An analysis of carbon accounting mechanisms linked to energy management

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Research Centre for Greenhouse Gas Innovation

Energy Management – Opportunities on Oil and Gas Sector
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Agenda

GHG accounting

EnM & EnP

Case study

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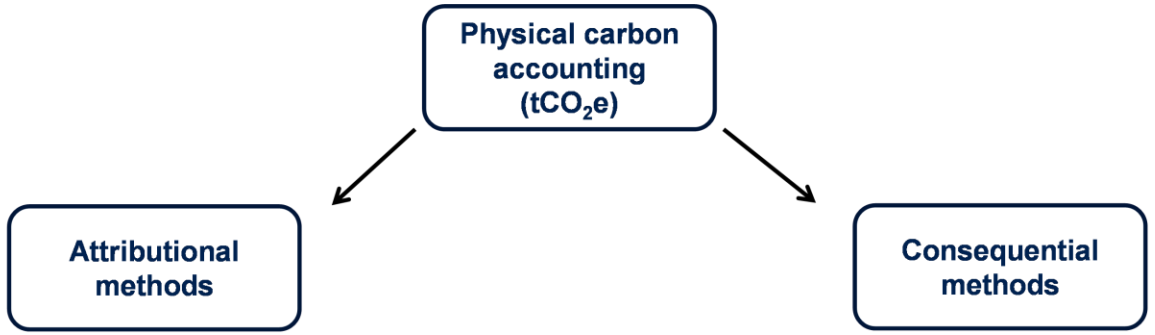
GHG accounting

- Key features of GHG accounting methods

Key features of GHG accounting methods (Brander, 2021)

GHG accounting



Categorisation of physical GHG accounting methods as ‘attributional’ or ‘consequential’ (Brander, 2021)

GHG accounting

- General estimation method

$$GHG\ Emissions = \sum_{boundary} (EF\ x\ AF)$$

Where:

EF – Emission Factor;

AF – Activity Factor;

- Challenges:
  - Defining boundaries
  - Defining EF and AF
  - Transparency and coherence

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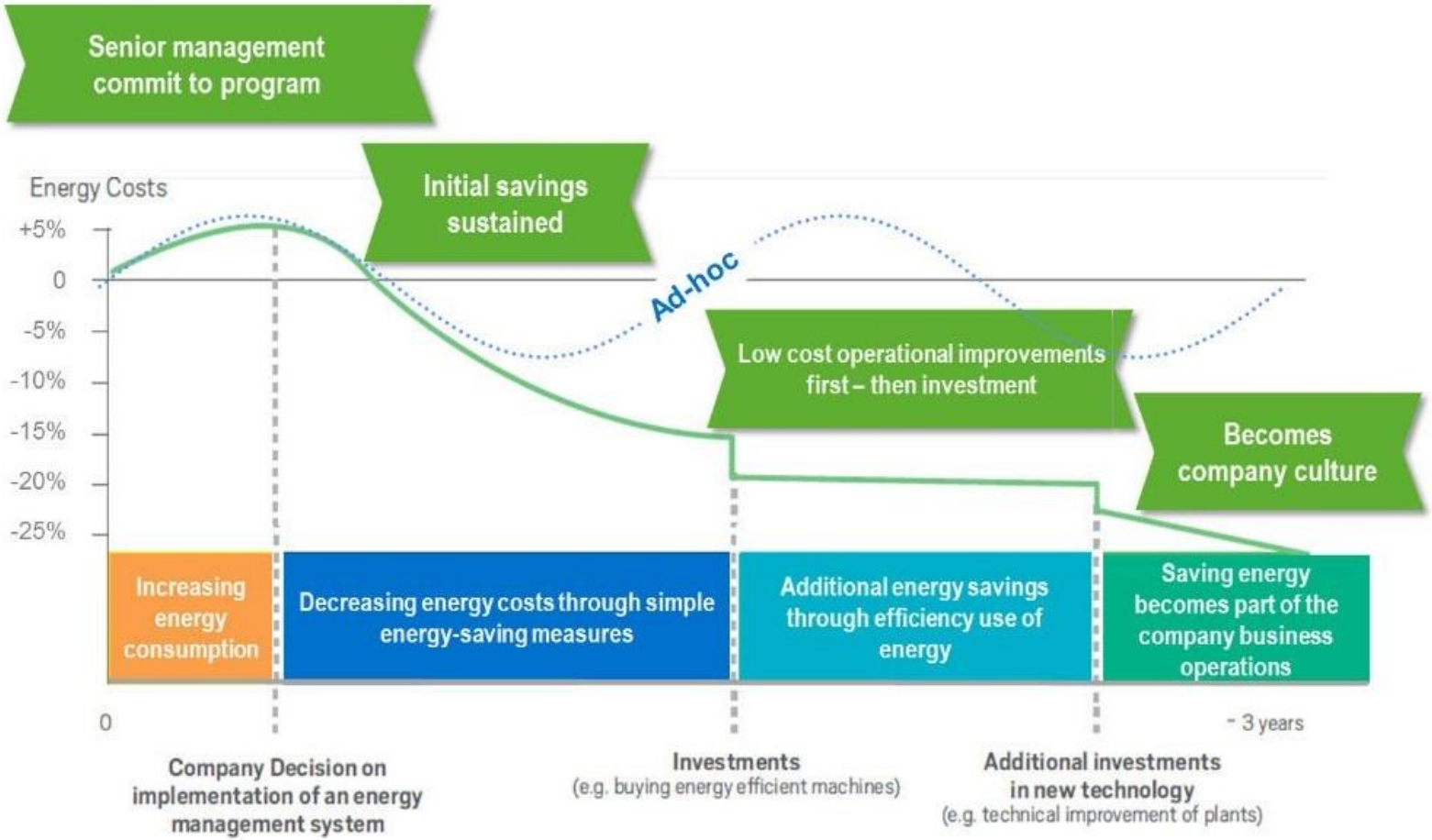
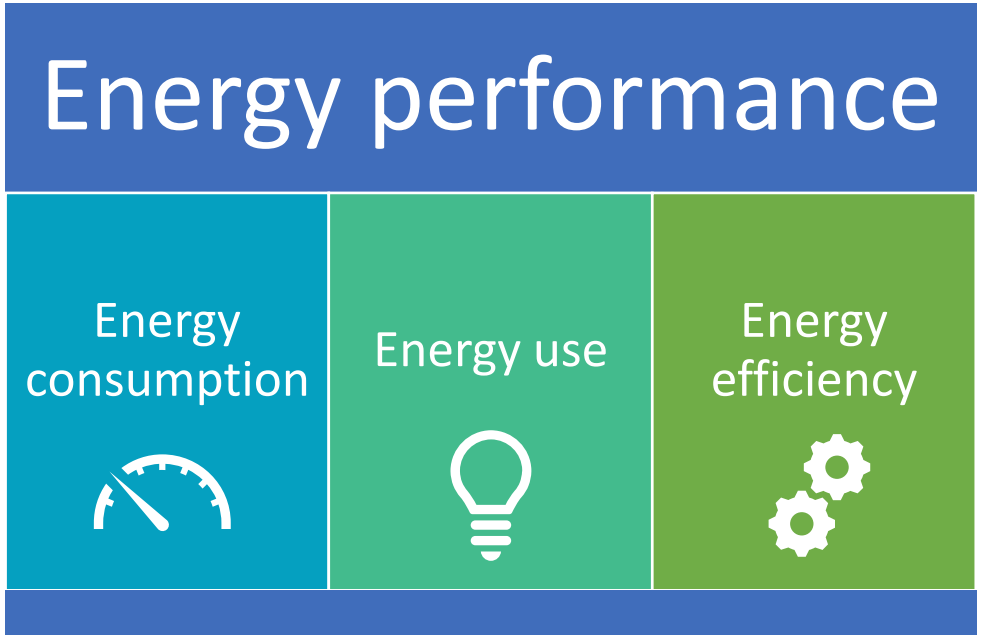
Energy Management (EnM)

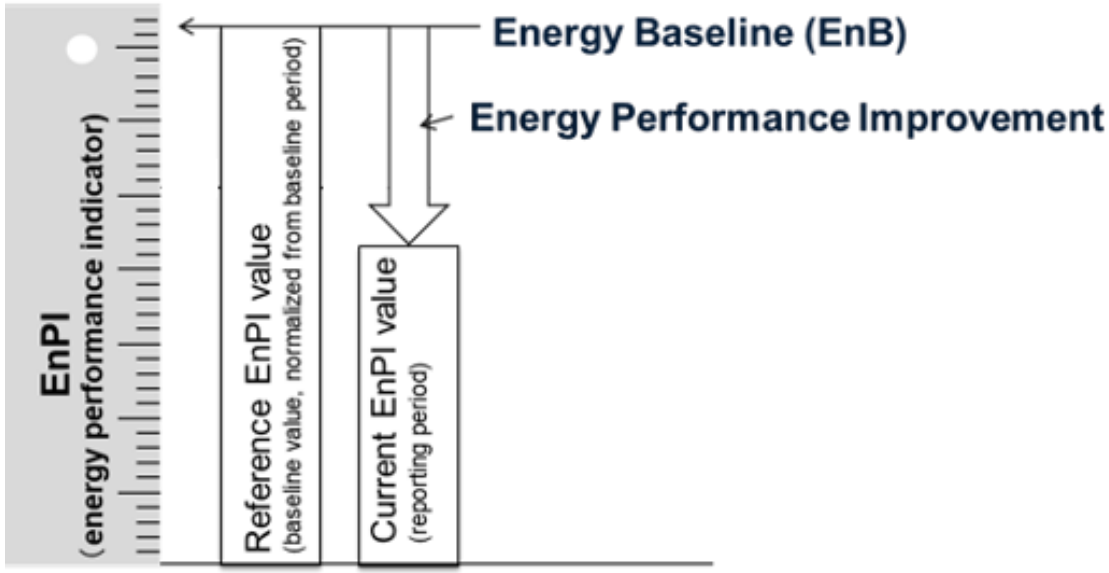


Gains of continuous improvement of an energy management system (KAHLENBORN et al., 2012)

Energy Performance (EnP)



Energy performance concept definition (ISO, 2018)



Concepts of energy performance improvement, EnPIs and EnBs (ISO, 2018)

Energy Performance Indicator (EnPI)

- Challenges:
  - Expressing appropriately
  - Defining a suitable calculation method
  - Transparency and coherence

Energy performance improvement and greenhouse gas emission correlation via energy savings as a proxy

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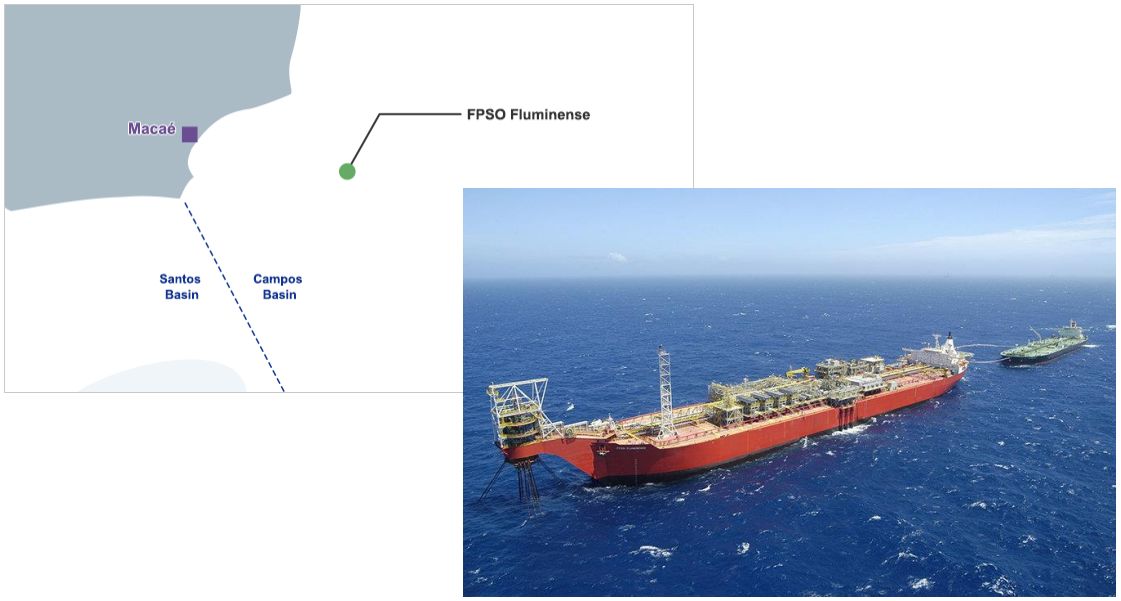
Case Study

- FPSO Fluminense



FPSO Fluminense (MODEC, 2020)

Energy efficiency measures (EEMs) were gradually implemented in FPSO Fluminense since late 2006.

How these EEMs have impacted this FPSO GHG emissions?

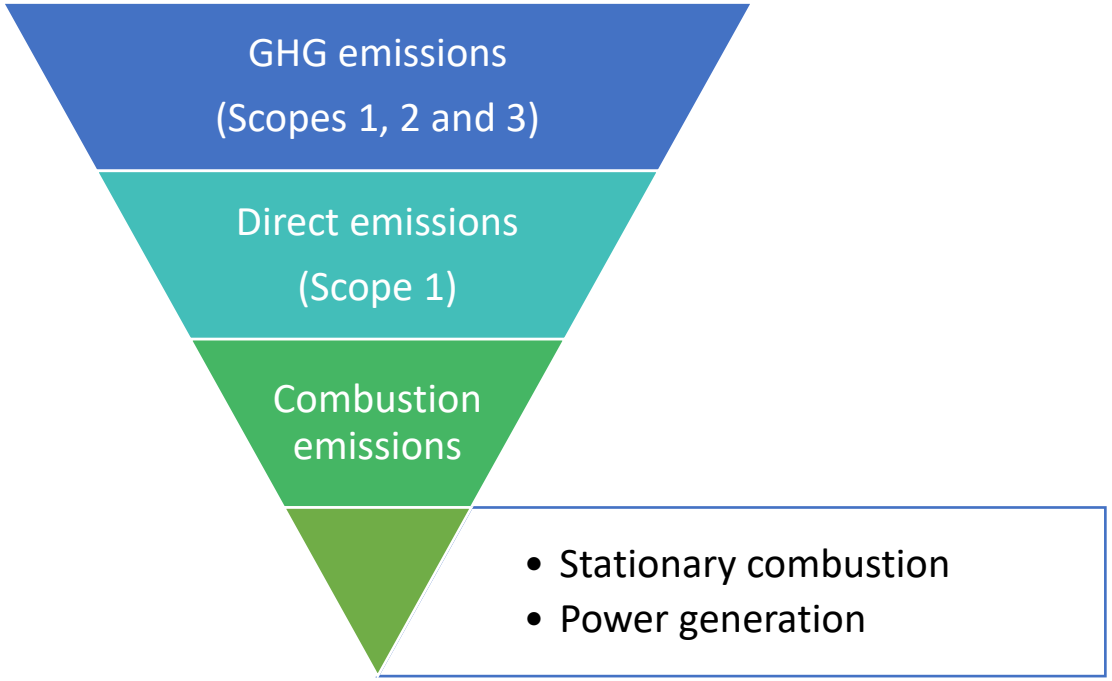
Case Study

- Evaluation Methodology

Case Study

Step 1

- Define boundaries and scopes



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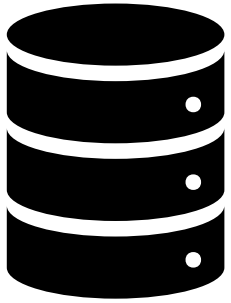
Step 2

- Calculate a specific emission factor from GHG inventory



2006 FPSO GHG inventory data

(CAMPOS et al., 2010)

Emission source	Emission Factor – EF (tCO_{2eq}/t)	Reference
Default stationary combustion of natural gas in energy industries (includes CO2, CH4, N2O)	2.695	IPCC (2006)
FPSO – Stationary combustion	2.888	Campos et al. (2010)

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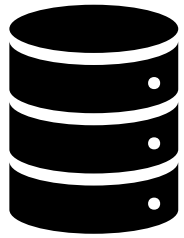
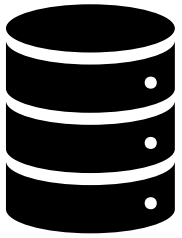
Step 3

- Calculate an adequate activity factor from energy performance evaluation

- EnPI
  - Expressing absolute consumption
  - Calculated by means of a statistical method
    - Linear regression
    - Relevant variable: Production



Production (t)



Gas consumption (t)

Data considered for EnPI statistical modelling (CAMPOS et al., 2010)

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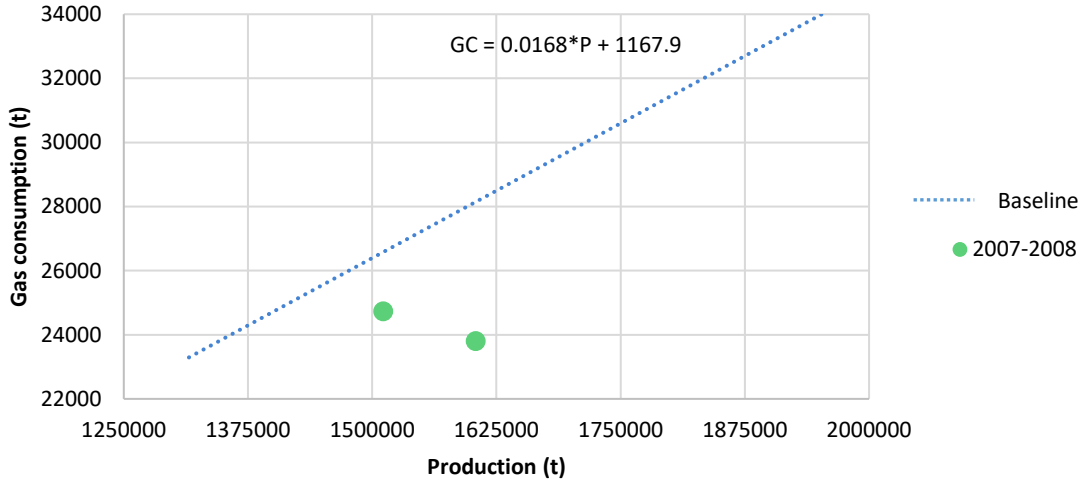
Step 3

- Calculate an adequate activity factor from energy performance evaluation



Normalized EnB (A)

Change in energy performance (all values in tonnes of gas consumption)

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Step 4

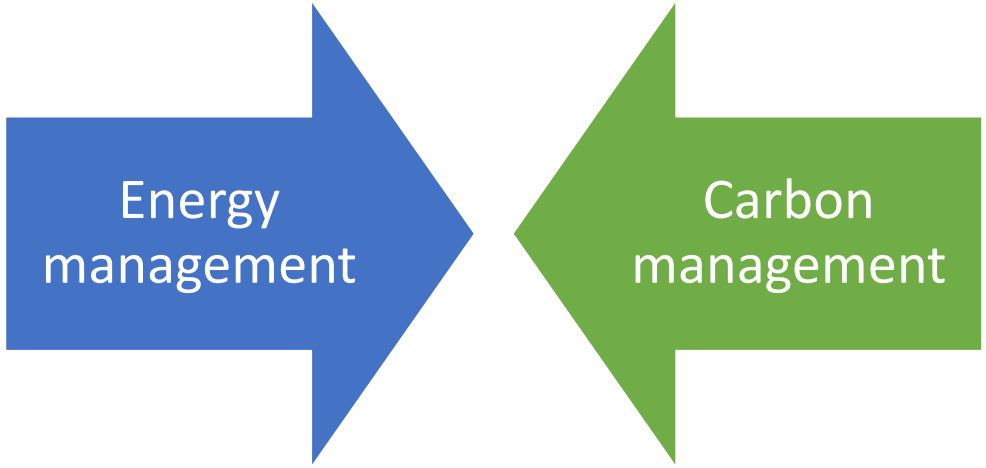
- Estimate the GHG emission mitigation from energy performance change

$$GHG\ Emissions = \sum_{boundary} (EF\ x\ \Delta EnP)$$

Assessment of change in GHG emissions due to change in energy performance (all values in tCO_{2eq})

Final remarks

- EnPI (within an EnMS) as an activity factor for GHG emission accounting:
  - Aligns to consequential methods
  - Support attributional methods (IPCC, 2019)
  - Improves transparency and coherence



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THANK YOU!

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