



ASOCIACIÓN REGIONAL DE EMPRESAS DEL SECTOR  
PETRÓLEO, GAS Y BIOCMBUSTIBLES  
EN LATINOAMÉRICA Y EL CARIBE.

# Environmental Performance Benchmarking in the Oil and Gas Industry in Latin America and the Caribbean (2017 data)

ARPEL Publication BE04-2018

## **Environmental Performance Benchmarking in the Oil and Gas Industry in Latin America and the Caribbean – Information of ARPEL Member Companies for 2017**

**Report BE 04-2018 – December 2018**

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# **1. Introduction, scope and methodology**

# Introduction

The environmental performance benchmarking report is a compilation of environmental statistics of ARPEL member companies which has been performed since 2008, on an annual basis.

- The report analyzes indicators on:
  - Oil spills in water and land
  - Produced water discharges and re-injection
  - Hydrocarbons discharges and concentration in process effluents
  - Hazardous and non-hazardous waste generation
  - Freshwater withdraw and use
  - Direct greenhouse gases (GHG) emissions

# Scope

- Nineteen companies or country business units from ten different countries submitted its data for 2017. Each company's country business unit is considered separately.
- Companies and countries:

<b>ANCAP</b> (Uruguay)	<b>PAN AMERICAN ENERGY</b> (Argentina)	<b>RECOPE</b> (Costa Rica)
<b>ECOPETROL</b> (Colombia)	<b>PEMEX</b> (Mexico)	<b>REPSOL</b> (Bolivia, Ecuador and Peru)
<b>EP PETROECUADOR</b> (Ecuador)	<b>PETROPAR</b> (Paraguay)	<b>TECPETROL</b> (Argentina)
<b>EQUION</b> (Colombia)	<b>PETROTRIN</b> (Trinidad & Tobago)	<b>YPF</b> (Argentina)
<b>OLDELVAL</b> (Argentina)	<b>PLUSPETROL</b> (Argentina, Bolivia and Peru)	<b>YPFB Transporte</b> (Bolivia)

# Scope

- The environmental information is reported voluntarily by ARPEL member companies.
- The information submitted in 2017 comes from:
  - 873 offshore production wells
  - 27,210 onshore production wells
  - 1,295 non conventional production wells
  - 63,850 kms of pipelines
  - 147 terminals
  - 18 refineries

# Scope

- The table below shows the total volume of hydrocarbons considered in the report

<b>Business Line</b>	<b>Thousand tonnes of hydrocarbons (produced, transported, operated or refined)</b>
<b>Offshore production</b>	<b>108,516</b>
<b>Onshore production</b>	<b>144,697</b>
<b>Non conventional production</b>	<b>6,026</b>
<b>Pipelines</b>	<b>257,801</b>
<b>Terminals</b>	<b>66,043</b>
<b>Refineries</b>	<b>93,477</b>
<b>Distribution / Transport</b>	<b>21,751</b>

## 2. Oil Spills

# Oil Spills - Indicators

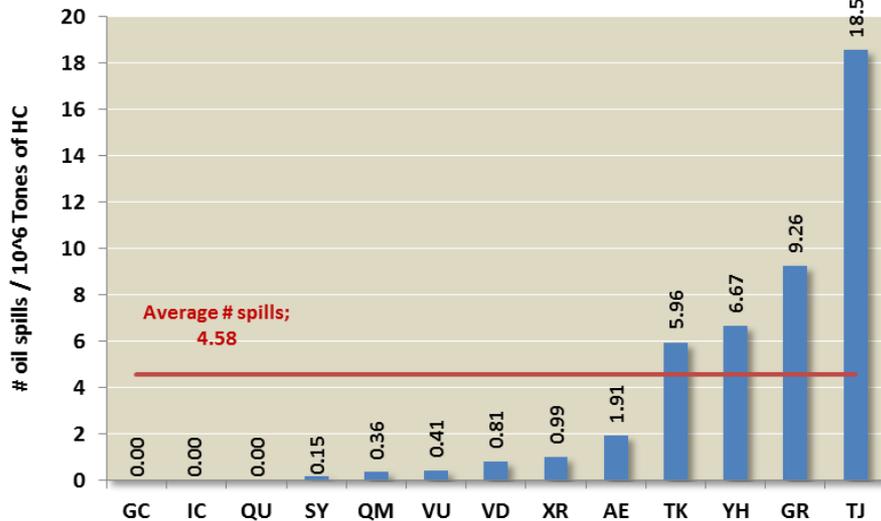
- Indicators
  - Total amount of spills and spilled volume (in barrels) per million hydrocarbon tonnes produced, processed or transported (depending on the business line).
  - Table of spills by business line
- Business Lines
  - Onshore production
  - Pipelines
  - Terminals
  - Refining
  - Distribution/Transport

# Oil Spills - definitions

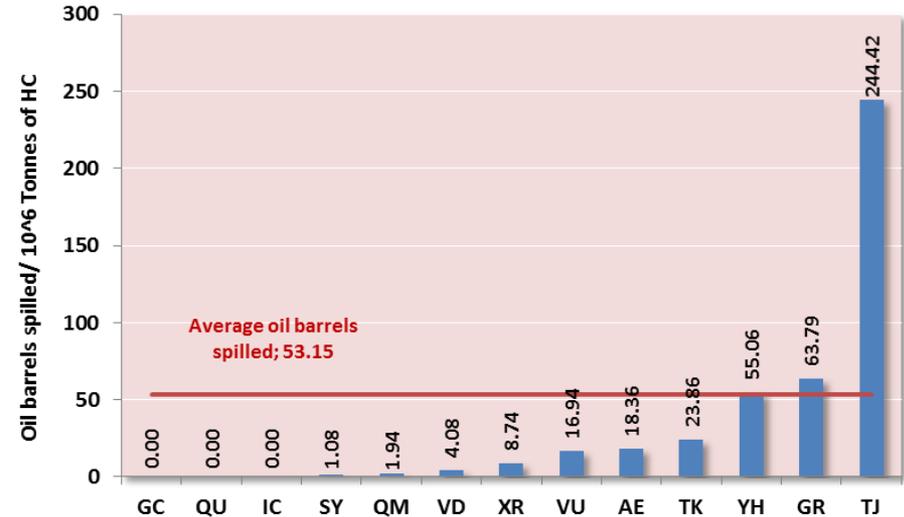
- Oil spills include:
  - Primary or secondary containment into the “environment”, including land (permeable materials like soil, sand, silts, shells, gravel, etc.), ice or water
- Water spills are those that reach surface water (fresh, salt or brackish). Offshore spills are always classified as water spills
- Oil spills do not include:
  - Primary and/or secondary containment or other impermeable surfaces if they do not reach the environment
  - Workover fluids and synthetic, oil or mineral based drilling fluids
  - Chemical spills
  - Spills of produced water or process wastewater
  - Historical or past leakage that reached the natural environment from tanks, pipes or other vessels, but is not associated with a current release

# Oil Spills – onshore production

# oil spills/10<sup>6</sup> Tonnes of HC (onshore production)



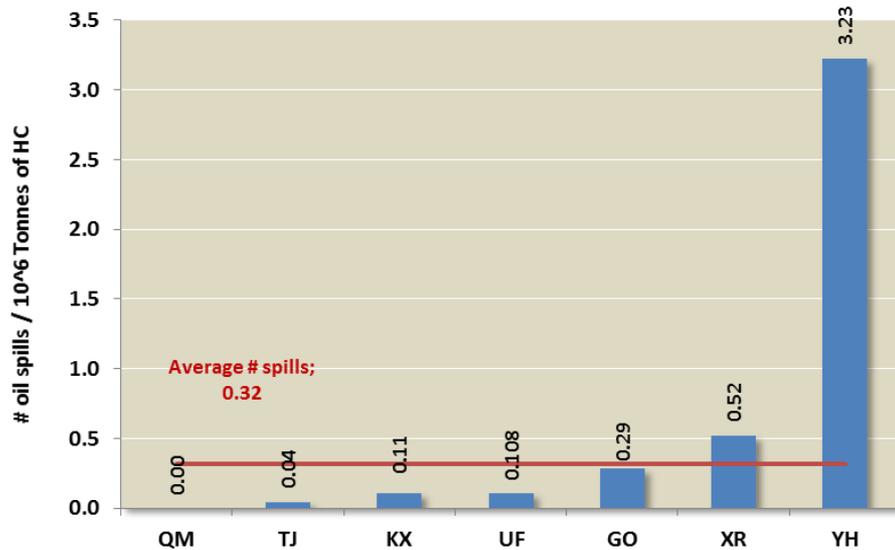
Barrels spilled/10<sup>6</sup> Tonnes of HC (onshore production)



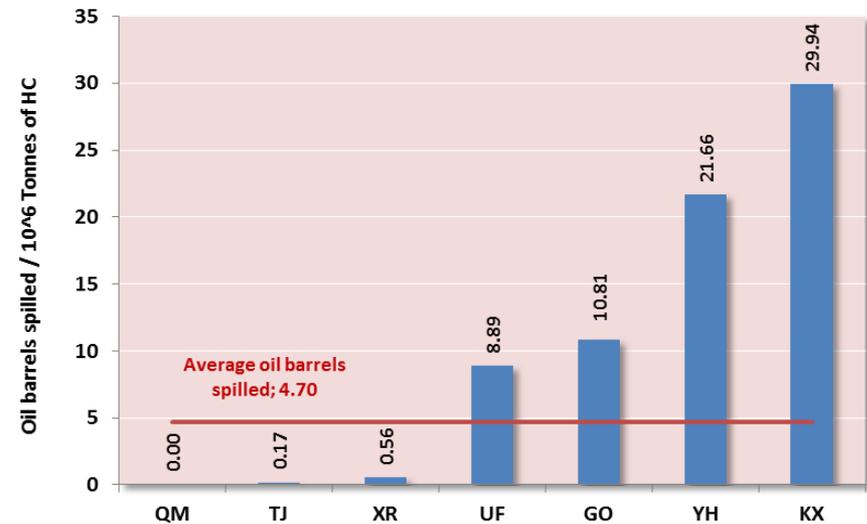
- A total amount of 13 companies shared information about oil spills for onshore production.
- Three of them did not report any oil spills.
- The average was 4.58 oil spills and 53.15 oil barrels spilled per million tonnes of hydrocarbons produced.

# Oil Spills - pipelines

# oil spills/10<sup>6</sup> Tonnes of HC (Pipelines)



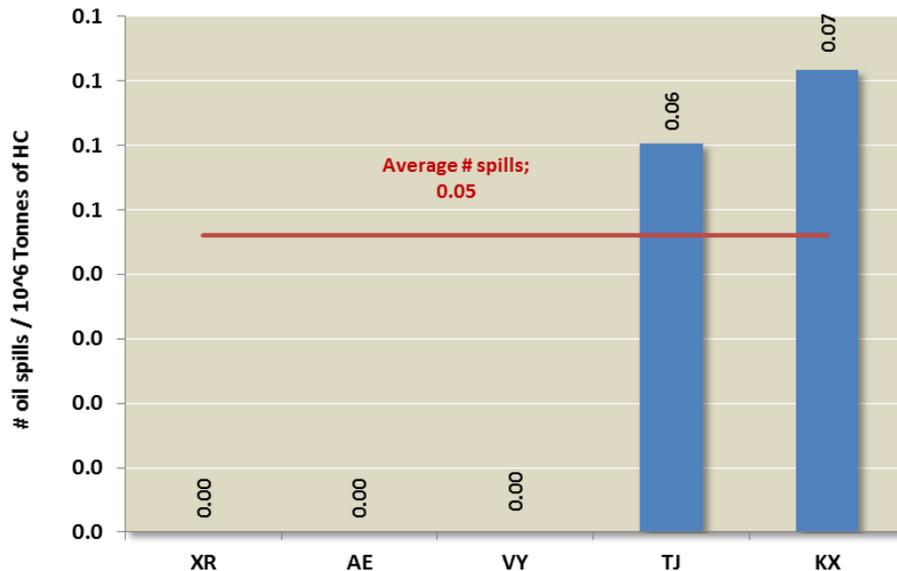
Barrels spilled/10<sup>6</sup> Tonnes of HC (Pipelines)



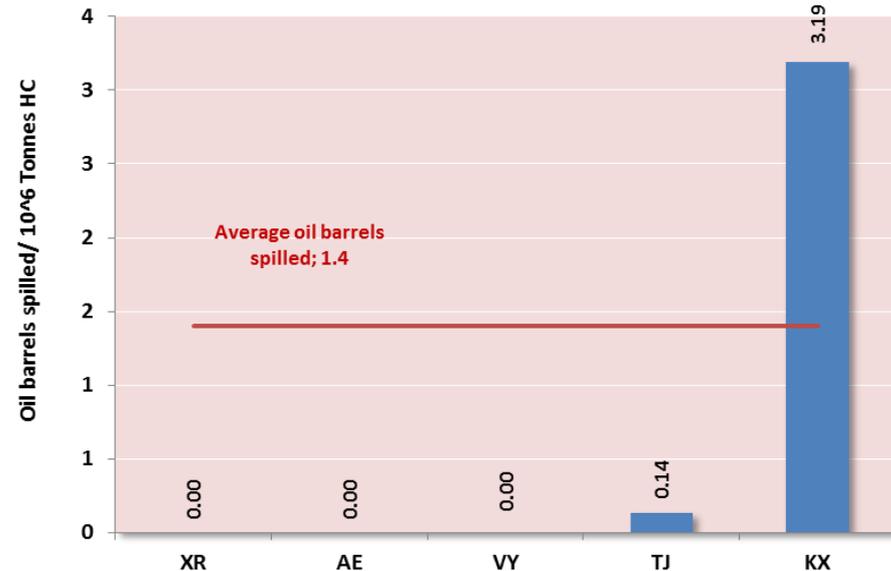
- Seven companies submitted data for pipelines
- Only one of them did not report any oil spills and another one shows values much higher than the average.
- The average was 3.23 oil spills and 4.70 oil barrels spilled per million tonnes of hydrocarbons transported by pipelines.

# Oil Spills - terminals

# oil spills/10<sup>6</sup> Tonnes HC (Terminals)



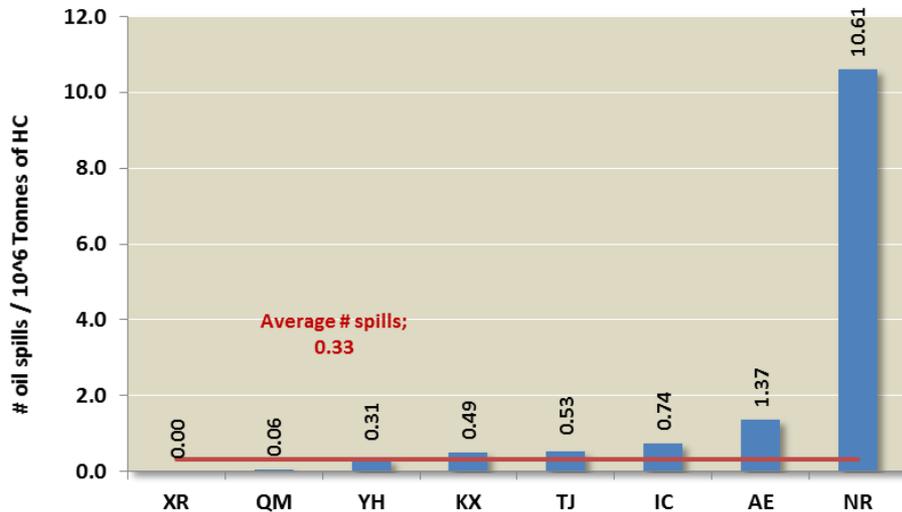
Barrels spilled/10<sup>6</sup> Tonnes HC (Terminals)



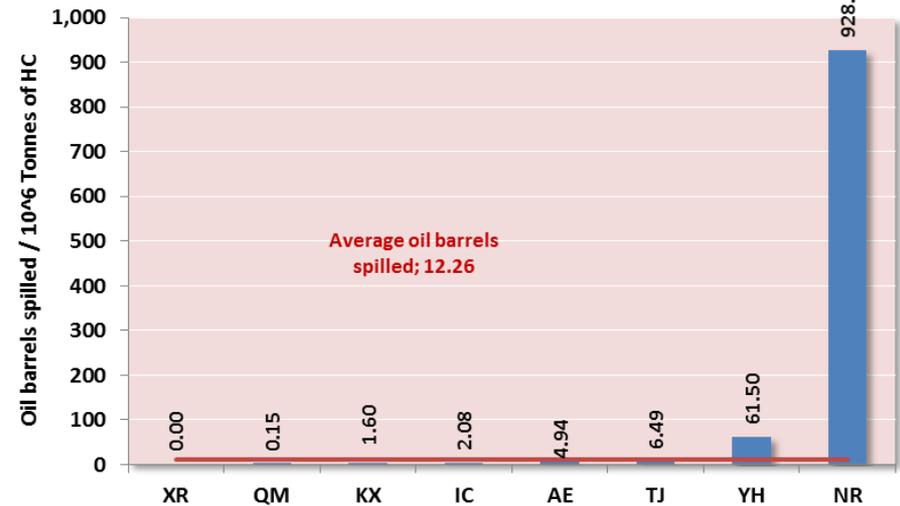
- Five companies submitted information for the business line terminals.
- Three of them did not report any oil spills.
- The average was 0.05 oil spills and 1.40 oil barrels spilled per million hydrocarbons operated.
- Terminals is the business line that shows less oil spills and oil barrels spilled per million tonnes of hydrocarbons operated.

# Oil Spills - refining

# oil spills/10<sup>6</sup> Tonnes of HC (Refineries)

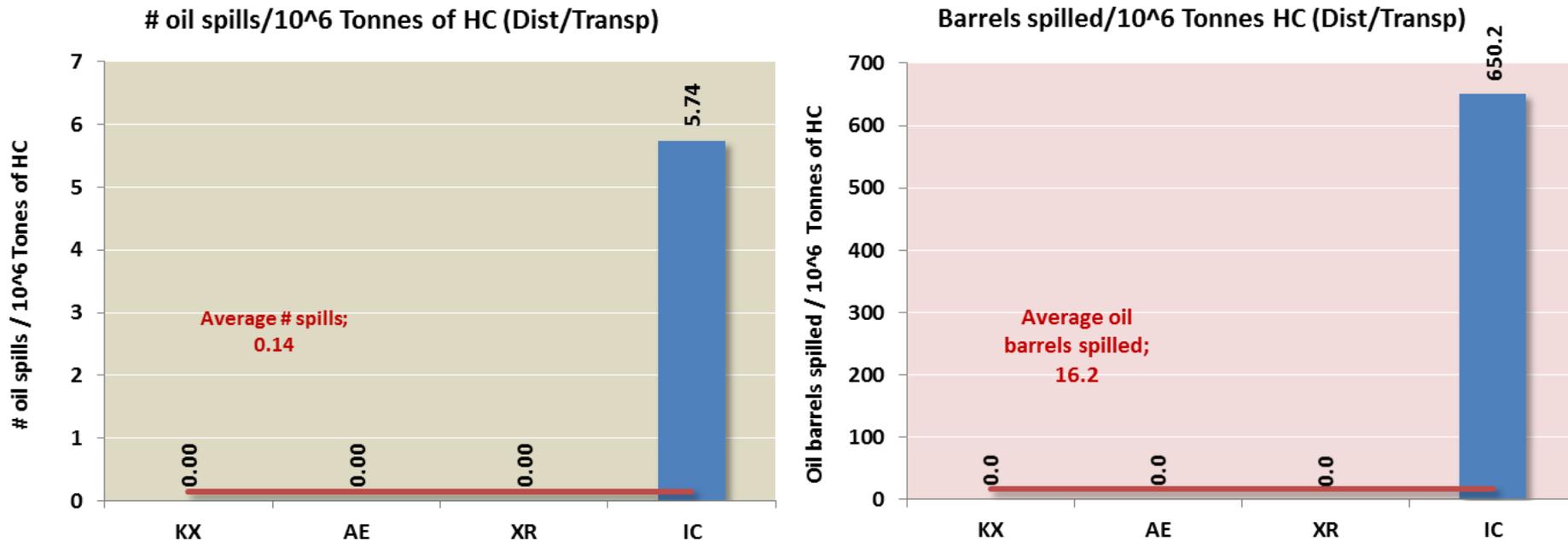


Barrels spilled/10<sup>6</sup> Tonnes of HC (Refineries)



- Eight companies submitted data about oil spills in the business line refining.
- Only one company did not report any oil spills.
- The average was 0.33 and oil spills and 12.26 oil barrels spilled per million tonnes of hydrocarbons charged for processing.
- Two single oil spills around 400 barrels each make the averages of companies YH and NR much higher than the global average.

# Oil spills - distribution



- Only 4 companies submitted data about oil spills and only 1 of them showed oil spills
- A single oil spill around 300 barrels affects the average significantly

# Oil spills broken down by business line



	# oil spills in land	# oil spills in water	# total oil spills	Vol spilled in land (bbl)	Vol spilled in water (bbl)	Total volume spilled (bbl)
<b>Offshore production</b>	<b>0</b>	<b>8</b>	<b>8</b>	<b>0.0</b>	<b>23.0</b>	<b>23.0</b>
1-10		7	7		11	11
10-100		1	1		12	12
+ 100		0	0		0	0
# spills or bbls. / 10 <sup>6</sup> Tonnes of HC		<b>0.07</b>	<b>0.07</b>		<b>0.2</b>	<b>0.4</b>
<b>average bbls per oil spill</b>					<b>2.9</b>	<b>2.9</b>
<b>Onshore production</b>	<b>657</b>	<b>6</b>	<b>663</b>	<b>7,634</b>	<b>56</b>	<b>7,691</b>
1-10	545	4	549	1,646	4	1,650
10-100	106	2	108	2,539	52	2,592
+ 100	6	0	6	3,449	0	3,449
# spills or bbls. / 10 <sup>6</sup> Tonnes of HC	<b>4.54</b>	<b>0.04</b>	<b>4.58</b>	<b>52.76</b>	<b>0.39</b>	<b>53.15</b>
<b>average bbls per oil spill</b>				<b>11.62</b>	<b>9.41</b>	<b>11.60</b>
<b>Pipelines</b>	<b>75</b>	<b>6</b>	<b>81</b>	<b>1,191</b>	<b>8</b>	<b>1,199</b>
1-10	66	6	72	79	8	87
10-100	7	0	7	205	0	205
+ 100	2	0	2	906	0	906
# spills or bbls. / 10 <sup>6</sup> Tonnes of HC	<b>0.29</b>	<b>0.02</b>	<b>0.32</b>	<b>4.66</b>	<b>0.03</b>	<b>4.70</b>
<b>average bbls per oil spill</b>				<b>15.88</b>	<b>1.33</b>	<b>14.80</b>
<b>Terminals</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>71</b>	<b>20</b>	<b>91</b>
1-10	1	0	1	2	0	2
10-100	1	1	2	69	20	89
+ 100	0	0	0	0	0	0
# spills or bbls. / 10 <sup>6</sup> Tonnes of HC	<b>0.03</b>	<b>0.02</b>	<b>0.05</b>	<b>1.09</b>	<b>0.31</b>	<b>1.40</b>
<b>average bbls per oil spill</b>				<b>35.63</b>	<b>20.00</b>	<b>30.42</b>
<b>Dist/Transp</b>	<b>3</b>	<b>0</b>	<b>3</b>	<b>340</b>	<b>0</b>	<b>340</b>
1-10	2	0	2	5	0	5
10-100	0	0	0	0	0	0
+ 100	1	0	1	335	0	335
# spills or bbls. / 10 <sup>6</sup> Tonnes of HC	<b>0.14</b>	<b>0.00</b>	<b>0.14</b>	<b>16.2</b>	<b>0.0</b>	<b>16.2</b>
<b>average bbls per oil spill</b>				<b>113.2</b>	<b>-</b>	<b>113.2</b>
<b>Refining</b>	<b>26</b>	<b>5</b>	<b>31</b>	<b>689</b>	<b>458</b>	<b>1,146</b>
1-10	17	3	20	50	7	56
10-100	8	1	9	211	63	274
+ 100	1	1	2	428	388	816
# spills or bbls. / 10 <sup>6</sup> Tonnes of HC	<b>0.28</b>	<b>0.05</b>	<b>0.33</b>	<b>7.37</b>	<b>4.90</b>	<b>12.26</b>
<b>average bbls per oil spill</b>				<b>26.49</b>	<b>91.52</b>	<b>36.98</b>

# Oil Spills by business line

- As it is possible to see in the previous table, onshore production was the business line that registered the highest amount of oil spills and oil barrels spilled per million tonnes of hydrocarbons operated.
- A total amount of 789 oil spills and 10,490 oil barrels spilled were registered for all business lines.
- 97% of the oil spills had land as the final destination, and only 3% reached surface water.
- Regarding volume, the proportion was 95% in land and 5% in water.

## **3. Produced Water**

# Produced Water – Indicators

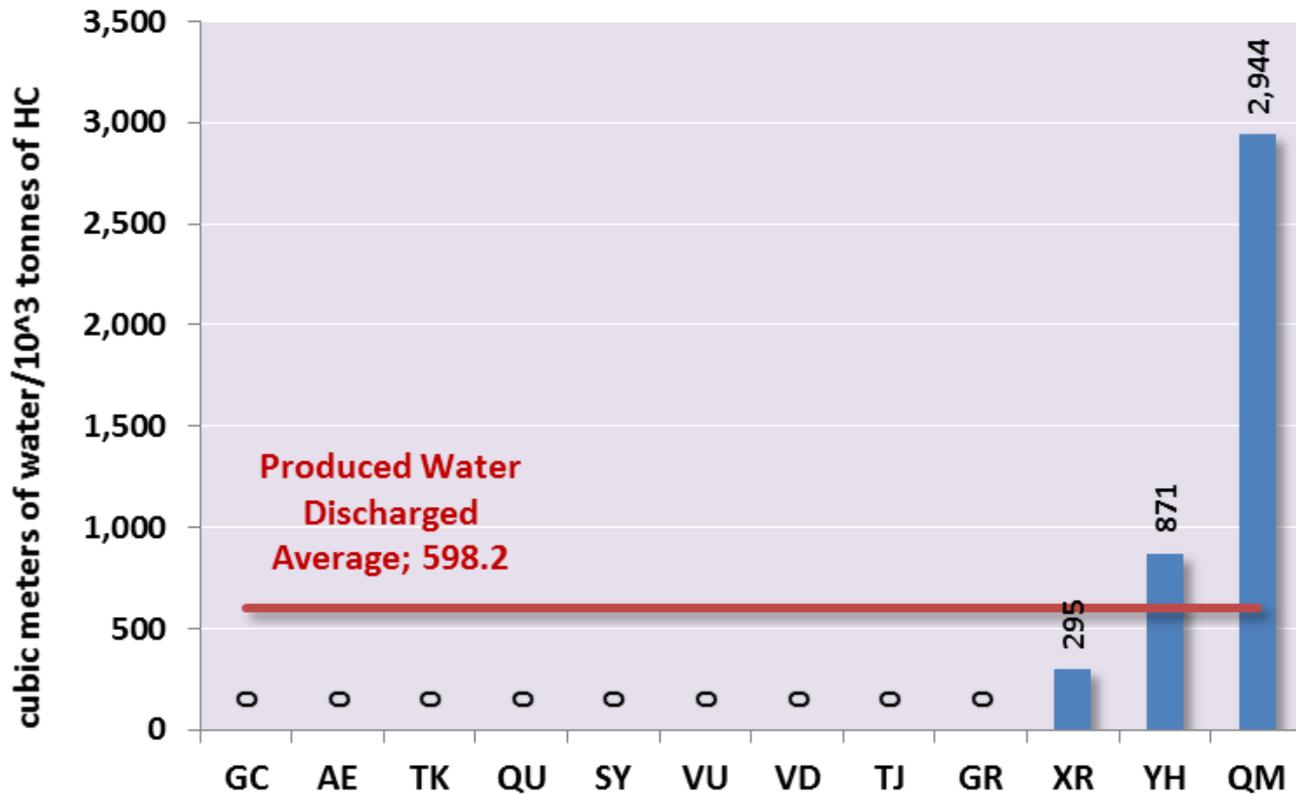
- Indicators
  - Produced water discharged
  - Hydrocarbons discharged in produced water
  - Produced water re-injection
- Business Lines
  - Onshore production

# Produced Water - Definitions

- “Produced water discharges” is the amount of produced water discharged to a water environment (both inland waterways and to the sea), including inland discharges to drainage structures that connect to waterways, as well as produced water that is treated and discharged on land.
- “Produced Water Re-injection” refers to the amount of produced water re-injected as a disposal management method, including both water disposed into injection wells, and water re-injected for secondary recovery.
- These indicators include:
  - the quantity of produced water discharged
  - the quantity of produced water that is treated and discharged on land
  - the quantity of hydrocarbon discharged to water through produced water discharges
  - the quantity of water re-injected as a disposal management method
- These indicators do NOT include:
  - Spills, upsets or accidental discharges (included in chapter 5.1)
  - Spills of oil-based drilling fluids and cuttings
  - Spills of drilling and production chemicals
  - Quantities discharged to third-party treatment facilities
  - Discharges of drilling fluids or drilling mud

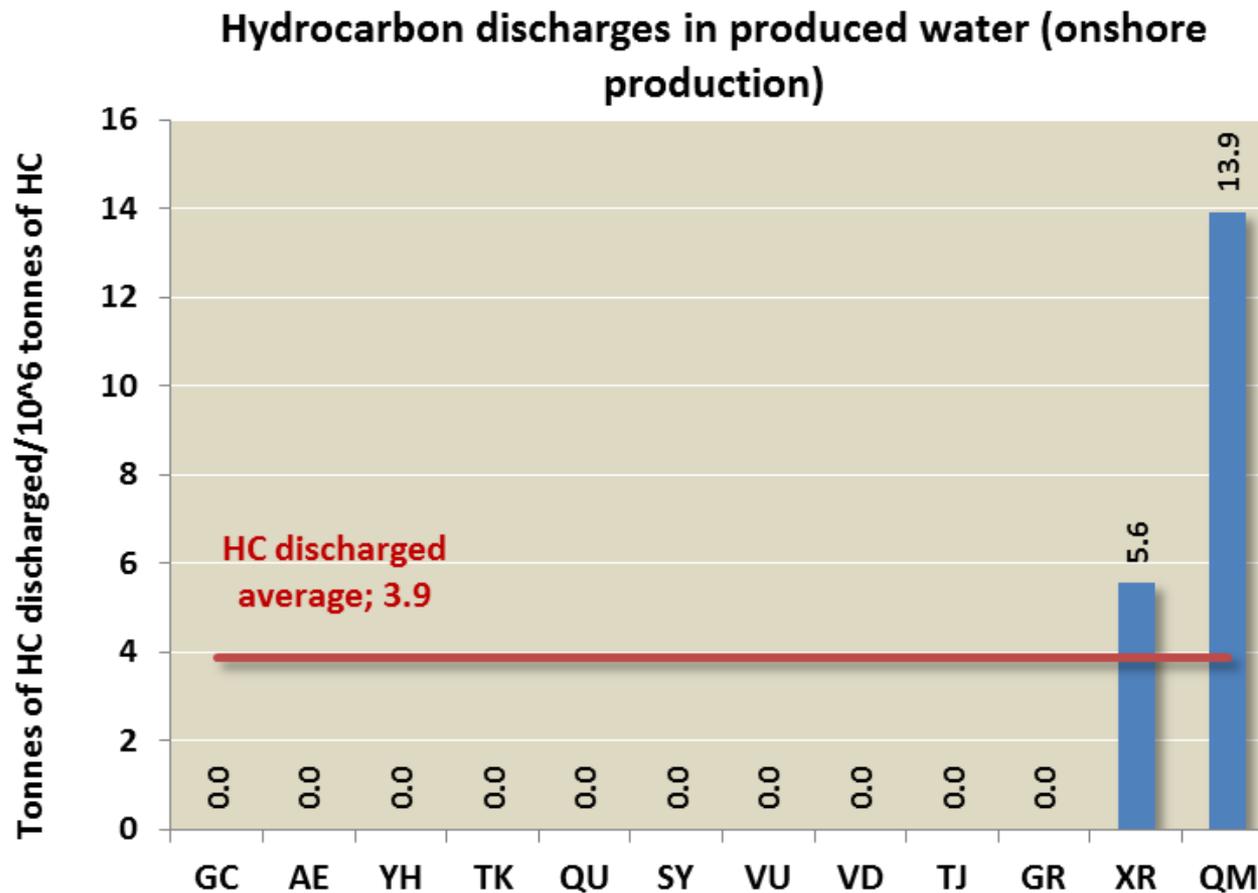
# Produced Water Discharges – onshore production

Produced water discharged (onshore production)

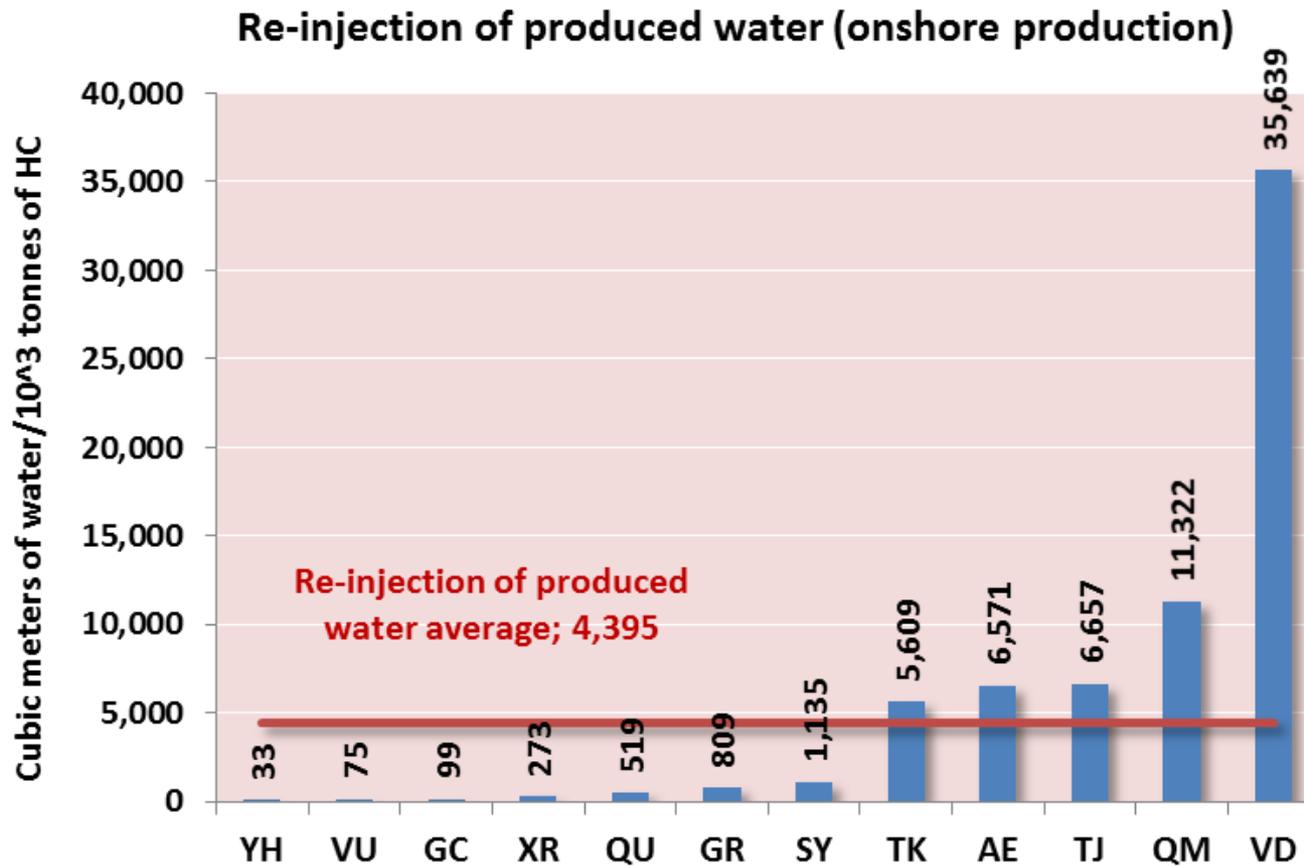


- Twelve companies submitted data about produced water management
- Nine of them re-inject all the produced water into the subsoil
- One of the other three companies re-injects 80% of the produced water and another one the 50%.

# Hydrocarbon Discharges in Produced Water – onshore production



# Prudced Water Re-injection – onshore production



## 4. Process Effluents

# Process Effluents - Indicators

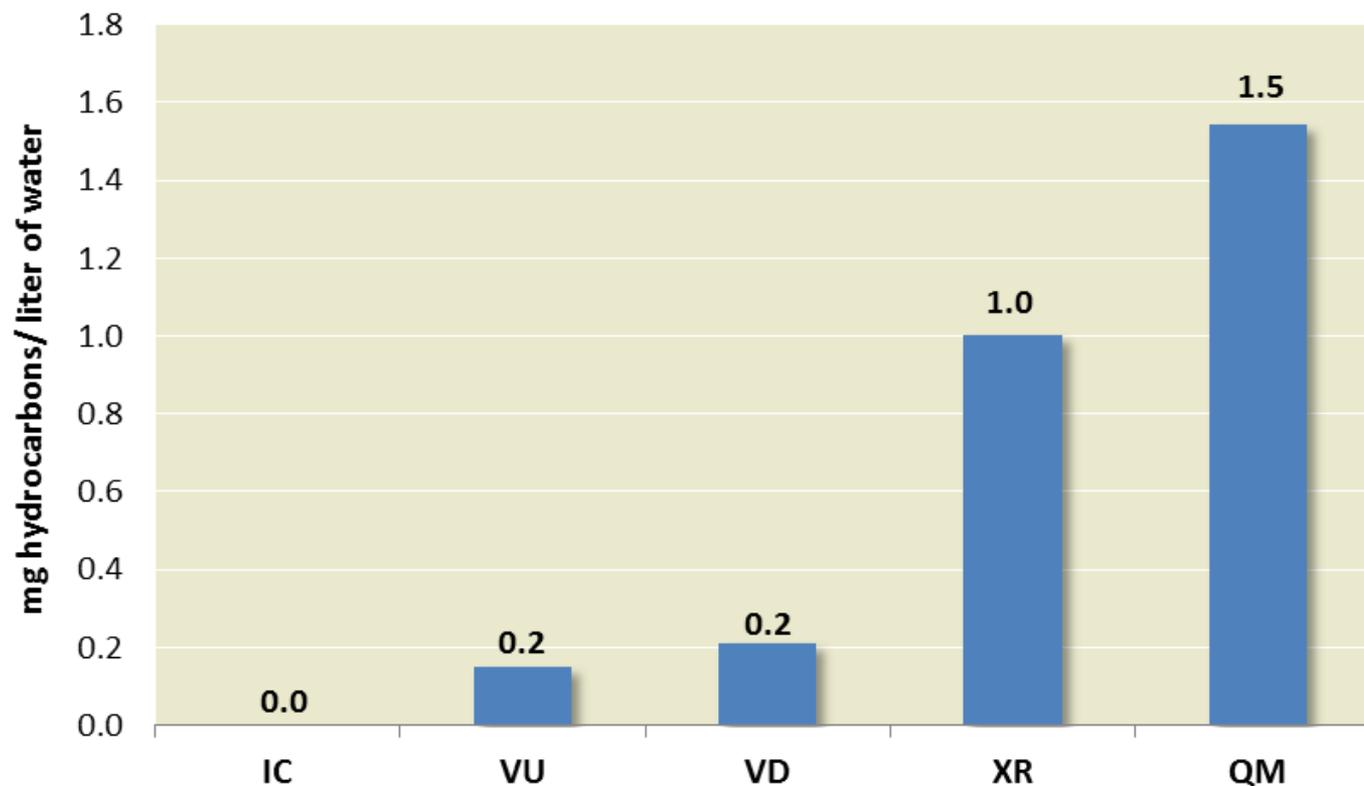
- Indicators
  - Concentration of hydrocarbons in water discharged as an effluent of the production process
- Business Lines
  - Onshore production
  - Pipelines
  - Terminals
  - Refining

# Process Effluents - Definitions

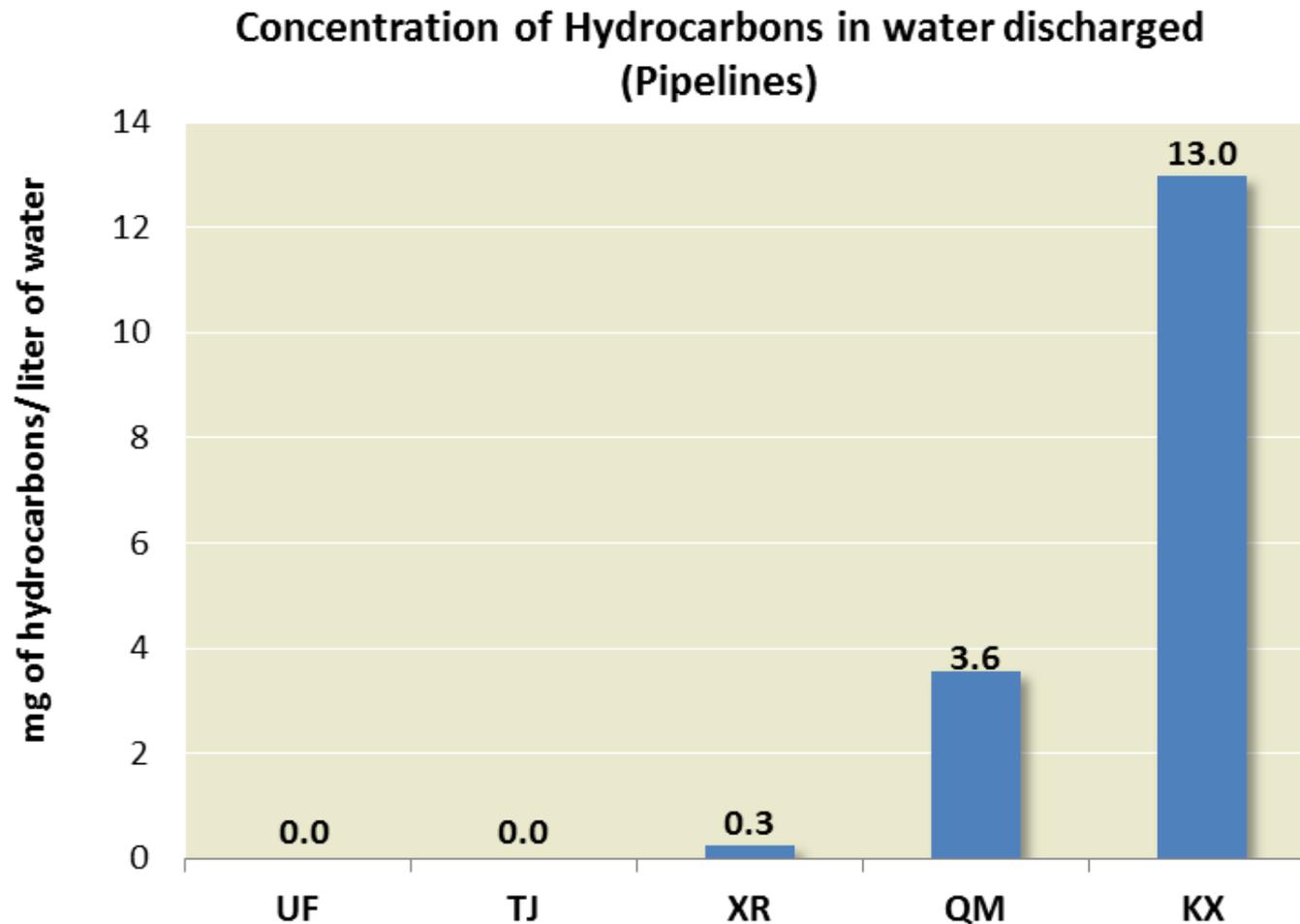
- These indicators include:
  - The quantity of hydrocarbons contained in discharges of process effluents from facilities. Inland discharges to drainage structures that connect to waterways are considered.
- These indicators do NOT include:
  - Oil spills or accidental discharges
  - Spills of drill cuts or hydrocarbon-based drilling fluids
  - Spills of chemical products coming from production and drilling activities
  - Amounts discharged to third parties treatment facilities
  - Discharges of drilling fluids and mud
  - For the Production function, produced water discharges should NOT be included because they are already considered on section 3.

# Hydrocarbons Concentration in Process Effluent Water – onshore production

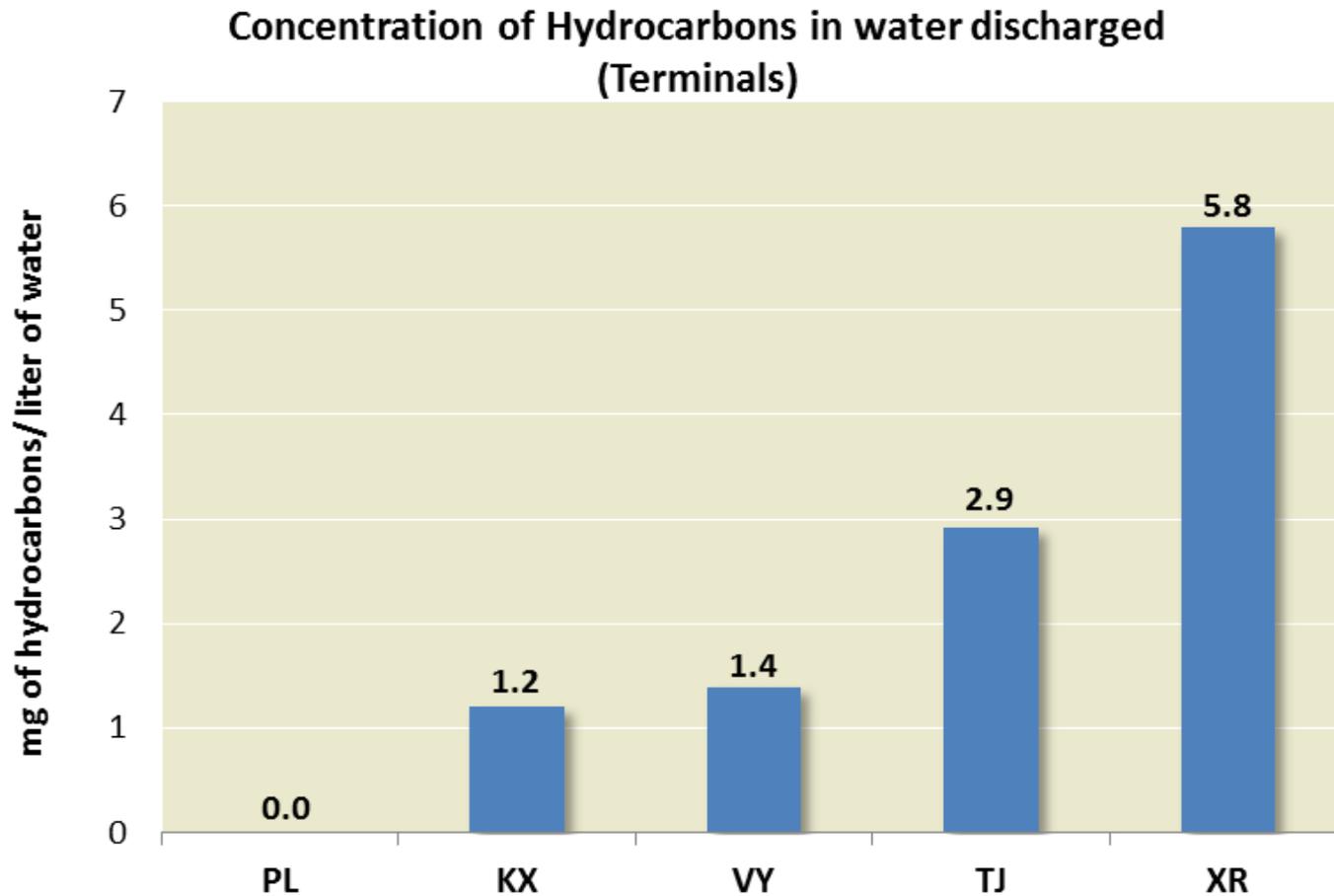
Concentration of Hydrocarbons in water discharged (onshore production)



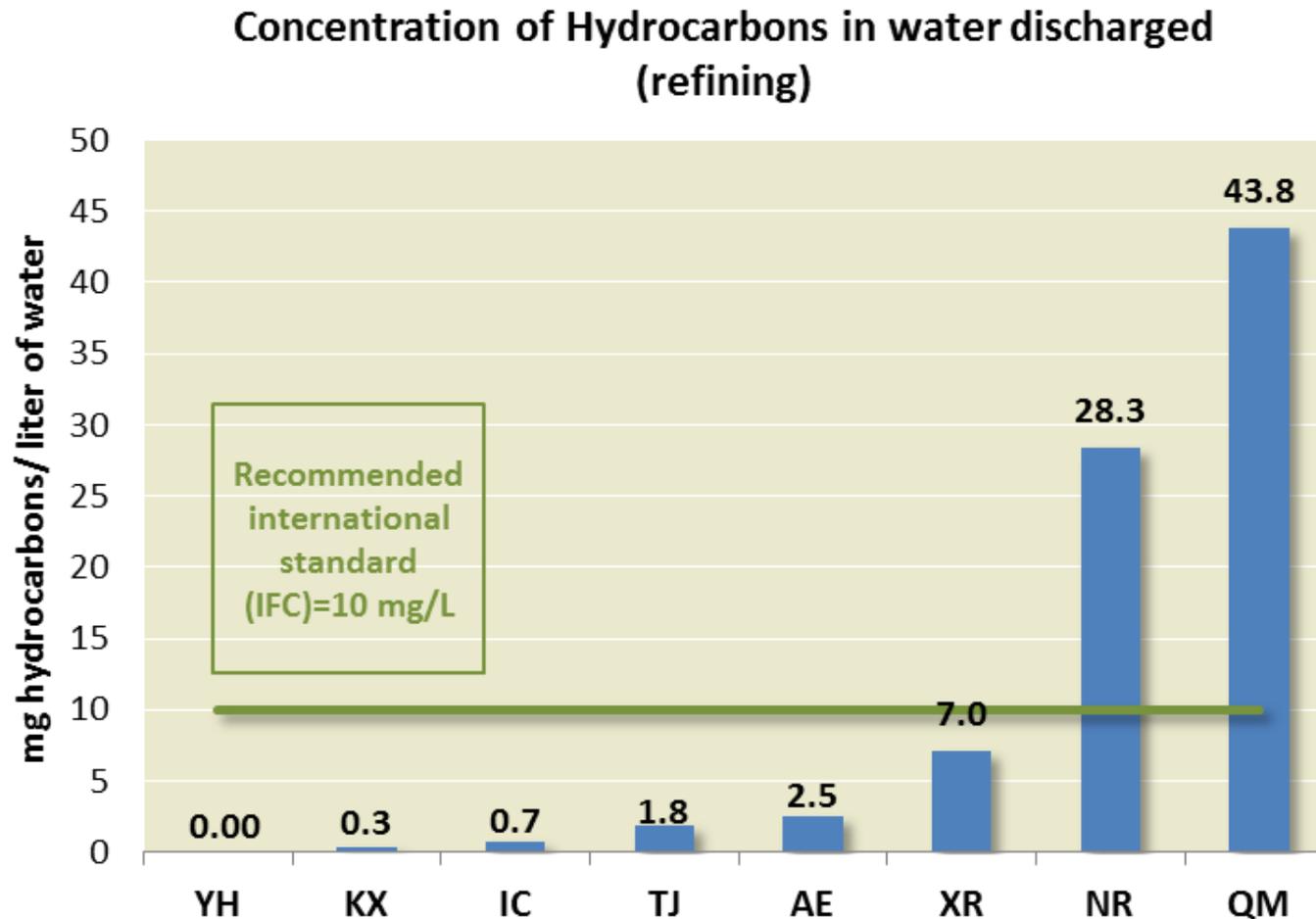
# Hydrocarbons Concentration in Process Effluent Water – pipelines



# Hydrocarbons Concentration in Process Effluent Water – terminals



# Hydrocarbons Concentration in Process Effluent Water – refining



## **5. Waste Generation**

# Waste Generation - Indicators

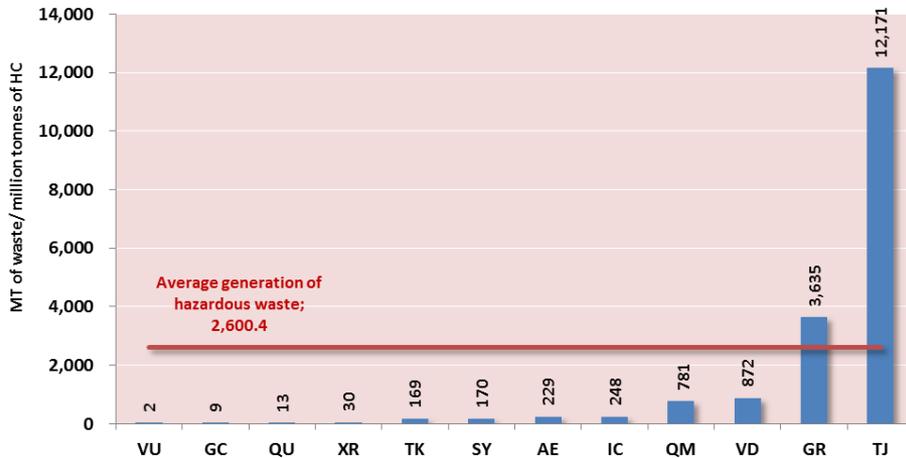
- Indicators
  - Generation of hazardous waste
  - Generation of non-hazardous waste
- Business lines
  - Onshore production
  - Pipelines
  - Terminals
  - Refining

# Waste Generation - Definitions

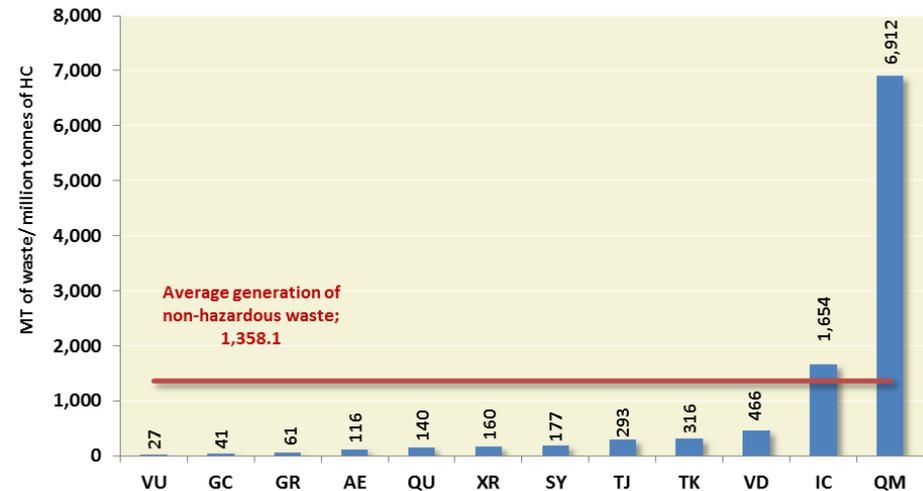
- Hazardous waste includes all waste that is defined as hazardous, toxic, dangerous, listed, priority, special, or some other similar term as defined by an appropriate local regulatory agency or authority. This metric includes both on-site and off-site disposal.
- Non-hazardous waste includes industrial wastes resulting from company operations that are not designated or listed as 'hazardous' by the appropriate local regulatory agency. 'Local' refers to the point of waste generation. This category consists of materials disposed of both on-site and off-site, including trash and other office, commercial or packaging related wastes.
- Hazardous waste do not include:
  - Hazardous wastes treated on-site and rendered non-hazardous
  - Non-hazardous waste (listed in the next section)
  - Hazardous wastes that by legitimate reuse, reclamation, or recycling cease to be regulated as hazardous wastes
- Disposal is considered any waste management option classified as 'disposal' by the appropriate local regulating authority. This could include: land filling or burning without energy recovery of waste and/or management of waste other than reuse, recycling, reclamation or other beneficial use.
- **Note:** The objective is to measure the waste generation linked with the normal production, transport and refining operations, etc. Those activities that may generate short term increases in the waste generation such as refinery maintenance, large remediation activities, construction projects, etc. should not be included in the report as they may distort the results.

# Waste Generation – onshore production

Generation of Hazardous Waste (onshore production)



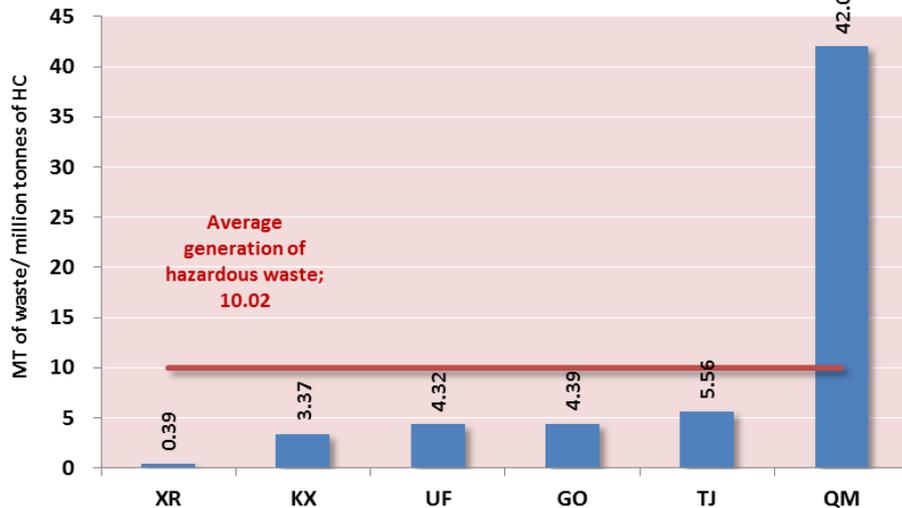
Generation of non-hazardous waste (onshore production)



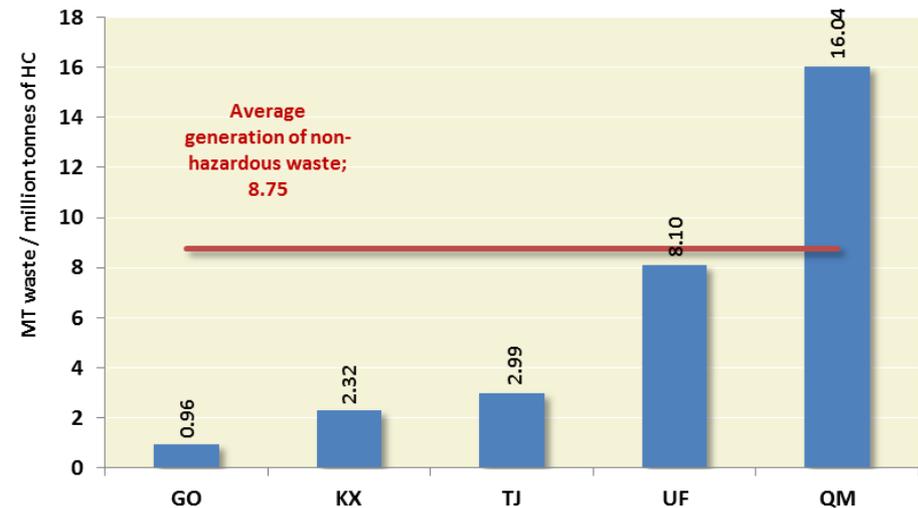
- A total amount of 12 companies submitted data about waste generation for onshore production.
- The waste generation average was 2,600.4 metric tonnes of hazardous-waste and 1,358.1 metric tonnes of non-hazardous waste per million tonnes of hydrocarbons produced.

# Waste Generation – pipelines

Generation of hazardous waste (pipelines)

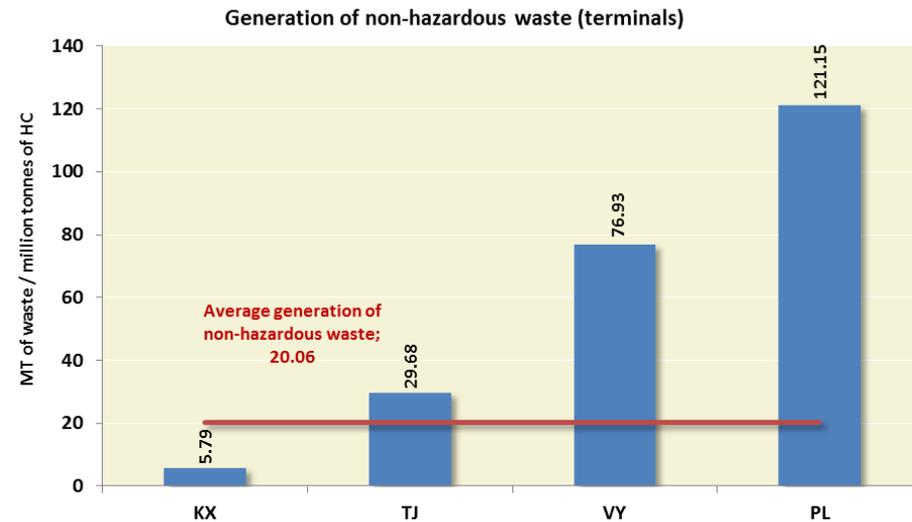
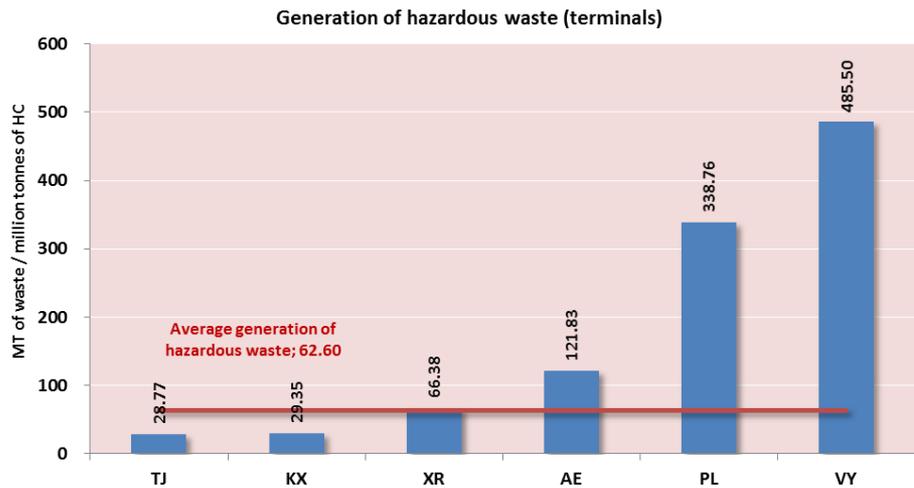


Generation of non-hazardous waste (pipelines)



- A total amount of 6 companies submitted data about waste generation for pipelines.
- The waste generation average was 10.02 metric tonnes of hazardous-waste and 8.75 metric tonnes of non-hazardous waste per million tonnes of hydrocarbons produced.

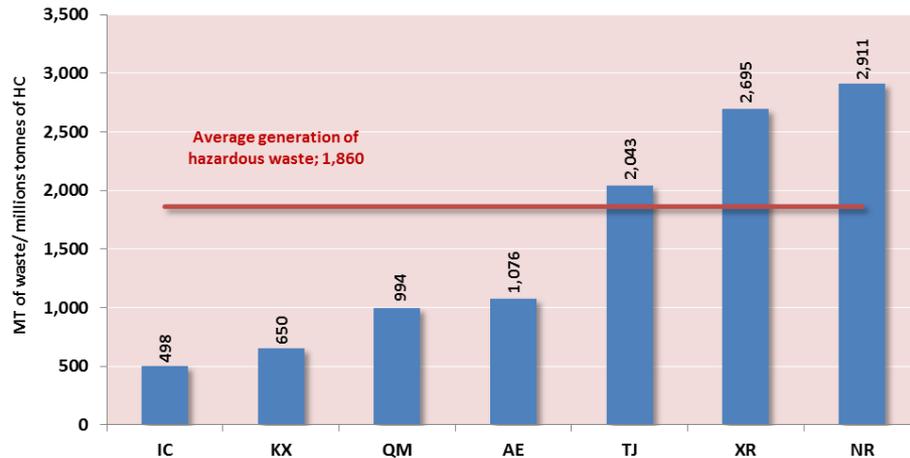
# Waste generation – terminals



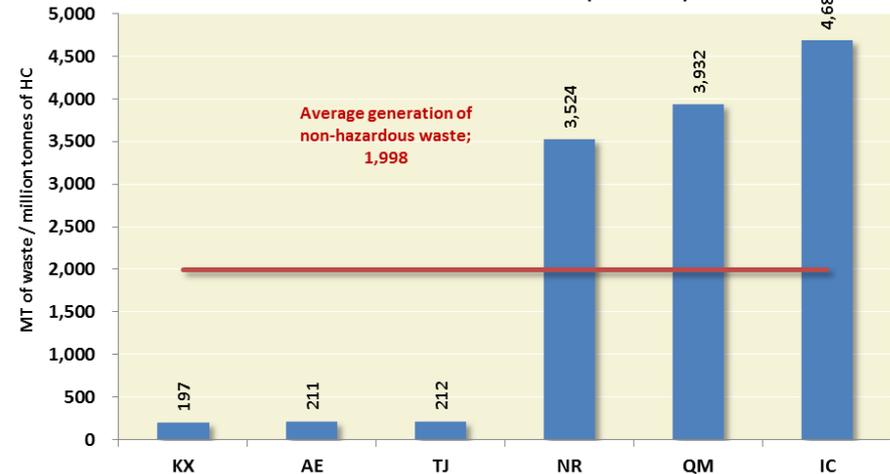
- A total amount of 6 companies submitted data about waste generation for terminals.
- The waste generation average was 62.60 metric tonnes of hazardous-waste and 20.06 metric tonnes of non-hazardous waste per million tonnes of hydrocarbons produced.

# Waste Generation – refining

Generation of hazardous waste (refineries)



Generation of non-hazardous waste (refineries)



- A total amount of 7 companies submitted data about waste generation for onshore production.
- The waste generation average was 1,860.0 metric tonnes of hazardous-waste and 1,998.3 metric tonnes of non-hazardous waste per million tonnes of hydrocarbons produced.

## 6. Freshwater

# Freshwater - Indicators

- Freshwater withdrawn
- % of freshwater withdrawn fromo indirect sources
- % water re-use
  
- Business Lines
  - Onshore production
  - Pipelines
  - Refining

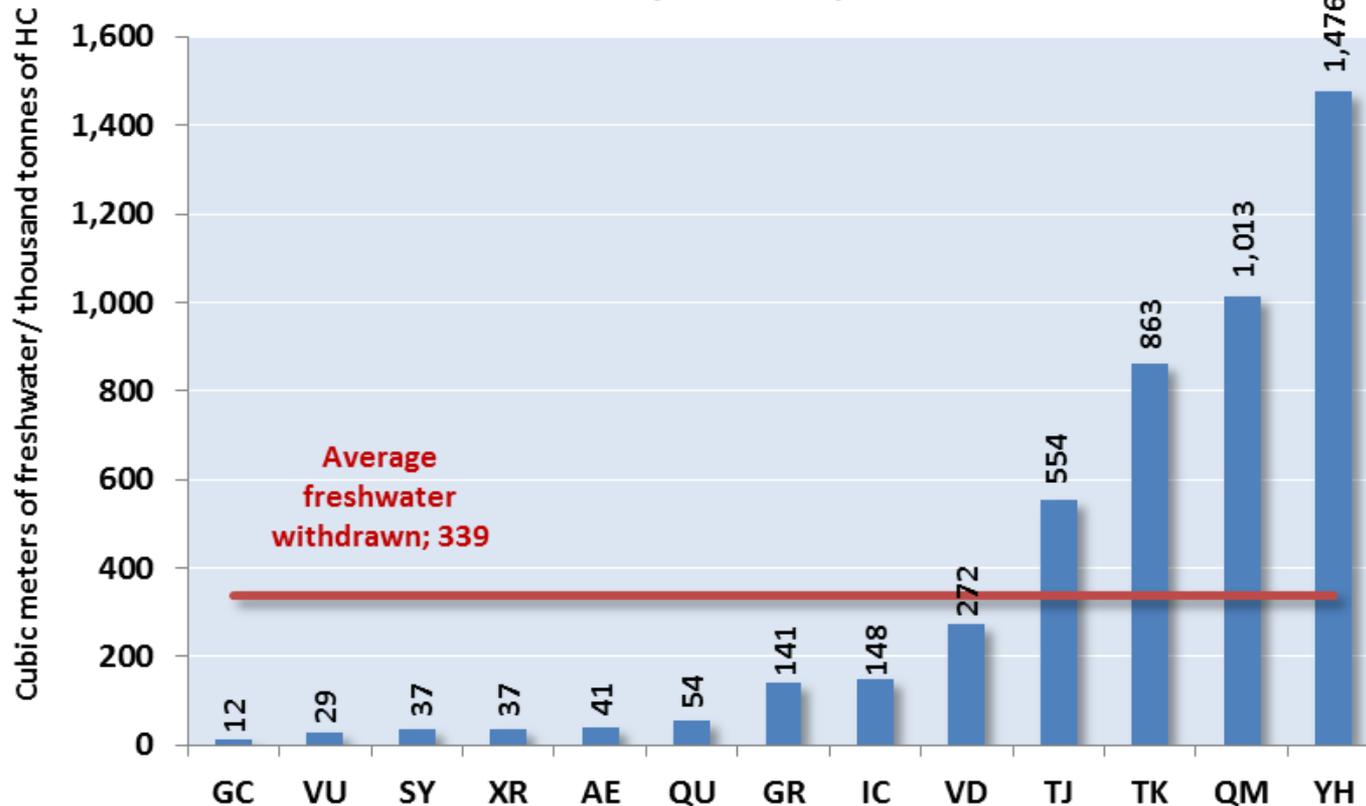
# Freshwater - Definitions

- **Fresh Water:** Non-brackish water, this includes drinking water, water used in agriculture, water used for domestic or industrial uses, etc. The total dissolved solids (TDS) concentration of this water type is up to 2000 mg/l.
- **Fresh water withdrawn:** the volume of fresh water used within the boundaries of the company (including service water) that was removed both from **direct sources** such as surface water or groundwater or **indirect sources** such as, harvested rainwater and municipal water supplies (note that only water that is used in the production processes should be considered)
- **Water reuse/recycle:** The volume of water used in more than one process (recycle), or reused more than one time in a single process (reuse), excluding cooling water.

# Freshwater indicators – onshore production

# Freshwater withdrawn – onshore production

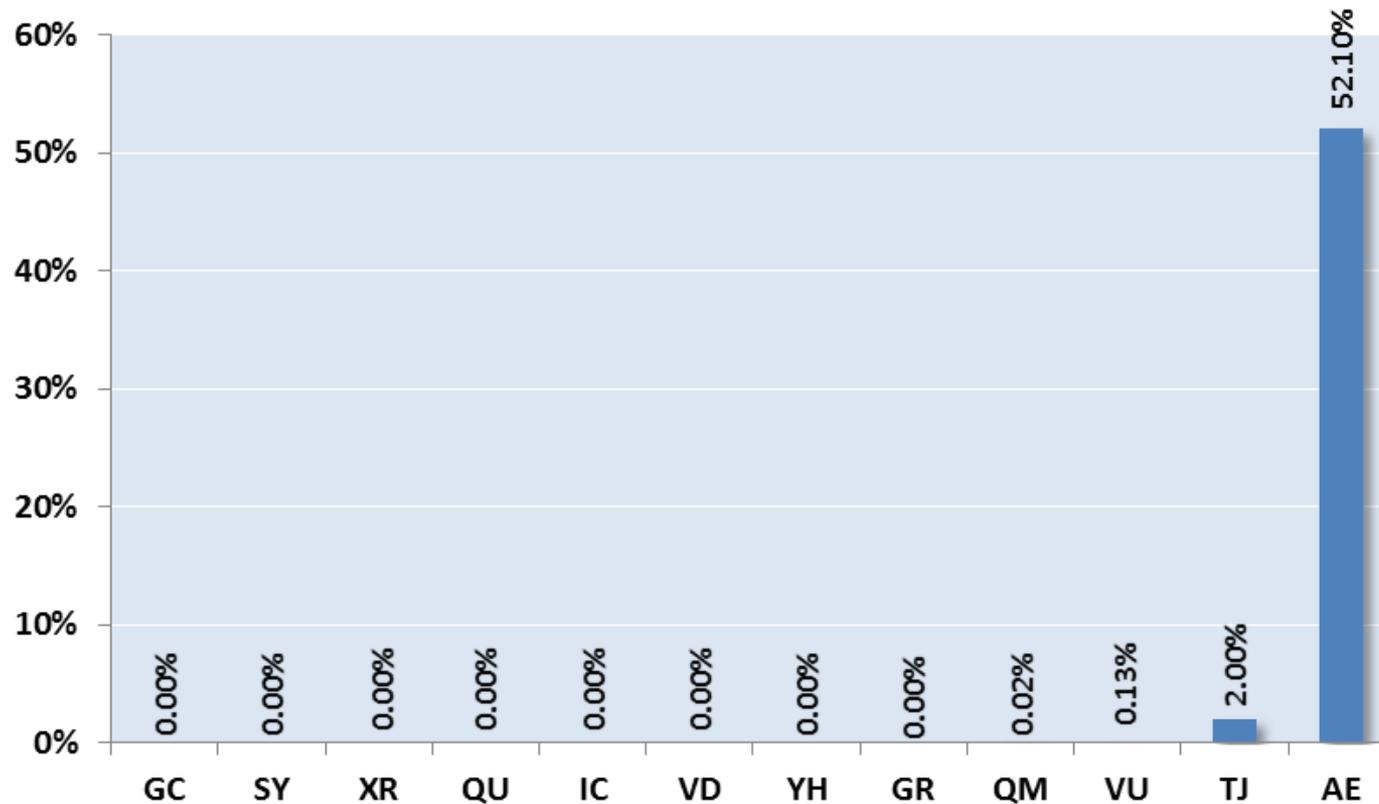
Freshwater withdrawn (m3) /thousand tonnes of HC (onshore production)



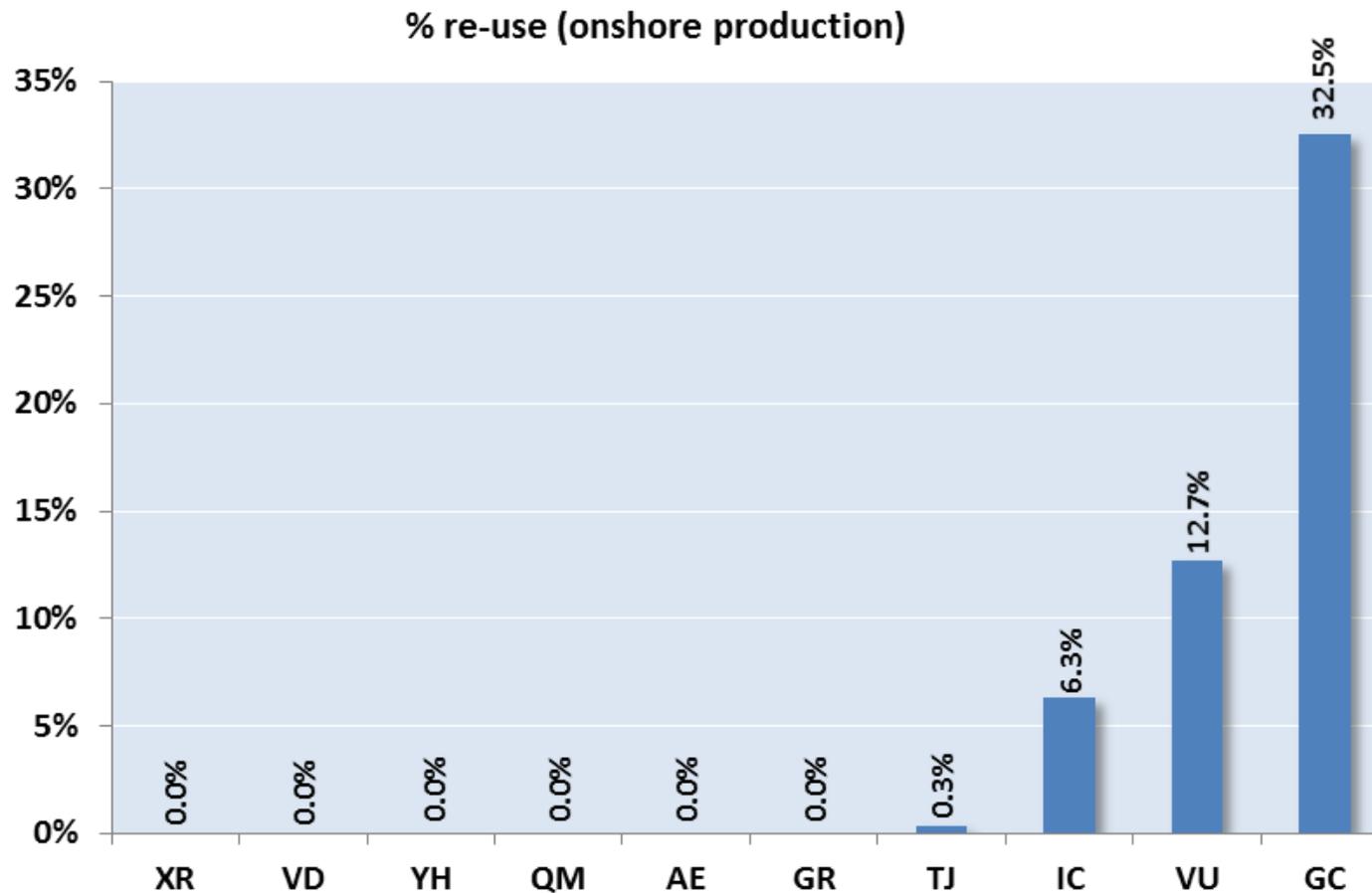
- The average freshwater withdrawn in onshore production was 339 cubic meters per thousand tonnes of hydrocarbons produced.
- All except one company withdrew most of the freshwater from direct sources.
- Only 4 companies show water re-use percentage higher than zero.

# % of freshwater withdrawn from indirect sources – onshore production

% freshwater withdrawn from indirect sources (onshore production)



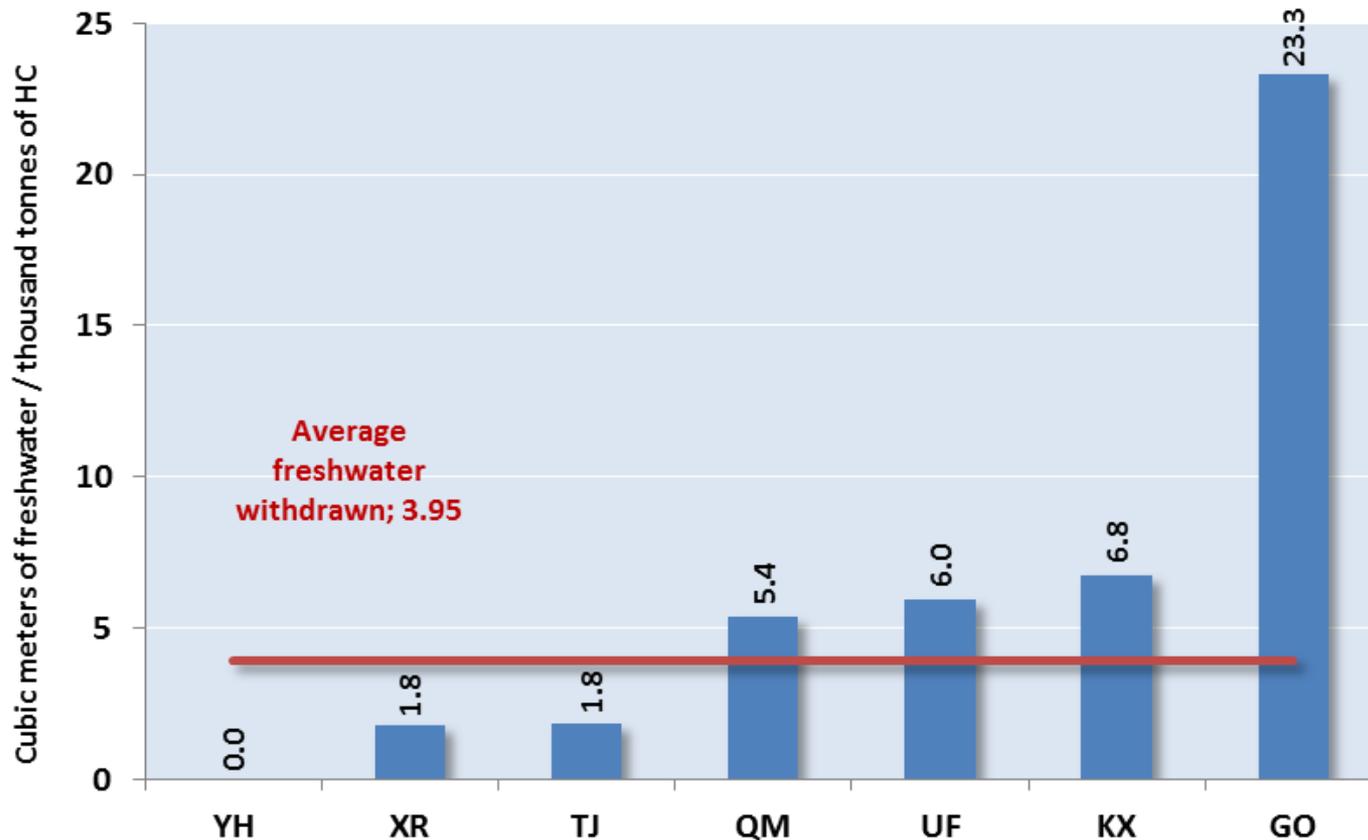
# % of water reutilization – onshore production



# Freshwater indicators - pipelines

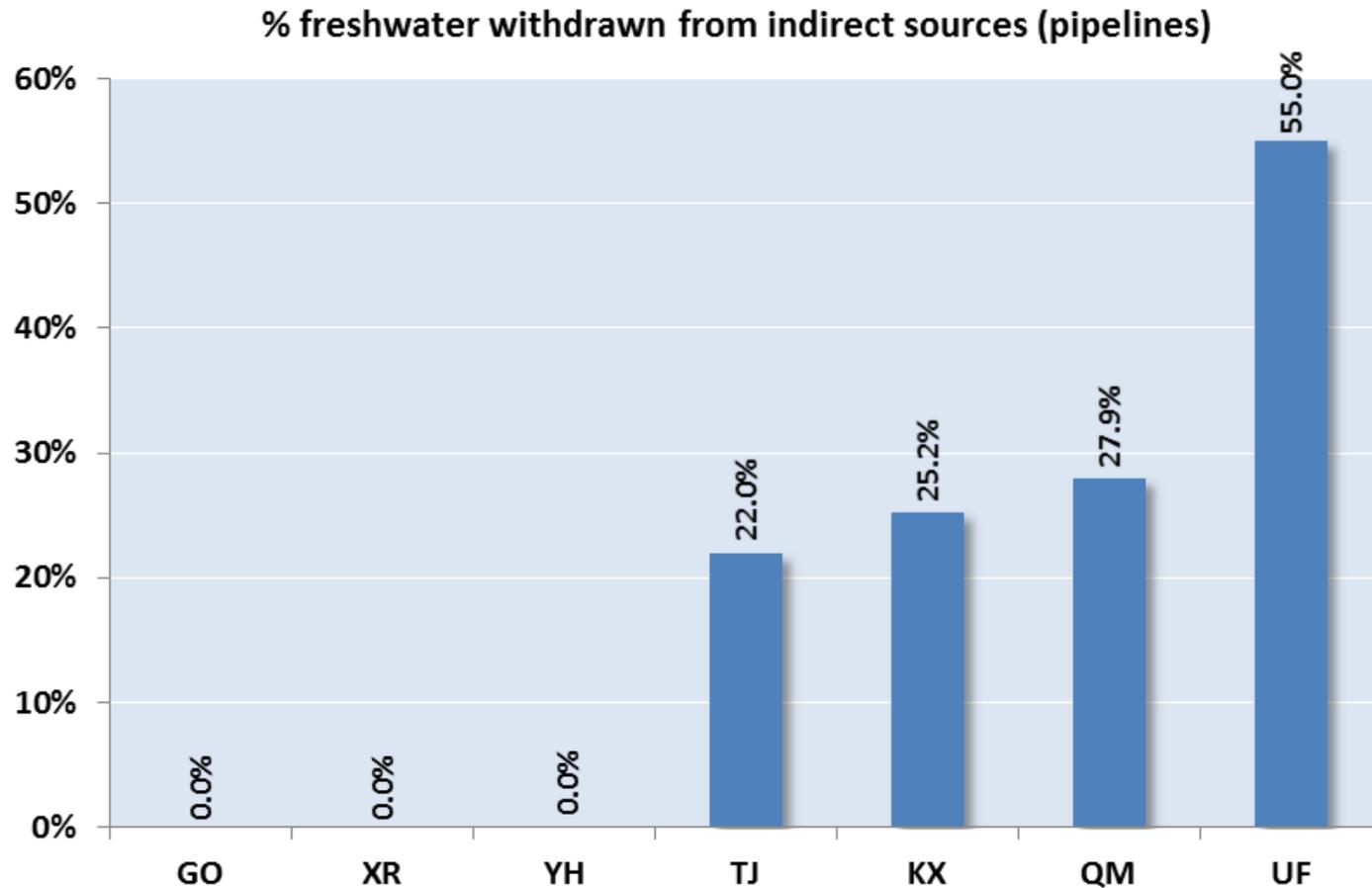
# Freshwater withdrawn – pipelines

Freshwater withdrawn (m3) / Thousand tonnes of HC (pipelines)

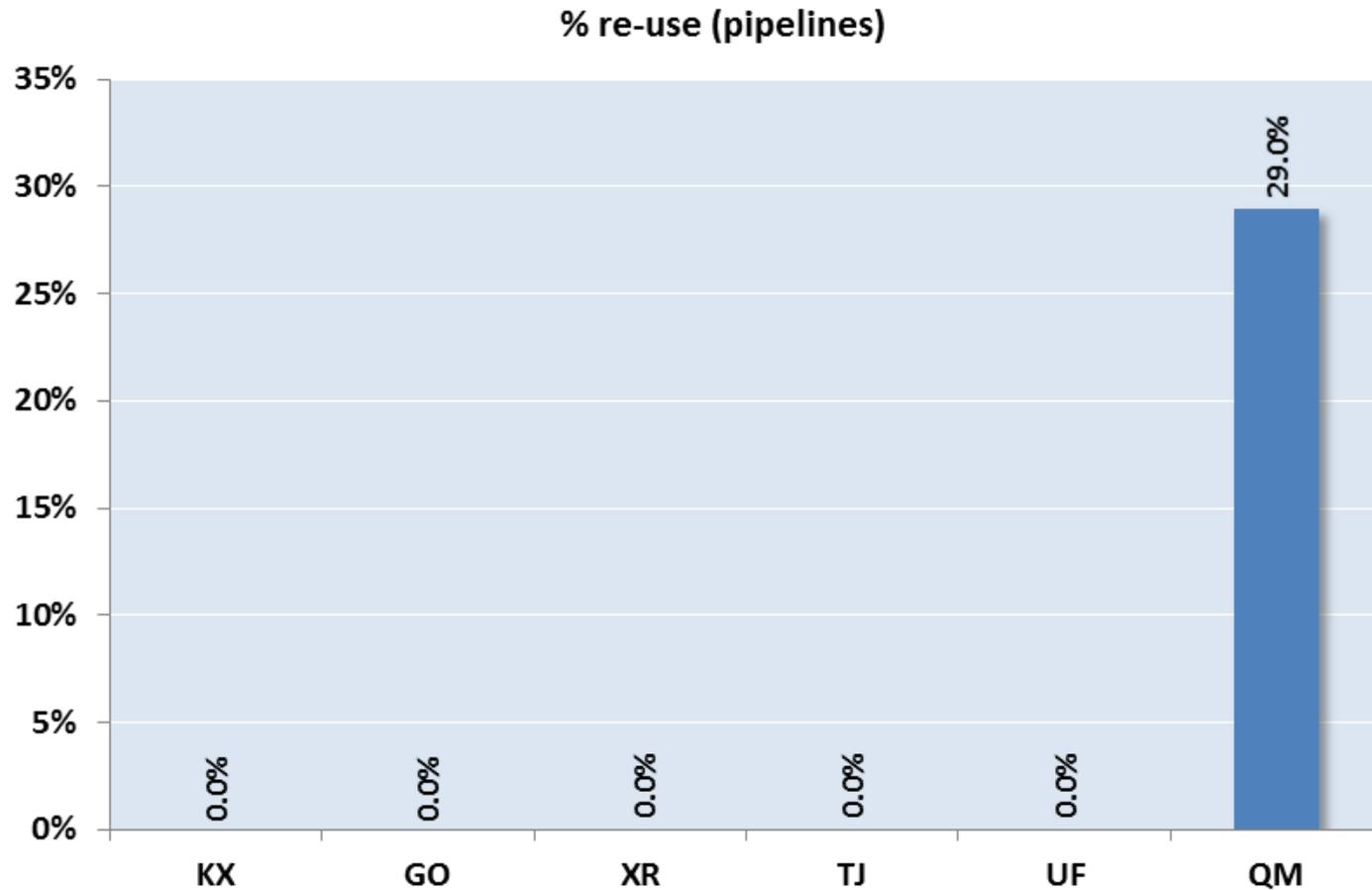


- The average freshwater withdrawn in pipelines was 3.95 cubic meters per thousand tonnes of hydrocarbons transported.
- More than a half of the companies withdraw a significant proportion of the water used from indirect sources.
- However, only one of them have significant a percentage of re-use.

# % of freshwater withdrawn from indirect sources – pipelines



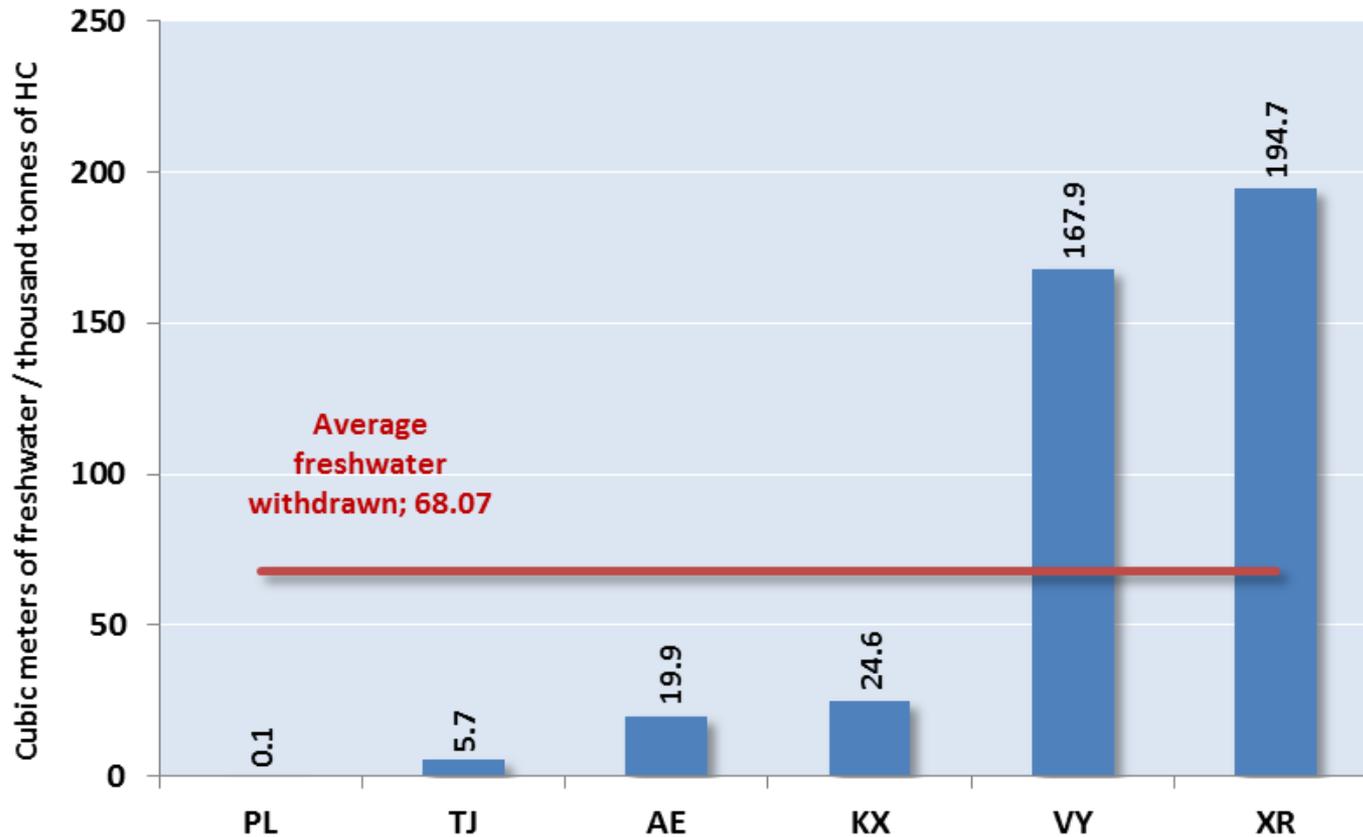
# % of water reutilization – pipelines



# Freshwater indicators - terminals

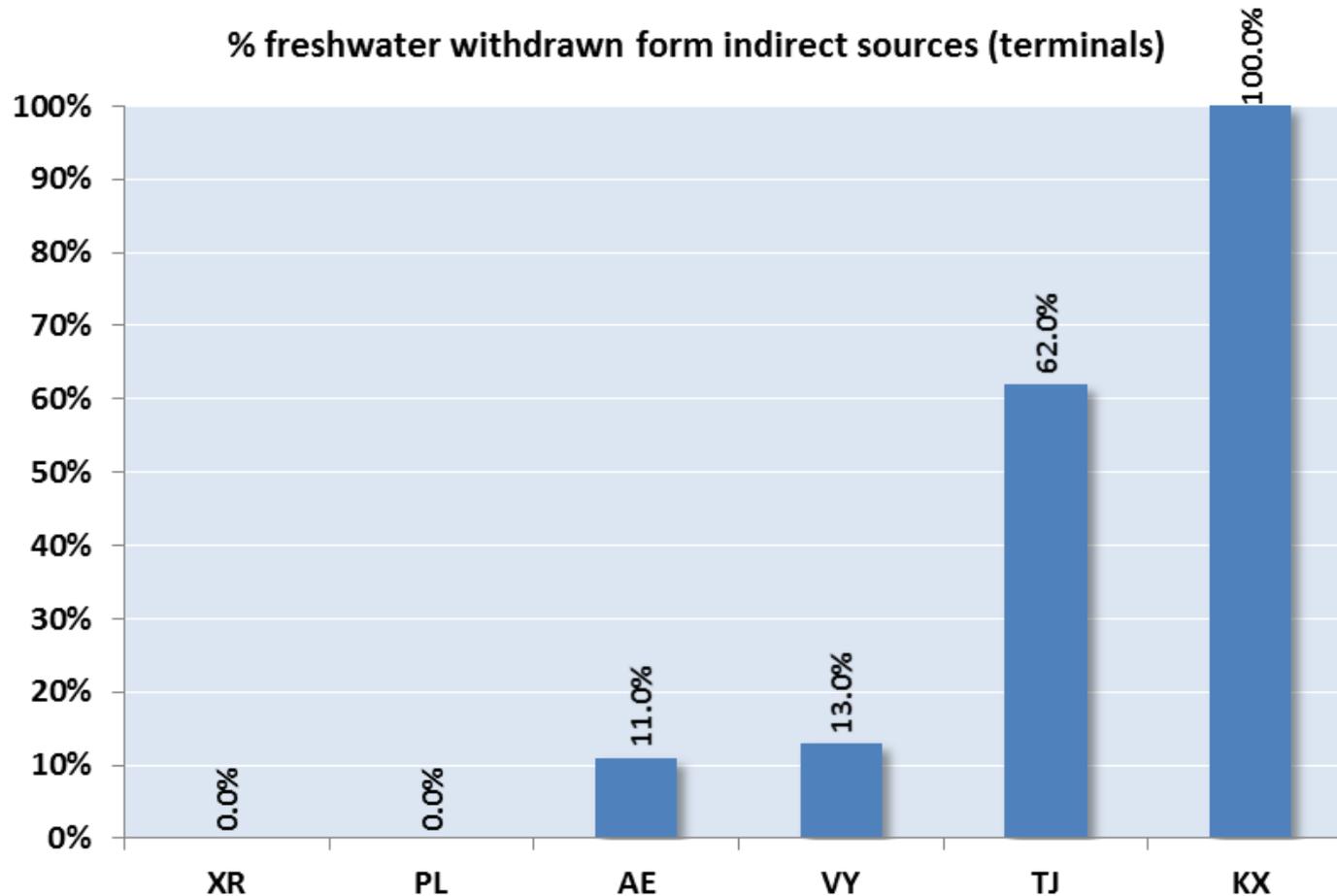
# Freshwater withdrawn – terminals

Freshwater withdrawn (m3) / thousand tonnes of HC (terminals)

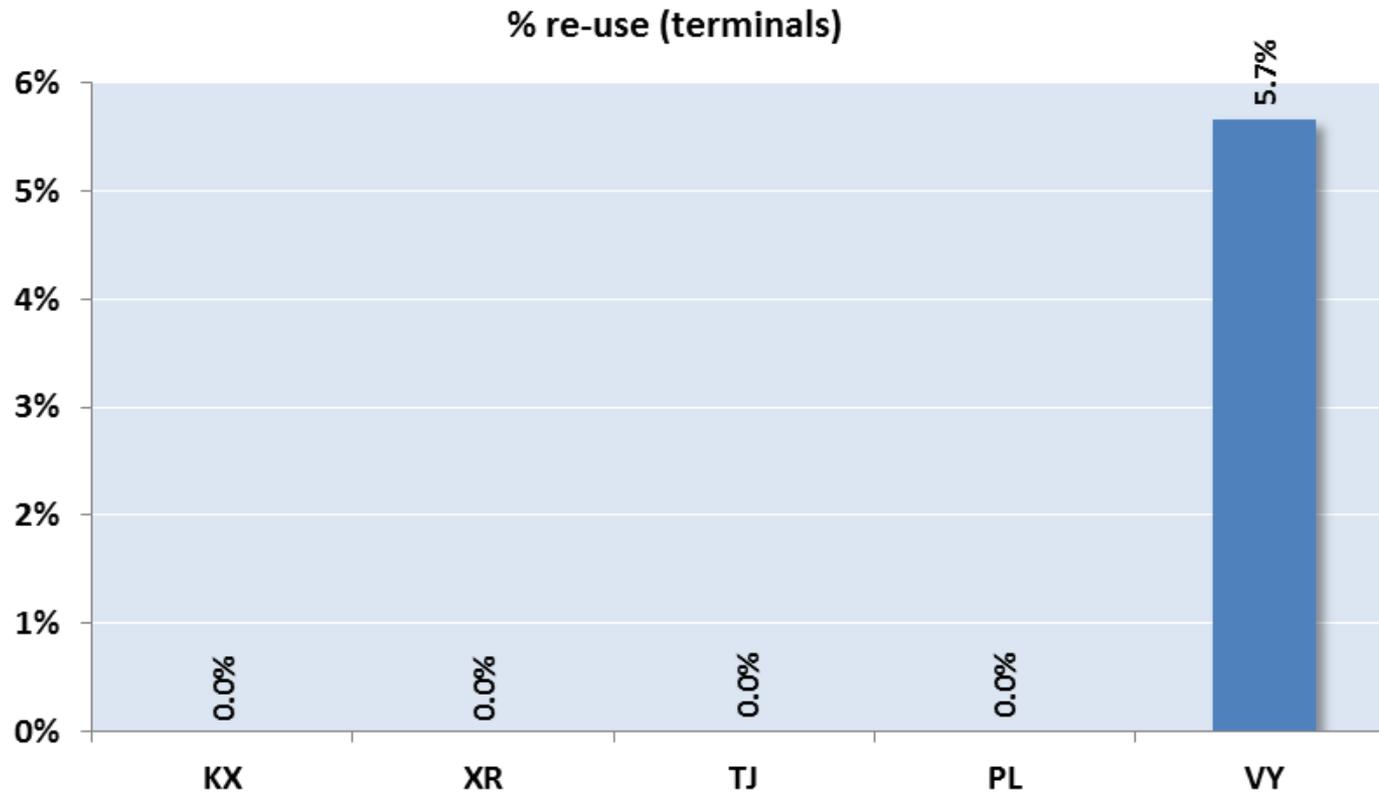


- The average freshwater withdrawn in terminals was 68.07 cubic meters per thousand tonnes of hydrocarbons operated.

# % of freshwater withdrawn from indirect sources – terminals



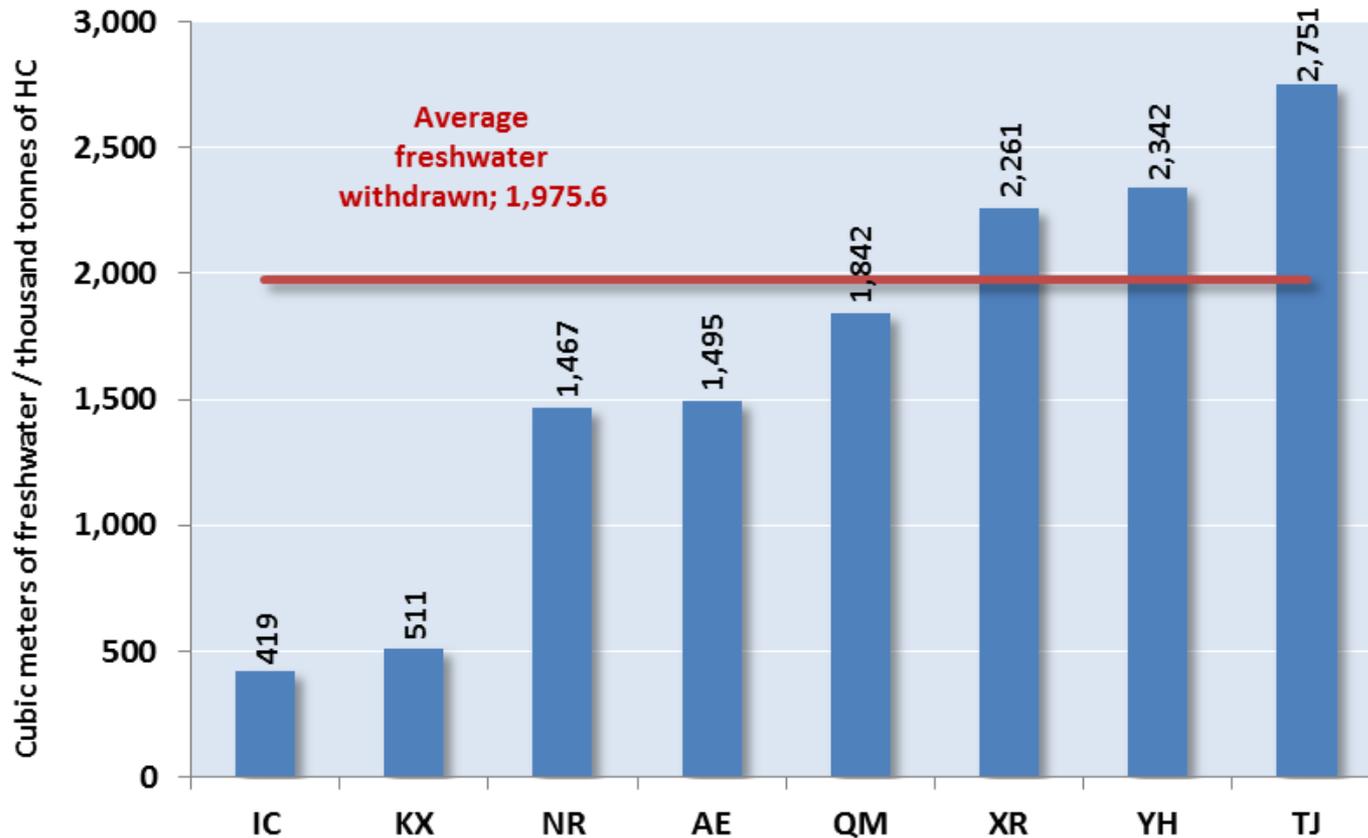
# % of water reutilization – terminals



# Freshwater indicators - refining

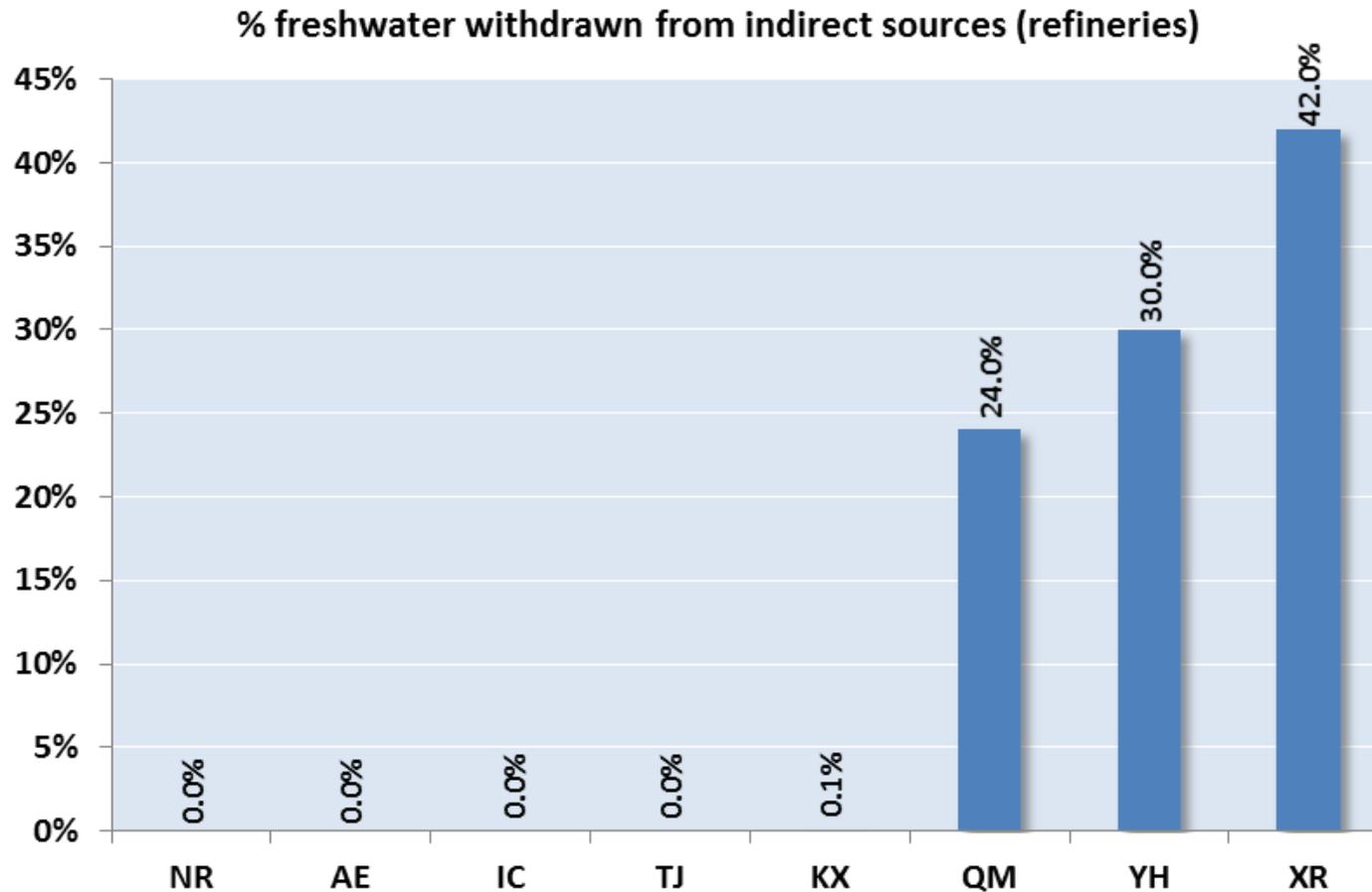
# Freshwater withdrawn – refining

Freshwater withdrawn (m<sup>3</sup>) / Thousand tonnes of HC (refineries)

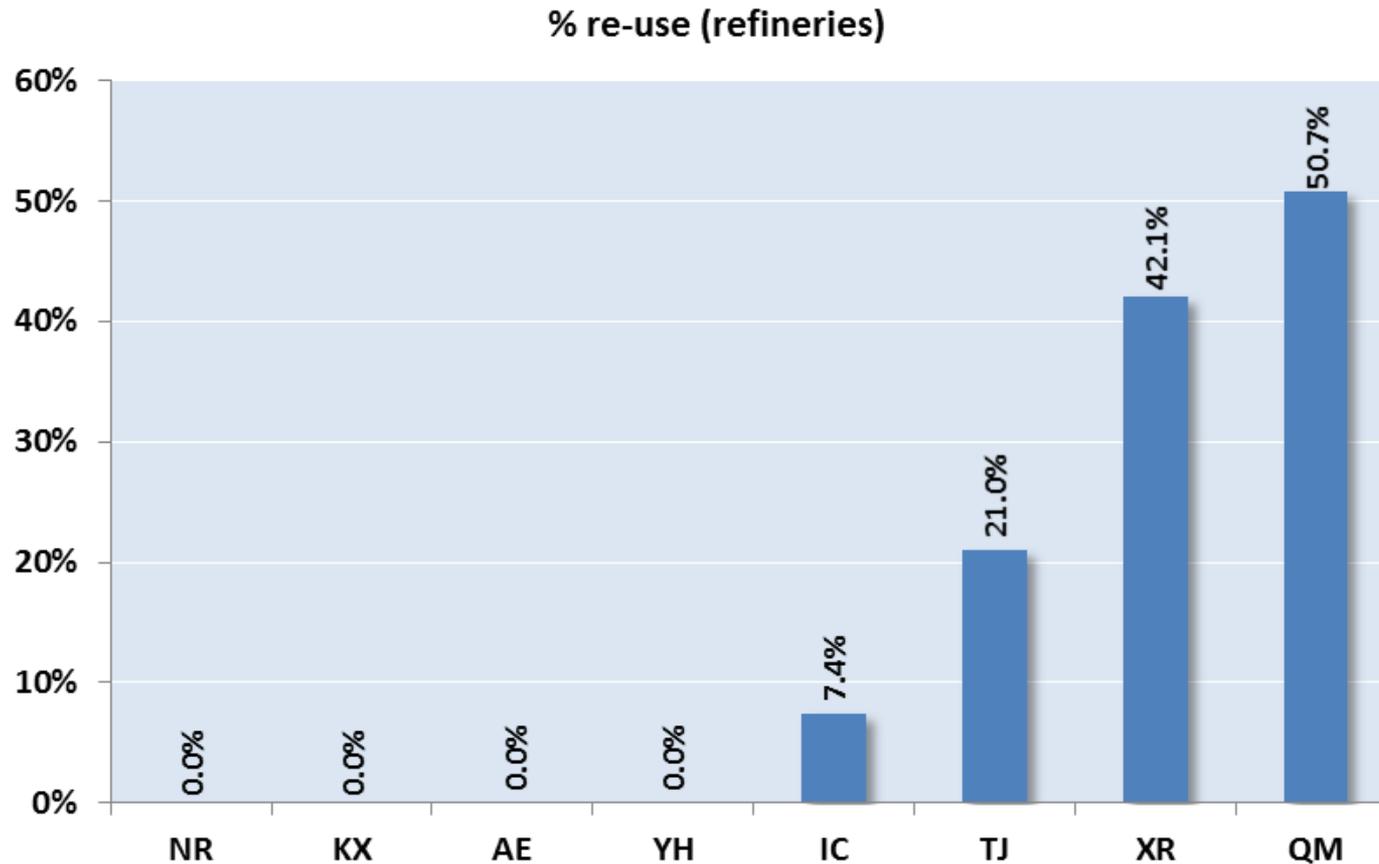


- Eight companies submitted data for the business line refining and the average freshwater withdrawn was 1,975.6 cubic meters per million tonnes of hydrocarbons processed.
- Three of them have significant percentage of freshwater withdrawn from indirect sources and four a significant proportion of re-use.

# % of freshwater withdrawn from indirect sources – refining



# % of water reutilization – refining



## **7. Greenhouse Gases (GHG) Emissions**

# GHG Emissions - Indicators

- Indicators
  - Direct Emissions (CO<sub>2</sub>; CH<sub>4</sub>; N<sub>2</sub>O and CO<sub>2</sub> equivalent)
- Business Lines
  - Oshore production
  - Pipelines
  - Refining

# GHG Emissions - Definitions

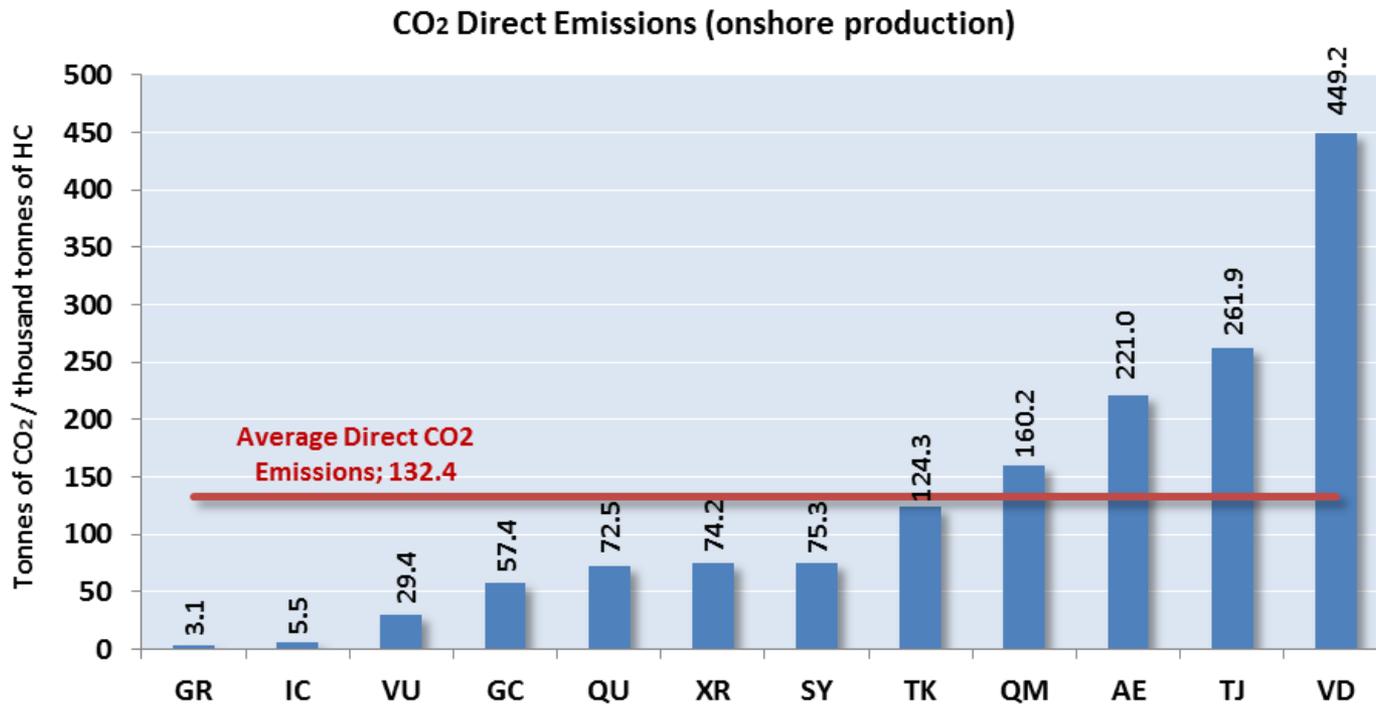
- The Intergovernmental Panel on Climate Change (IPCC) considers 7 greenhouse gases (GHG), in this report are considered only the emissions of carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O) which are the most significant for the oil and gas industry operations.
- GHG emissions from the following sources shall be included:
  - Combustion (e.g. fuel used for gas compression, power generation, heat, coke burning, etc.)
  - Flaring (mainly CO<sub>2</sub>) and venting (mainly CH<sub>4</sub>)
  - Processes (e.g. ship loading, storage tanks, glycol dehydration, sulfur recovery units, hydrogen production)
  - Fugitive emissions (including pipelines and leak units)
  - Non-routine events (e.g. pipelines maintenance, gas releases, equipment maintenance)
- Emissions estimations shall include both mobile sources as ships carrying products, tanker trucks, mobile rigs and mobile production facilities, and stationary sources as production facilities, refineries, chemical plants, terminals, rigs and offices.

# GHG Emissions - Definitions

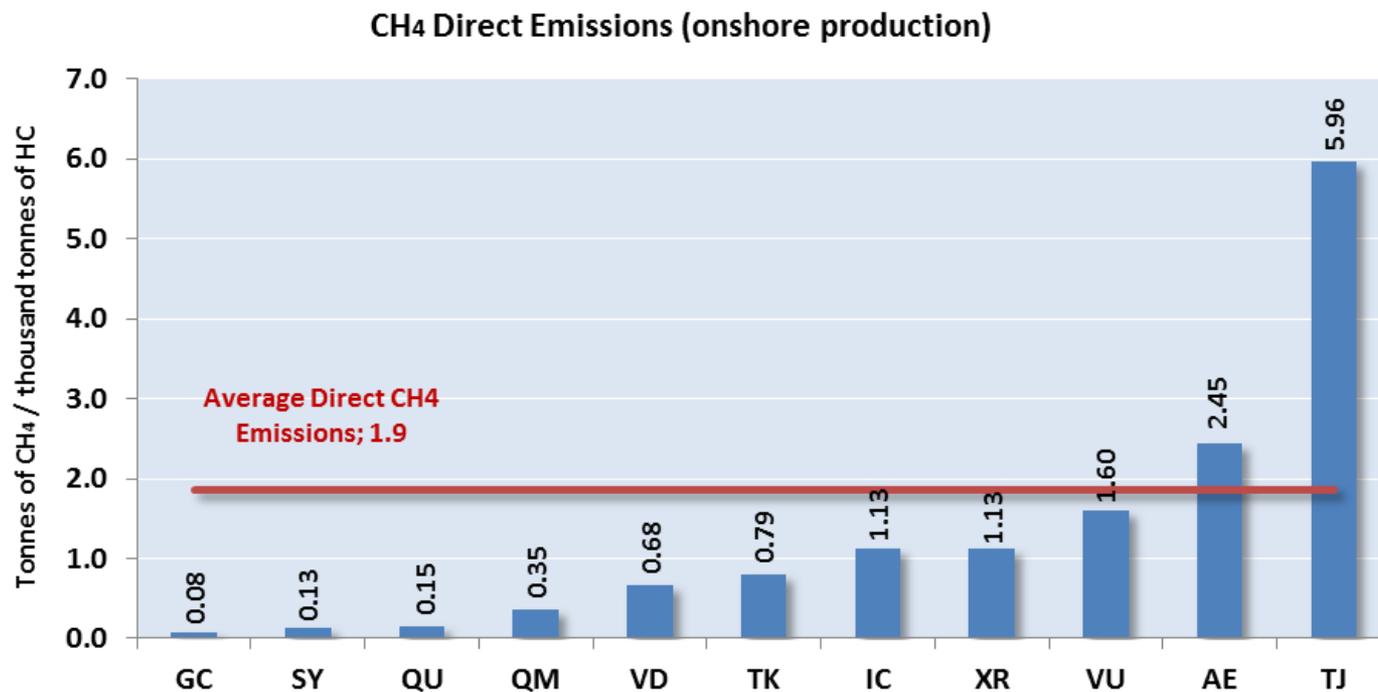
- GHG Protocol defines 2 types of emissions:
  - **Direct:** emissions from sources that belongs (partial or totally) and/or are operated by the reporting entity
  - **Indirect:** emissions that are a consequence of the activities of the reporting entity, but that are generated by sources that belong or are controlled by another entity (e.g. electricity used)
- Additionally, the mentioned protocol classifies the emissions in 3 different scopes. This manual will consider only scopes 1 and 2 which are defined below:
  - **Scope 1:** All GHG emissions (mobile or stationary sources)
  - **Scope 2:** Indirect GHG emissions coming from the consumption or purchase of electricity, steam, heat or cooling.
  - **Note:** CO<sub>2</sub> that is sold as a product, used for enhanced oil recovery or sequestered (e.g. through CCS), generally is not considered by companies as part of their own GHG emissions. It should be removed from GHG emissions inventory as carbon sink.

# Direct GHG Emissions – Onshore production

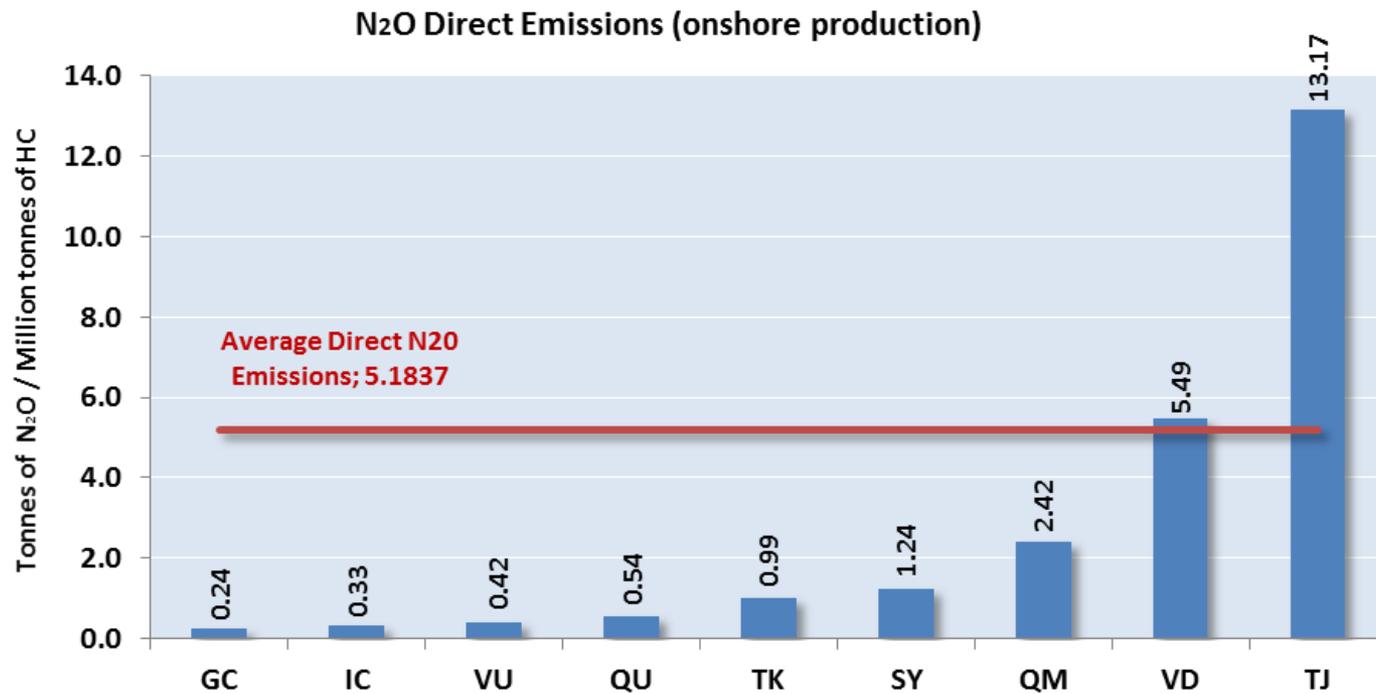
# CO<sub>2</sub> Direct Emissions – onshore production



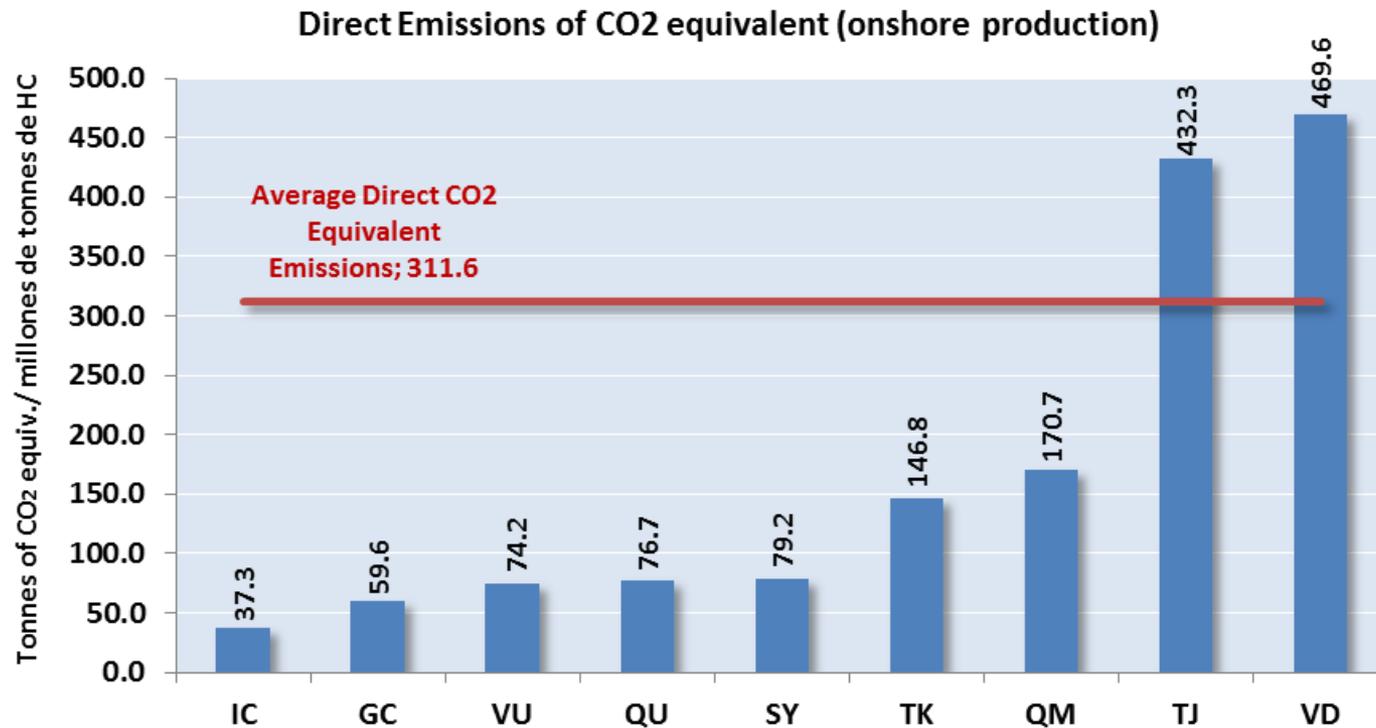
# CH<sub>4</sub> Direct Emissions – onshore production



# N<sub>2</sub>O Direct Emissions – onshore production

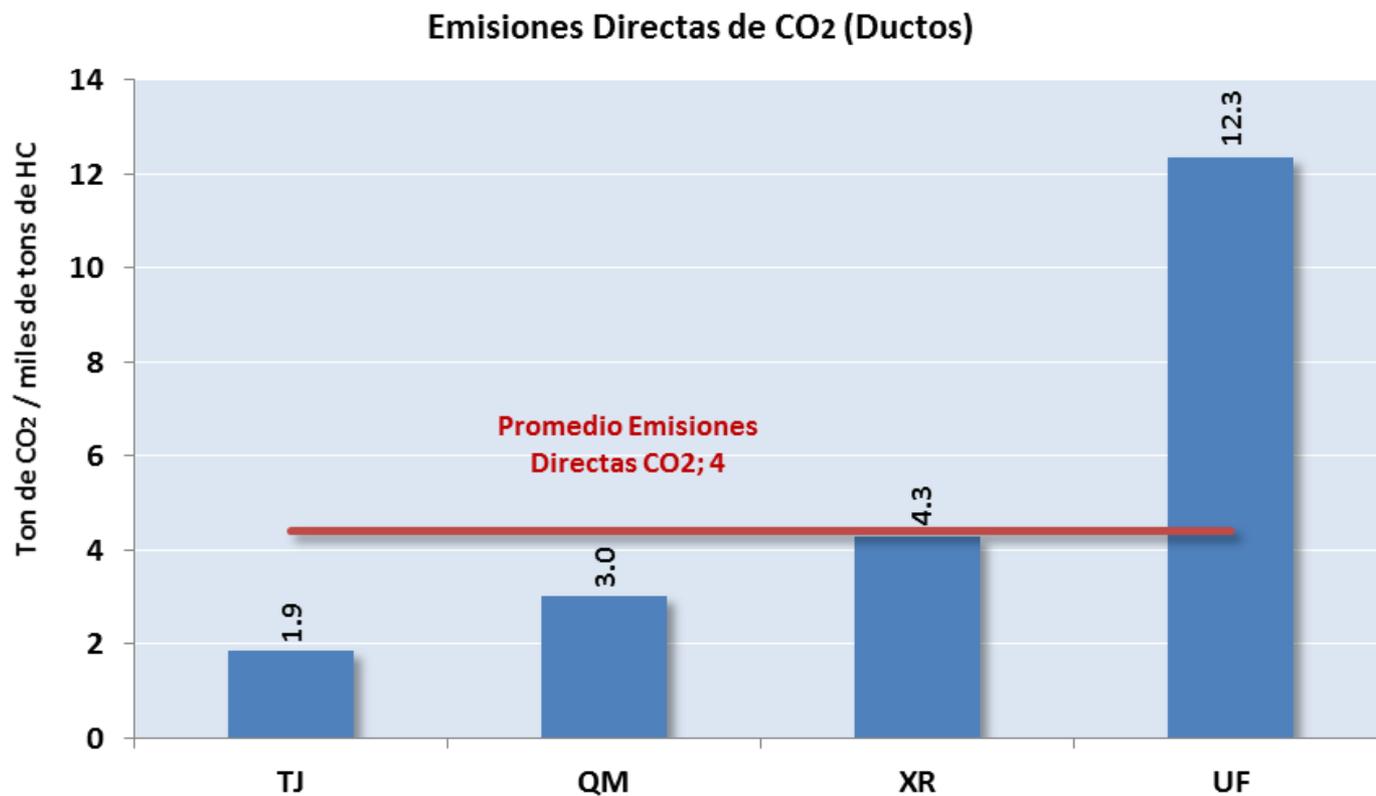


# CO<sub>2</sub> Equivalent Direct Emissions – onshore production

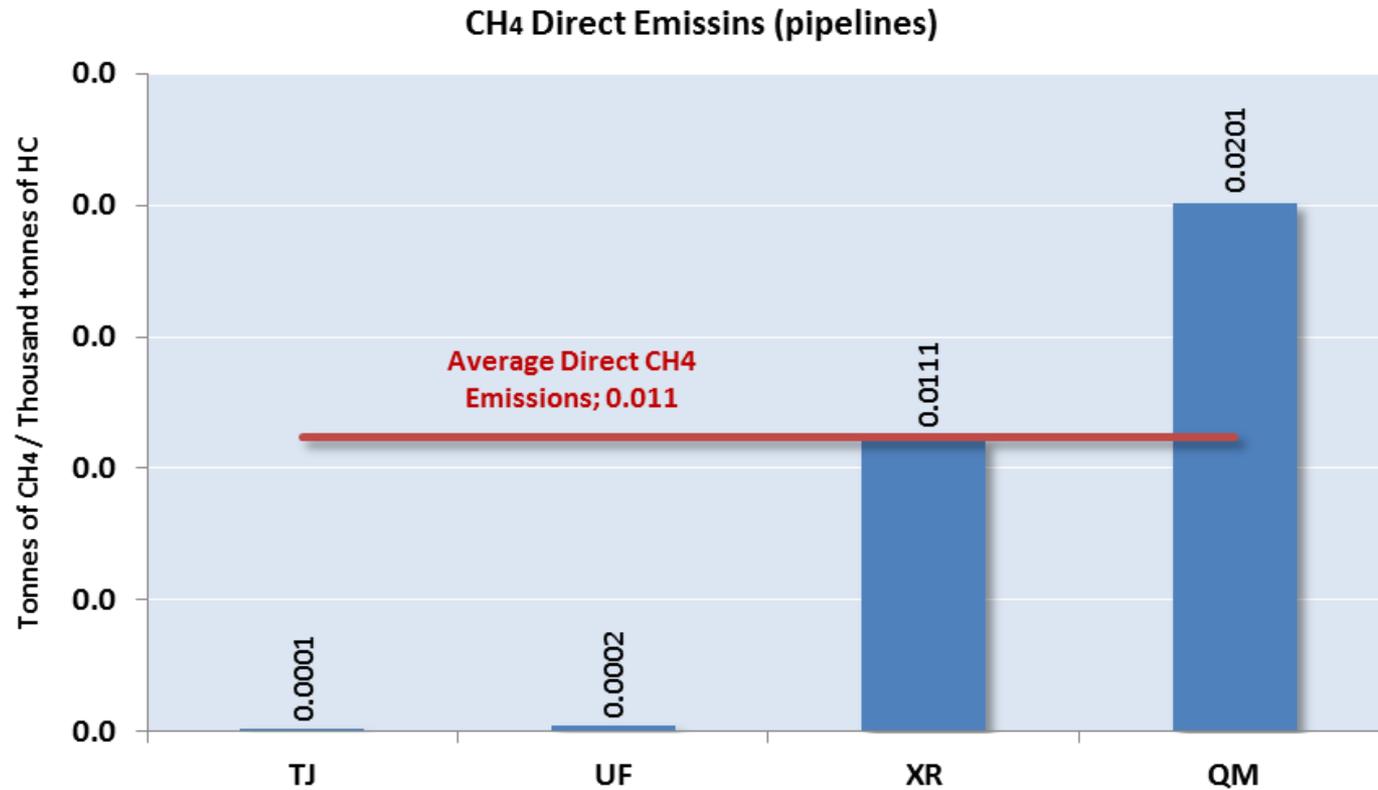


# Direct GHG Emissions – Pipelines

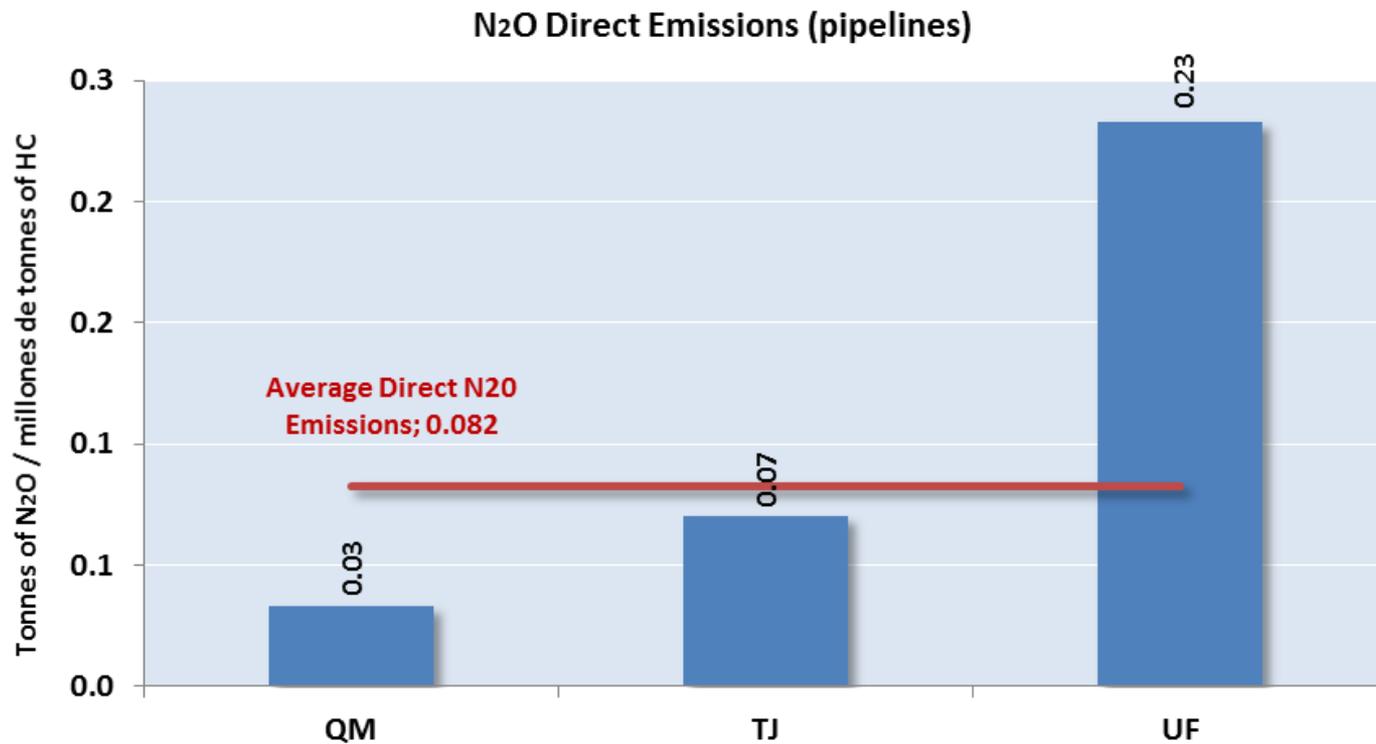
# CO<sub>2</sub> Direct Emissions – pipelines



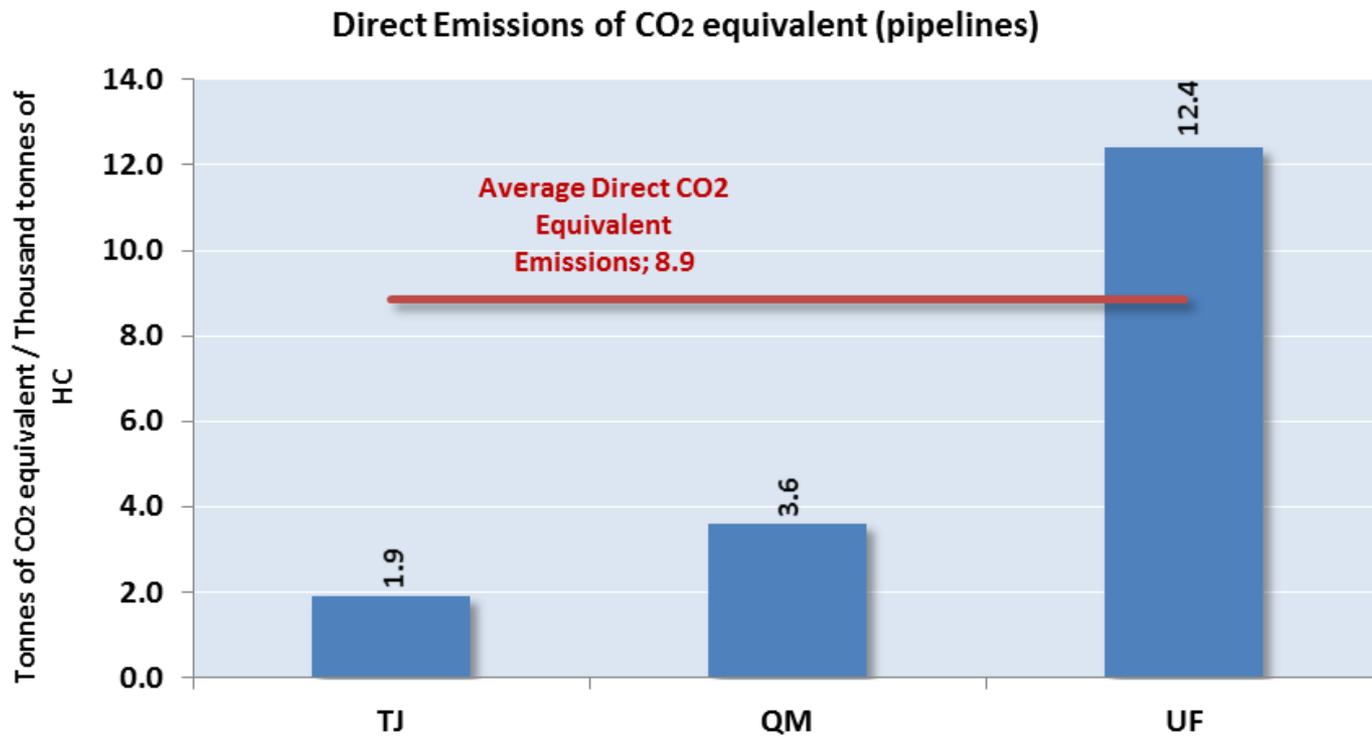
# CH<sub>4</sub> Direct Emissions – pipelines



# N<sub>2</sub>O Direct Emissions – pipelines

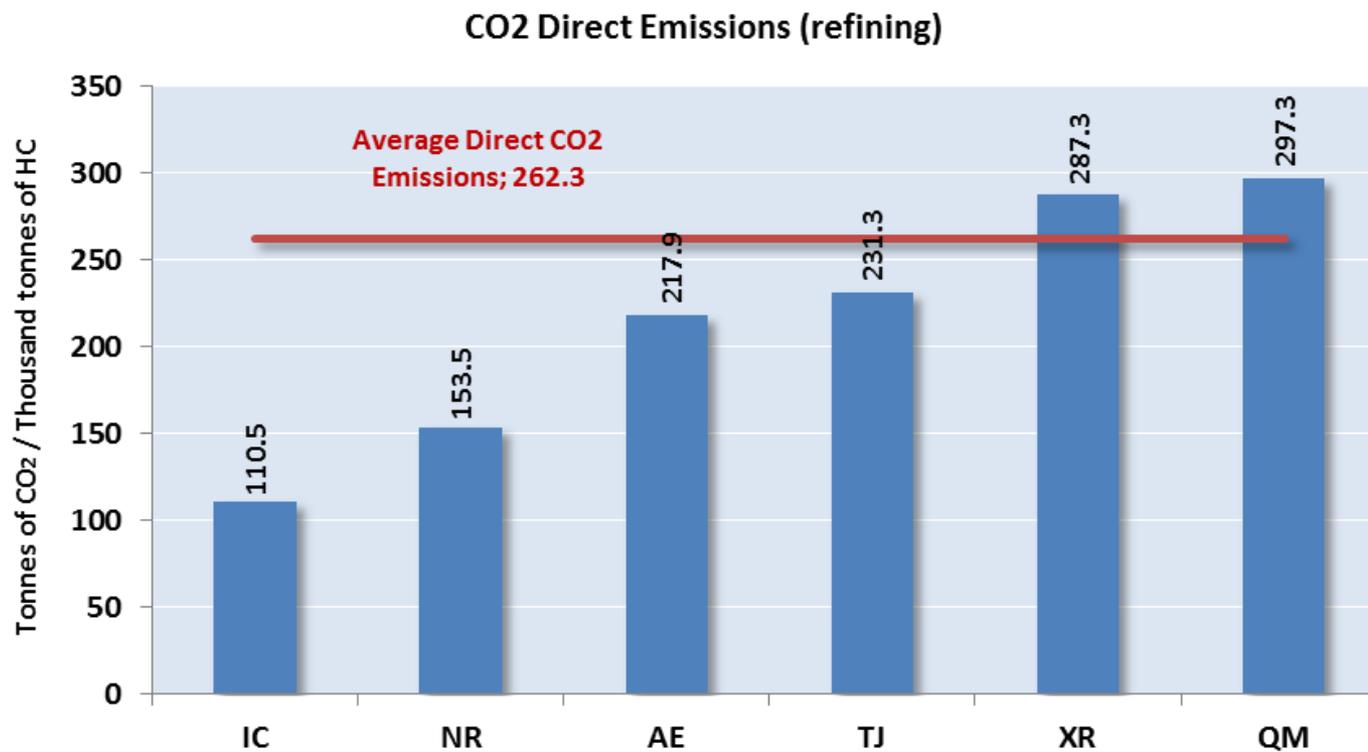


# CO<sub>2</sub> Equivalent Direct Emissions – pipelines

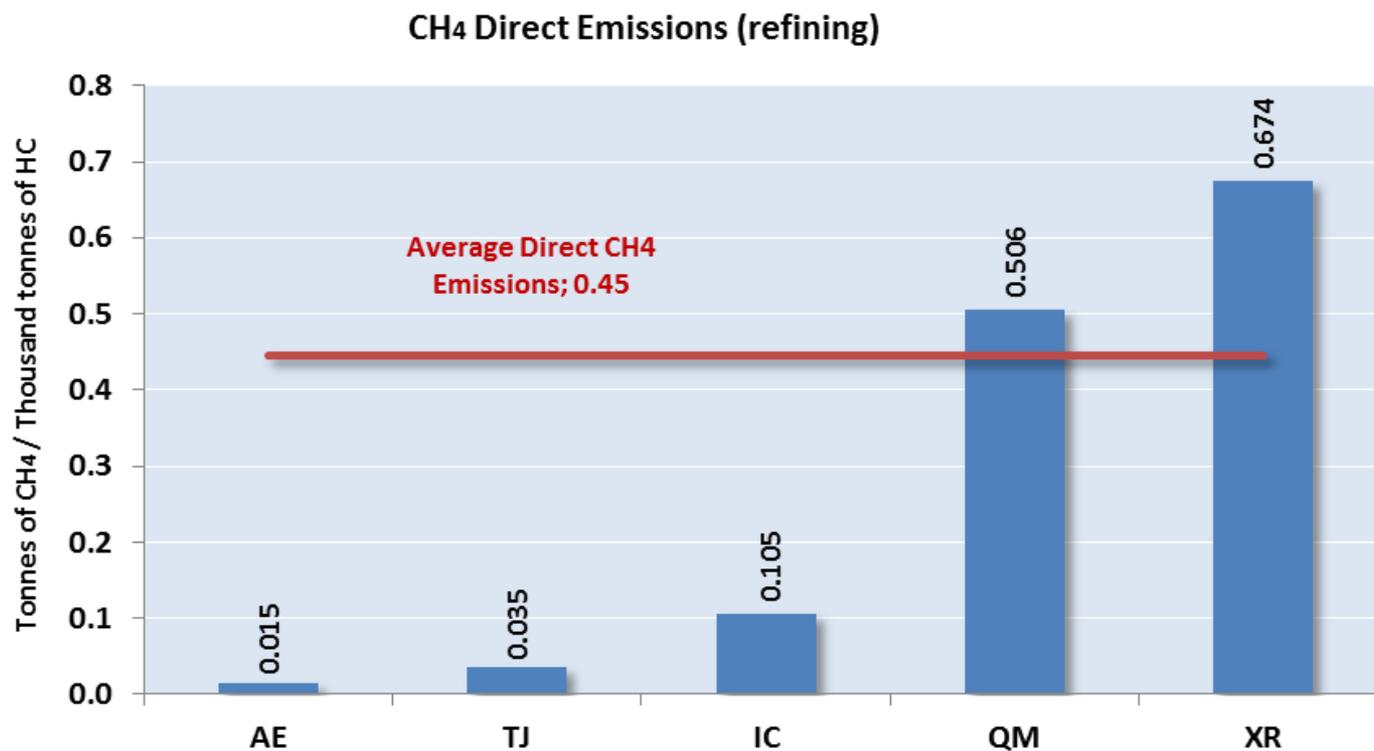


# Direct GHG Emissions – Refining

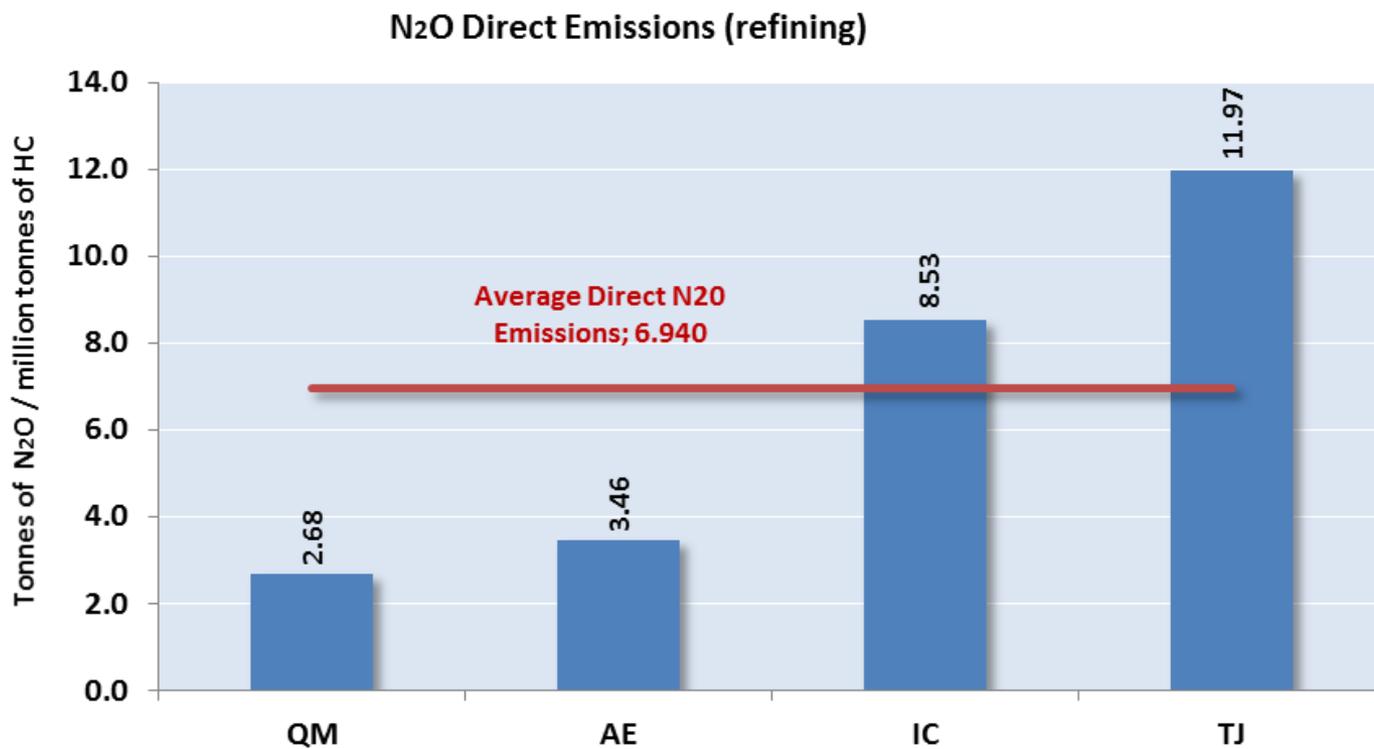
# CO<sub>2</sub> Direct Emissions – refining



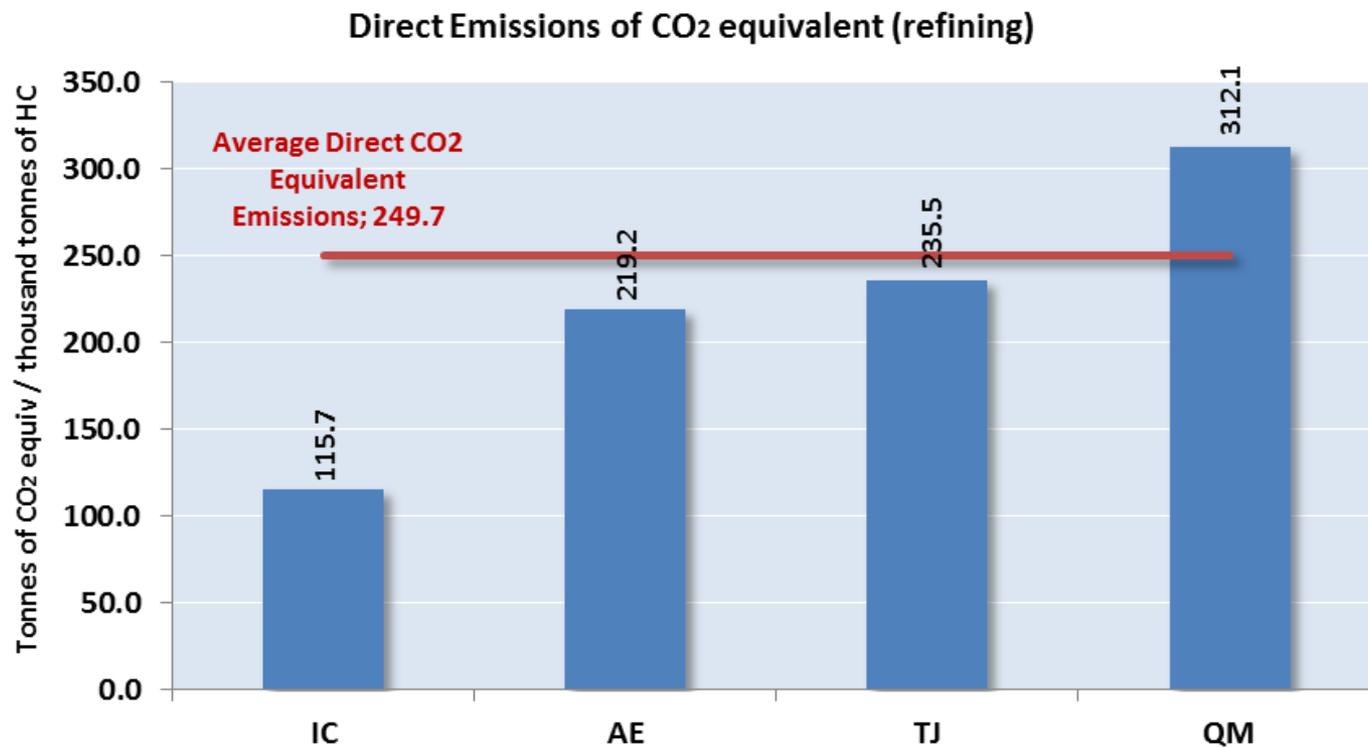
# CH<sub>4</sub> Direct Emissions – refining



# N<sub>2</sub>O Direct Emissions – refining



# CO<sub>2</sub> Equivalent Direct Emissions – refining



# Environmental Performance Benchmarking in the Oil and Gas Industry in Latin America and the Caribbean (2017 data)

[www.arpel.org](http://www.arpel.org)

