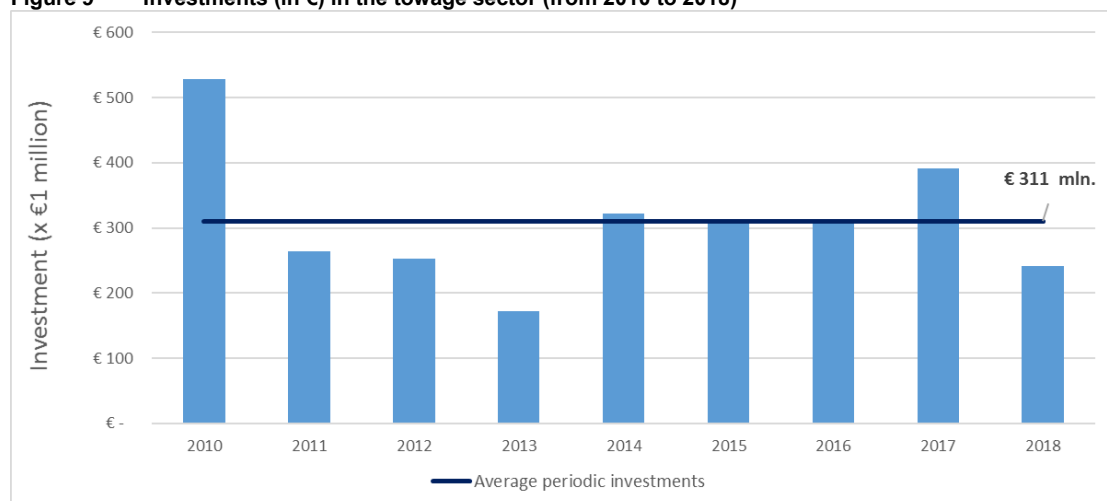
In the following section, the individual purchase values per tug are translated to sectoral investment by looking at the fleet development.

European investments in the towage sector

Since 2010, the average yearly investment in tugs equals **€311 million** (i.e. based on average on 35 tugs new built per year). 2010 was very good year for investments, and after a dip in the three years thereafter, 2014-2017 were also years with average investments per year. 2018 showed a slowdown compared to the four years before. Investment in the towage sector are presented in figure 9. A detailed analysis of the investments is presented in Annex III.

³⁴ European Tugowners Association (2019), Questionnaire - Additional information

Figure 9 Investments (in €) in the towage sector (from 2010 to 2018)



Concluding, yearly investments in the European tugboat industry are equal to **311 million euro's in new built tugs**.

6.3 Investment outlook

The towage industry doubled new orders according to Tug Technology and Business (2018).

Especially, Asian and Turkish shipyards build more tugs these years. In absolute terms, new worldwide production of tugs equalled roughly 300 tugs (297 tugs). The worldwide orderbook³⁵ categorized different type of tugs as follows:

- Harbour tugs: 255
- ATBs: 10
- Tractor tug: 8
- Salvage tug: 6
- Pusher tug: 4
- Other tugs: 14

Most of the tugs, larger than 20 metres, are contracted in respectively Europe, Asia, Far East and North America³⁶. One of the main investment drivers in the industry are the increasing environmental rules, which are driven by policy and societal expectations to reduce the carbon footprint of the maritime industry³⁷.

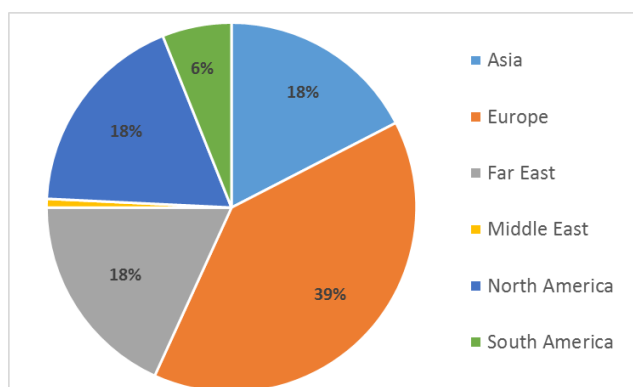


Figure 10 Contracting tugs larger than 20 metres

³⁵ BRL Shipping Consultants (2018), <https://www.mpropulsion.com/news/>

³⁶ Tug Technology and Business (2019), <https://www.tugtechnologyandbusiness.com/news/>

³⁷ Dansk Maritime (2018), <https://danskemaritime.dk/wp-content/Market-Forecast-Report.pdf>

7 Cargo assisted by European tugs in European sea ports

7.1 Introduction

The transportation of cargoes in and out of European ports fuels the efficiency of the European production and consumption markets. These goods are delivered in all kinds of ships specialised in containers, bulk, liquid and general cargoes. Some of these ships (are obliged to) use tug assistance and others can access the European ports on their own. In terms of legal requirements of tug assistance, ports have different characteristics and so we find differences in nautical rulings between European ports. In addition, vessel dimensions (length, width and draft), type of vessel and other characteristics influence requirements for tug assistance. ETA has asked Ecorys whether it is possible to assess the total amount of cargo assisted to/from European ports which somewhere in the voyage have been assisted by European tugs.

We developed a three-step approach to establish a first answer to this question. First, we provide insight in the total throughput, number of vessels and number of tugs in Europe's 15 largest ports. In the second step, the tug utilisation in European major ports is analysed. After approximating the utilisation of European tugs, these figures are then translated to the number of vessels and cargo throughput in European ports.

7.2 European major sea ports

We have gathered data on the 15 largest European sea ports:

- Antwerp
- Bremerhaven
- Hamburg
- Algeciras
- Barcelona
- Valencia
- Le Havre
- Marseille
- Genova
- Trieste
- Amsterdam
- Rotterdam
- Sines
- Immingham
- London

Table 5 Total throughput and number of vessels in Europe's major sea ports in 2017

Ports	Throughput (in mln. tons)	Number of vessels	Number of tugs
Europe's major sea ports	1.605	135.584	217

Source: Eurostat (2019) & MarineTraffic (2019)

Eurostat provides yearly figures on total throughput and number of vessels. Figures of the major European ports are presented in table 5. The main outcomes of the table are briefly discussed.

The total throughput in Europe's major ports equalled roughly **1,6 billion tons** of cargo in 2017. Especially the ports in the Hamburg-Le Havre range have a large share in the total throughput. Next to cargo volume, these ports had **135 thousand** yearly ship calls.

In these 15 European ports there are **217** tugs located, which equals 14% of the total European tugfleet. The vast majority of tugs are either active in small ports or were outside of the port's geographical range at the time of data extraction (May 2019)³⁸.

The European tugboat fleet consists of 1.595 tugs of which **217 tugs** are active in the 15 largest ports. These ports have a combined annual throughput of **1,6 billion tons** and **135 thousand vessel calls**.

7.3 Tug utilization in European sea ports

7.3.1 Legal requirements for tug

Studying the specific tug requirements in four ports, i.e. the Port of Antwerp³⁹, Cork⁴⁰, Belfast⁴¹ and Bristol⁴² reveals that the following factors could influence the need for tug assistance:

- Length of the vessel;
- Width (e.g. 45 meters or more in the Port of Antwerp);
- Draft of the vessel (e.g. using 2 tugboats is required with a draft of more than 11.5 m);
- Deadweight Tonnage (DWT);
- Manoeuvring thruster (bow thruster) is a transversal propulsion device that makes the vessel more manoeuvrable;
- External factors (i.e. weather circumstances);
- Type of vessel (e.g. necessity to escort tankers).

Some ports are better accessible than others, but even individual terminals can be more difficult to access and therefore face additional tug requirements. In addition, other (external and irregular) factors like weather circumstances play a major role in tug use.

The actual tug utilization cannot be derived from analysing regulation on tug deployment alone. We decided to gather tug utilization data from the Marine Traffic AIS database. After calculating the number of yearly tug operations and estimating the share of escorted vessels, we can calculate the share of cargo volumes that will encounter tug assistance while operating in the port area.

7.3.2 Tug utilization

Randomized representative sample

The main aim of this chapter is to approximate the number of ships and corresponding cargo volume moved by the European tug fleet. In order to do that, a representative selection of tugs active in the 15 major ports is chosen to determine the average tug utilization.

The randomized sample includes **69 tugs** (total population is 217 tugs), has a confidence level of 95% and a confidence interval of 10%. The sample is thereby roughly representative for the tug activities in the 15 ports as a whole⁴³. The tug events (tug operation started and ended) have been monitored in the time period 10/07/2019 to 16/07/2019 in the Marine Traffic AIS database. Additionally, data has been collected on the operating window (i.e. duration), vessel name, distance to vessel, (local) area, speed, course and location of the tug.

³⁸ MarineTraffic (2019), Vessel Event Data

³⁹ Port of Antwerp, *Port Instructions*

⁴⁰ Port of Cork (2017), *Towage Requirements*

⁴¹ Port of Belfast, *Minimum Towage Requirements*

⁴² Port of Bristol (2015), *Towage Guideline*

⁴³ Survey System (2019), <https://www.surveysystem.com/sscalc.htm>

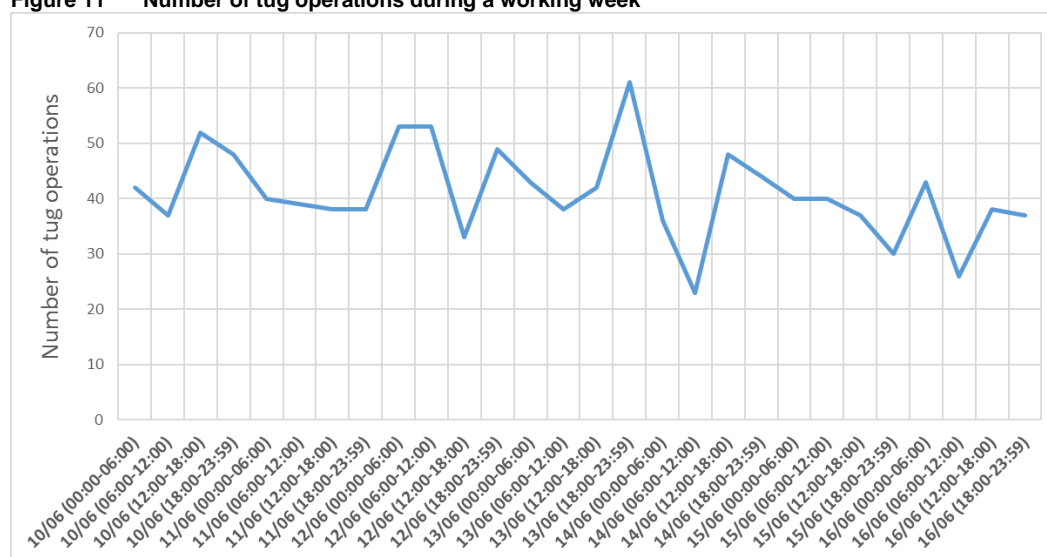
The random representative sample consists of the following main aspects:

- A selection of **69 randomly chosen tugs** in the 15 largest European ports.
- The selected period is a week from **Monday 10th to Sunday 16th of June 2019**.
- Two events are monitored: (1) **Tug operation started**; (2) **Tug operation ended**.

Yearly tug utilization

Figure 7.2 displays the number of tug operations from 10/07/2019 to 16/07/2019. Most of the tugs operations (27%) start in the afternoon (from 18:00 to 23:59). However, these figures seem rather constant throughout the different parts of the day. Only, during weekend days (at 15/06/2019 and 16/06/2019) the number of operations appears to be slightly lower.

Figure 11 Number of tug operations during a working week



Source: MarineTraffic (2019), Vessel Event Data

The key figures on tug operations are summarized in Table 6.

Table 6 Yearly tug utilization

Tug utilization	Key figures	Unit
Random sample	69	Number of tugs
Tug operations started	1.148	Number of tug operations started
Average tug operations	2,4	Per day
Average tug operations	± 17	Per week per tug
Average tug operations	865	Per year (based on 52 weeks)
Tug operations in the largest 15 ports	Key figures	Unit
Tugs in the 15 largest ports	217	Number of tugs
Tug operation in the 15 largest ports	187.740	Number of operations

The 69 tugs that represent European port tugs have started 1.148 tug operations, which equals roughly 17 tug operations per tug per week. The number of tug operations per week is used to calculate the number of tug operation per day (2.4) and year (865). These figures are used to extrapolate the random sample towards the tug fleet in Europe's major seaports.

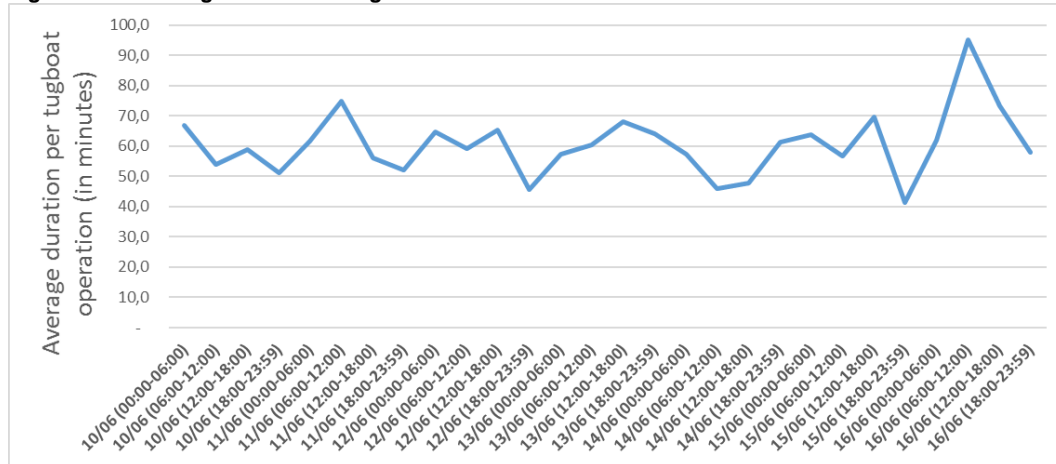
This leads to an average number of yearly tug operations equal to **187.740**.

In the remainder of this chapter, the average number of yearly tug operations will be used to approximate the amount of cargo assisted by European tugs in the largest 15 ports.

Duration of tugboat activities

Another interesting indicator is the duration of tugboat activities. For the same time period 10/07/2019 to 16/07/2019 the average duration of a tugboat activity is roughly 1 hour (i.e. **56 minutes**). Especially the afternoon and night activities appear to have a longer duration (see Figure 12).

Figure 12 Average duration of tugboat activities



Source: MarineTraffic (2019), Vessel Event Data

7.4 Cargo moved by tugs in European sea ports

After determining the tug utilization and number of tug operations in European ports, the share of cargo volume moved by tugs is determined. Firstly, the number of vessels that need tug assistance are determined, whereas the percentage of cargo moved is estimated afterwards.

Number of vessels with tug assistance

The average number of yearly tug operations equals **187.740**. According to assumption 1, half of these operations consist of incoming and outgoing journeys. Therefore, the number of tug operations will be divided by **two**.

According to the legal requirements for tugs, larger vessels might require two tugs instead of one, which affects the number of vessels with tug assistance (assumption 2). The random sample shows that in 230 of the 1.100 tug operations two tugs are needed, which is equal to **20%** of the total number of tug operations.

Taking these two assumptions into account, shows that the number of vessels with tug assistance equals **56.300 vessels** (i.e. 42% of the total number of vessel). In table 7, figures on the total throughput, number of tugs, operations and number of vessels with tug assistance are presented.

$$\text{Number of vessels with tug assistance} = \left(\frac{187.740}{2} \right) - (187.740 * 20 \%) = \mathbf{56.300} \text{ (equal to 42\%)}$$

Table 7 Vessels and throughput facilitated by tugboats

Ports	Number of vessels	Number of tugs	Number of tug operations	Number of vessels with tug assistance
Europe's major sea ports	135.584	217	187.700	56.300

Cargo moved by EU tugs

According to the legal requirements for tugs, larger vessels are often required to have tug assistance (see assumption 3, methodology), which means that the total European throughput cannot be extrapolated based on the share of vessels that experience tug assistance (i.e. equal to 42%).

To calculate how much of the total cargo is moved by the 42% largest ships assisted by tugs we used detailed data based on vessel characteristics of ships using Dutch seaports in 2018.

Figure 7.6 displays the number of ships in different classes in Dutch ports. According to Eurostat⁴⁴, there are **135.584 ship calls** registered through Europe in 2017. The majority of these ships are rather small (ranging from vessel class 1 to 4). For the purpose of this study, we are particularly interested in the largest **56.300 vessels** as these are assumed to have tug assistance. In the following section, the vessel classes are offset against the total throughput.

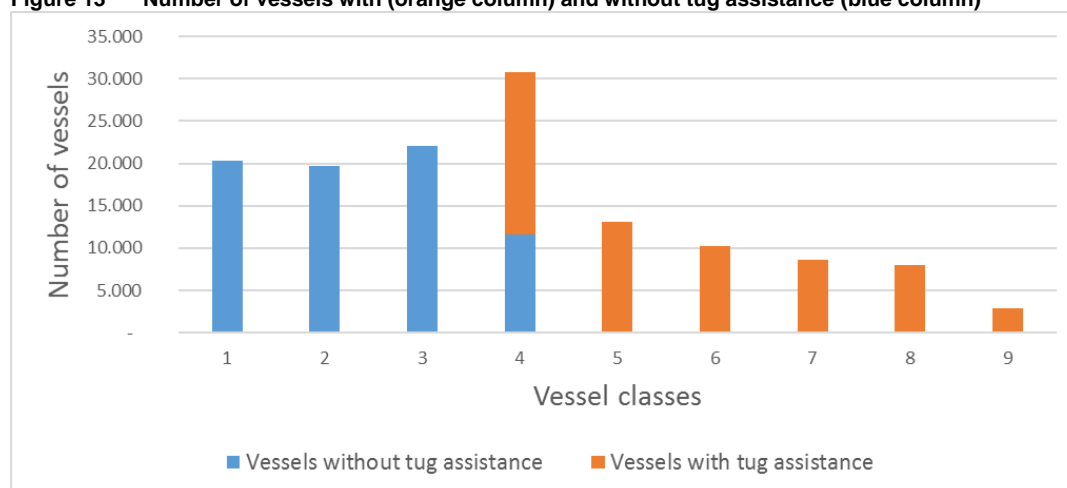
Figure 13 Number of vessels with (orange column) and without tug assistance (blue column)

Table 8 starts by presenting the absolute deadweight tonnage in Dutch ports and the corresponding percentage in respect to the total DWT. Larger vessels clearly transport the majority of cargo in Dutch port. For instance, vessel classes 4 to 9 already cover **91%** of the total DWT in Dutch ports. We have assumed these findings to be a fair estimation of the situation in the largest 15 European ports.

⁴⁴ Eurostat (2019), *Vessels in main ports by type and size of vessels (based on inwards declarations) - quarterly data*

Table 8 Cargo moved by European tugs in the largest 15 EU ports

Vessel class	Total Deadweight (in 1.000 tons)	Deadweight (in %)	Cargo moved by EU tugs (in 1.000 tons)
1	30.383	2%	26.591
2	50.163	3%	43.902
3	89.775	5%	78.570
4	191.371	10%	167.486
5	166.686	9%	145.881
6	221.526	12%	193.877
7	342.819	19%	300.031
8	478.182	26%	418.499
9	263.760	14%	230.840
Total	1.834.665	100%	1.605.678

Considering the average tug utilization shows that there are **187.700** tug operations started in the EU. As there are incoming and outgoing vessels and some vessels need two tugs to assist, the total share of tug assisted vessels is equal to 42% (equal to **56.300 vessels**). Assuming these are the largest vessels in the fleet, the total cargo moved equals roughly **80 to 90%** (roughly 1.3 billion tons out of 1.6 billion tons) of cargo in the major European seaports.

8 Strategic outlook European towage sector

8.1 The future of the towage industry

Concerning the strategic outlook for the European towage sector, there are three developments shaping the industry in the years to come. The first factor has to do with the changing port landscape in Europe and what changing port calls will mean for the industry. The second factor has to do with the market structure: the market for towage seems under pressure for further concentration. The third important aspect that will drive the sector is the need for innovation in the domain of digitalisation and energy transition. Hereunder we will cover all three aspects.

8.1.1 Changing port landscape

The ever-growing size of especially container vessels has led to a change in the whole port industry. Not only port and terminal infrastructure have to adapt, also maritime services providers have to invest in equipment and procedures to be able to provide safe services for the industry.

Some ports are faced by more and larger ship calls, especially after the Panama Canal expansion, and need to upgrade to bigger tugs. There is already evidence of speculative construction by some shipbuilders for 90-tonne bollard pull tugs. However, the exact application of these tugs in the European port landscape is rather unclear. In the future, there is likely to be a call for tugs with 80-90 tonnes of bollard pull, as sometimes there is a requirement to handle naval vessels. This opens the way to more agreements for construction of other ASD designs. In addition, the rise of short sea shipping as an European alternative to road transport might lead to a growth for towage services in both major and more regional European seaports.

8.1.2 Market structure calls for actions

Commentators saw the proposed merger between the major players KotugSmit (NL) and Boluda (ES) as a sign that the current market structure in which port towage service providers are active calls for further concentration among players. The continuing pressure on tariffs has led to a very competitive environment. Smaller players in the market will find it harder to cope with these challenges on their own⁴⁵. Also, major shipping lines want to have one supplier of towage services that can serve them in all major European seaports, in the proposed merger between KotugSmit and Boluda this was mentioned as a further stimulus⁴⁶.

8.1.3 Drive for innovation: digitalisation & energy transition

The towage sector, as all maritime sectors, is subject to developing plenty of possible applications and innovations. In the domain of digitalisation, we see two major developments. Firstly, developing the towage sector can play a major role in port call optimisation. In the future seaports will increasingly compete on the efficiency that is achieved during a vessel call. Currently, port authorities together with maritime service providers are already exchanging real time data. In several major international ports, the towage sector plays an important role in these initiatives⁴⁷. The other major development is the rapid rise in communication and connectivity between ship and

⁴⁵ Damen Harbour & Terminal Journal (2019), "Tugs Market"

⁴⁶ Financieel Dagblad (2019), *Kotug-ceo Ard-Jan Kooren: 'We gaan niet zitten jammeren, we nemen liever maatregelen'* (in Dutch)

⁴⁷ <https://portcalloptimization.org/images/Press%20release%20Port%20Strategy.pdf>

shore. A higher degree in operating efficiency can be achieved when support staff on shore can real time monitor engines and other mission critical systems on board.

Autonomous operated tugs a next step in towage innovation?

In April 2019, a Singapore based consortium of both the Singapore Maritime & Port Authority announced the launch of the first truly autonomous tugs in 2020. In cooperation with a number of major technology providers an already existing tugboat will be rebuilt into an autonomous 52 tonnes bollard pull tug for port operations⁴⁸. During the 2018 International Tug, Salvage & OSV Convention and Exhibition (ITS) ITS in Marseille, Kotug showed during a live presentation how the RT Borkum tug, at that point in time sailing in the port of Rotterdam, could be operated by a captain in Marseille using a special remote secured internet line and camera images⁴⁹.

Finally, the energy transition will also affect the harbour towage industry. Stricter emission requirements are expected in most seaports in the short term, while in the longer term a shift to alternative fuels will be required. Major engine providers are already marketing LNG fuelled engines as an option in this energy transition⁵⁰. Another option might be the application of hybrid tugs where the conventional engine is supplemented by battery technology⁵¹.

⁴⁸ Tug Technology and Business (2019), *First autonomous tug in 2020*, https://www.tugtechnologyandbusiness.com/news/view/first-autonomous-tug-in-2020_57569.htm

⁴⁹ Kotug (2018), *Kotug demonstrates remote controlled tugboat sailing over long distance*, <https://www.kotug.com/newsmedia/kotug-demonstrates-remote-controlled-tugboat-sailing-over-long-distance>

⁵⁰ Wartsila (2015), *New LNG tug opens a market*, <https://www.wartsila.com/twentyfour7/in-detail/new-lng-tug-opens-a-market>

⁵¹ RH Marine (2018), *The advantages of a low emission hybrid e-tug*, <https://www.rhmarine.com/news/the-advantages-of-a-low-emission-hybrid-e-tug/>

Annex I: Tug characteristics

Table 9 Tug characteristics: number of tugs, average year built and age

Port Country	Port Country (abbreviation)	Number of tugs	Average year built	Age
Belgium	BE	58	1998	21
Bulgaria	BG	15	1990	29
Cyprus	CY	17	1990	29
Germany	DE	100	1997	22
Denmark	DK	30	1989	30
Estonia	EE	12	1993	26
Spain	ES	161	1996	23
Finland	FI	50	1975	44
France	FR	69	1998	21
Great Britain	GB	196	1997	22
Greece	GR	83	1987	32
Croatia	HR	12	1991	29
Italy	IT	141	2001	18
Lithuania	LT	11	1997	22
Latvia	LV	17	1990	29
Malta	MT	13	1992	27
Netherlands	NL	125	2000	19
Poland	PL	37	1988	31
Portugal	PT	40	1987	32
Romania	RO	41	1987	32
Sweden	SE	48	1983	36
Slovenia	SI	4	2003	16
Ireland	IE	13	1990	29
Norway	NO	54	1989	30
Turkey	TR	166	2000	19
Iceland	IS	6	2002	17
Ukraine	UA	76	1986	33
Total / Average		1.595	1992	27

Source: MarineTraffic (2019)

Annex II: New built tugs, period 2010 – 2018

Table 10 New built tugs (period 2010 – 2018)

Country	Port Country	Number of tugs	2010	2011	2012	2013	2014	2015	2016	2017	2018
Belgium	BE	58	2	5	5	0	0	1	1	2	1
Bulgaria	BG	15	0	0	0	1	0	0	0	1	0
Cyprus	CY	17	0	0	0	0	2	0	0	0	0
Germany	DE	100	4	3	4	2	6	4	3	2	2
Denmark	DK	30	1	0	1	1	0	0	1	0	0
Estonia	EE	12	0	0	0	0	0	0	0	1	0
Spain	ES	161	5	3	1	1	0	1	3	5	5
Finland	FI	50	0	0	0	0	0	0	0	0	1
France	FR	69	1	1	0	2	1	0	2	1	1
Great Britain	GB	196	9	1	5	1	6	6	3	9	0
Greece	GR	83	1	1	0	0	1	1	0	1	0
Croatia	HR	12	1	0	0	0	0	0	0	0	0
Italy	IT	141	8	3	0	2	3	3	5	6	3
Lithuania	LT	11	0	0	0	0	0	3	0	0	0
Latvia	LV	17	0	1	0	1	0	0	0	0	0
Malta	MT	13	0	1	0	0	0	0	0	1	0
Netherlands	NL	125	6	1	3	4	5	6	7	2	6
Poland	PL	37	1	0	0	0	0	1	2	0	1
Portugal	PT	40	0	1	2	0	0	0	0	0	0
Romania	RO	41	1	0	0	0	0	0	0	0	1
Sweden	SE	48	2	1	1	0	1	0	0	0	0
Slovenia	SI	4	0	1	0	0	0	0	0	1	0
Ireland	IE	13	3	0	0	0	0	0	0	0	0
Norway	NO	54	1	0	0	0	3	1	0	2	0
Turkey	TR	166	2	6	4	2	7	9	17	4	7
Iceland	IS	6	0	0	0	0	0	0	0	0	1
Ukraine	UA	76	1	2	4	0	2	0	0	0	0
Total / average		1.595	49	31	30	17	37	36	44	38	29

Source: MarineTraffic (2019)

Annex III: Investments

Table 11 **Yearly investments in the towage sector**

Years	Number of tugs	Lower estimate	Higher estimate	Average estimate
2010	49	460 mln.	598 mln.	310,5 mln.
2011	31	230 mln.	299 mln.	310,5 mln.
2012	30	220 mln.	286 mln.	310,5 mln.
2013	17	150 mln.	195 mln.	310,5 mln.
2014	37	280 mln.	364 mln.	310,5 mln.
2015	36	270 mln.	351 mln.	310,5 mln.
2016	44	270 mln.	351 mln.	310,5 mln.
2017	38	340 mln.	442 mln.	310,5 mln.
2018	29	210 mln.	273 mln.	310,5 mln.

Source: MarineTraffic (2019) & Purchase prices

About Ecorys

Ecorys is a leading international research and consultancy company, addressing society's key challenges. With world-class research-based consultancy, we help public and private clients make and implement informed decisions leading to positive impact on society. We support our clients with sound analysis and inspiring ideas, practical solutions and delivery of projects for complex market, policy and management issues.

In 1929, businessmen from what is now Erasmus University Rotterdam founded the Netherlands Economic Institute (NEI). Its goal was to bridge the opposing worlds of economic research and business – in 2000, this much respected Institute became Ecorys.

Throughout the years, Ecorys expanded across the globe, with offices in Europe, Africa, the Middle East and Asia. Our staff originates from many different cultural backgrounds and areas of expertise because we believe in the power that different perspectives bring to our organisation and our clients.

Ecorys excels in seven areas of expertise:

- Economic growth;
- Social policy;
- Natural resources;
- Regions & Cities;
- Transport & Infrastructure;
- Public sector reform;
- Security & Justice.

Ecorys offers a clear set of products and services:

- preparation and formulation of policies;
- programme management;
- communications;
- capacity building;
- monitoring and evaluation.

We value our independence, our integrity and our partners. We care about the environment in which we work and live. We have an active Corporate Social Responsibility policy, which aims to create shared value that benefits society and business. We are ISO 14001 certified, supported by all our staff.



P.O. Box 4175
3006 AD Rotterdam
The Netherlands

Watermanweg 44
3067 GG Rotterdam
The Netherlands

T +31 (0)10 453 88 00
F +31 (0)10 453 07 68
E netherlands@ecorys.com
Registration no. 24316726

W www.ecorys.nl

Sound analysis, inspiring ideas