CONTRIBUTIONS OF ENERGY MANAGEMENT TO CLIMATE CHANGE MITIGATION – A CASE STUDY IN THE NATURAL GAS PRODUCTION CHAIN

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Research Centre for Gas Innovation

cleaner energy for a sustainable future

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Contributions of Energy Management to Climate Change Mitigation

- Objectives
- Energy Mgt Perspectives
- Opportunities in Oil & Gas Sector
- Conclusions & Future

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Research Project Objectives

- International analysis of energy efficiency promotion and related models
- International (ISO & UNIDO) activities of energy management system in promoting NG energy efficiency
- Analysis of Oil&Gas opportunities related to energy performance improvement
- Follow up efforts of standardization & regulation of NG and energy efficiency

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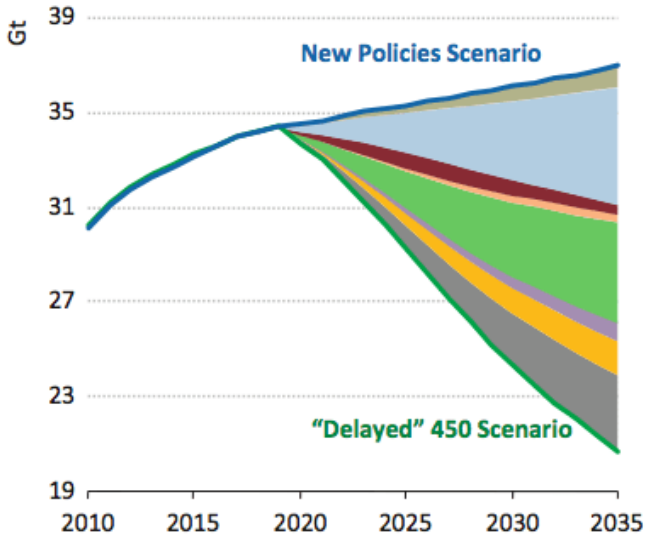
Start point for international actions related to energy efficiency

- Energy Efficiency context
  - EIA scenario for CO2 emissions abatement
  - energy savings, renewable and CCS are the most important initiatives
  - CO2 measurement methodologies are essential in the context

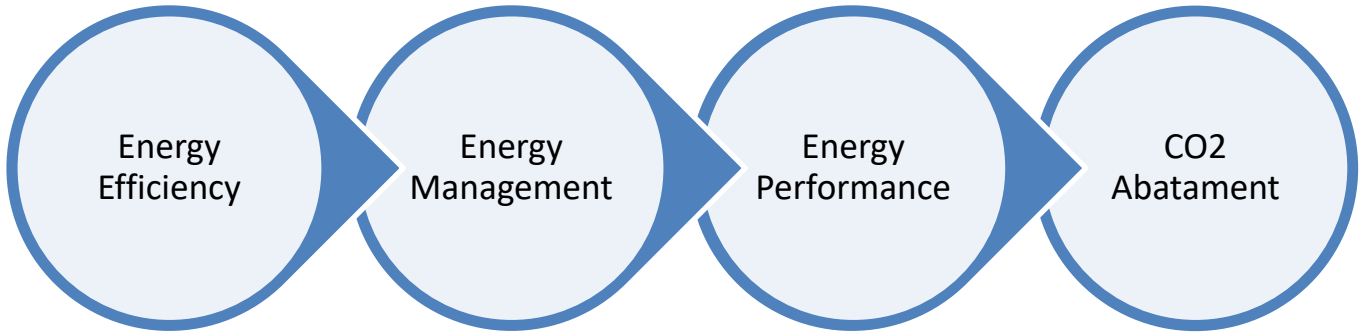
Figure 3.15 ▷ World energy-related CO_2 emissions abatement in a "delayed" 450 Scenario relative to the New Policies Scenario



CO_2 Abatement	2025	2035
Demand	5%	5%
End-use efficiency	27%	31%
Power plant efficiency	11%	3%
Fuel and technology switch	2%	2%
Renewables	25%	26%
Biofuels	5%	5%
Nuclear	9%	9%
CCS	15%	20%
Total (Gt CO_2)	6.2	16.4

International Energy Agency

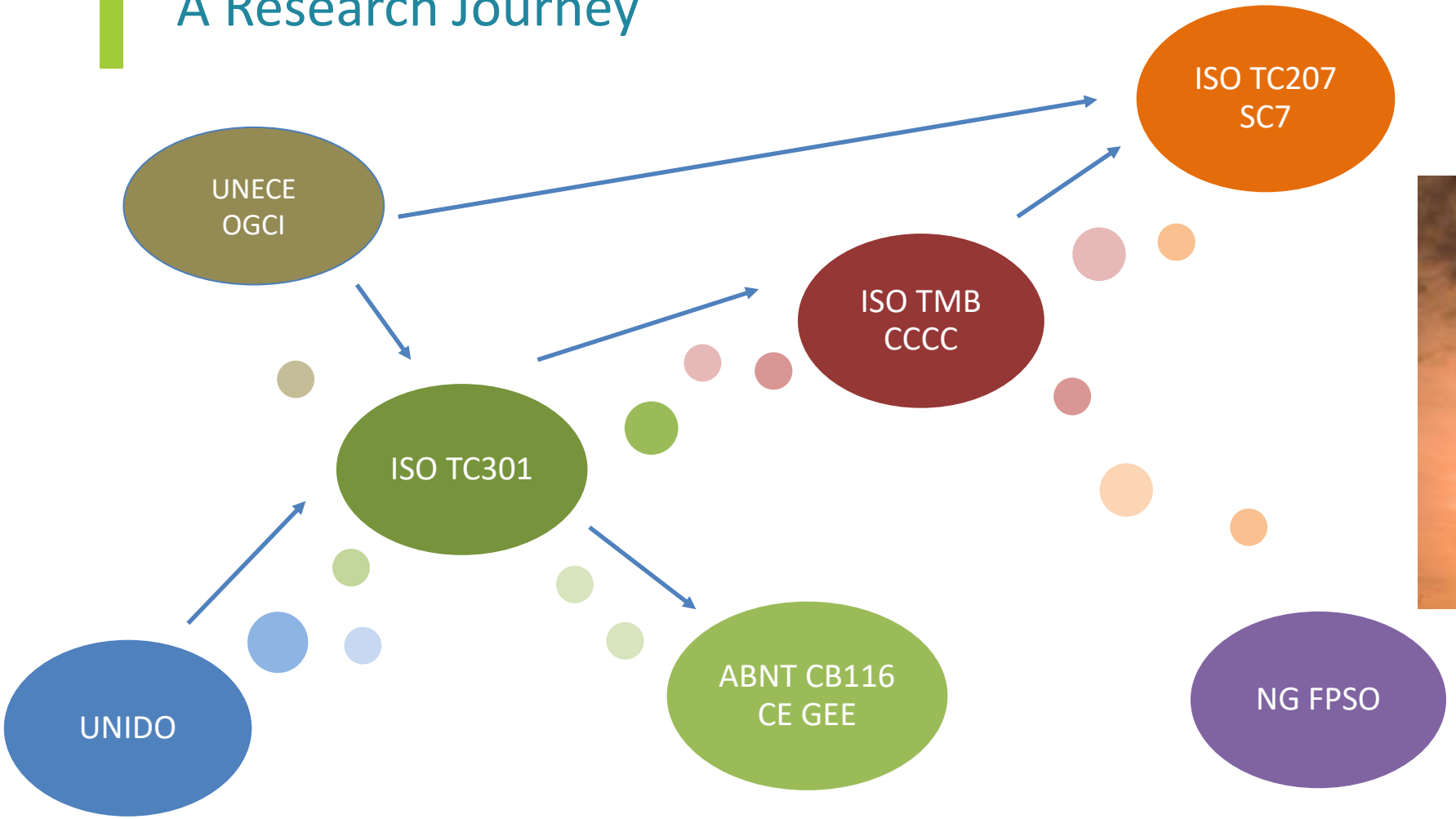
Energy Efficiency and CO2 abatement connection



- Assuming 50% ISO50001 implemented in the industrial and commercial sectors by 2030
- 16 EJ of anual primary Energy savings
- 1000 Mt of avoided anual CO2 emission

1st paper – Energy Policy – ISO TC301 interaction

Energy Mgt standards and methodologies – A Research Journey



UNIDO International Interface – Sustainable energy and climate agreement

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

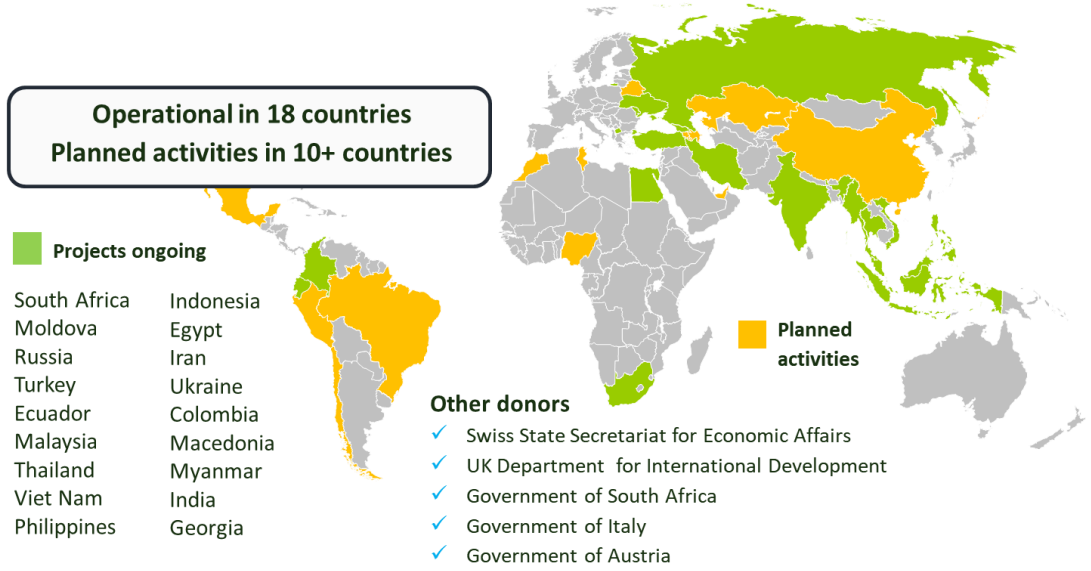
UNIDO

7 AFFORDABLE AND CLEAN ENERGY

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

13 CLIMATE ACTION

- Industrial Energy Efficiency Programme

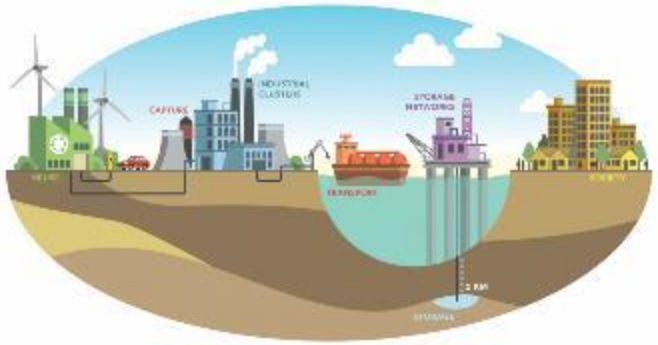


- Clean Energy Ministerial
  26 countries

CLEAN ENERGY MINISTERIAL
Accelerating the Global Clean Energy Transition

Main related Initiatives
- Energy Mgt Working Group (EMWG)
- Clean Energy Policy

SUSTAINABLE ENERGY FOR ALL



UNECE Group of Experts on Gas – UN Sustainable Development Goals

- UNECE Activities & Focus
  - Synergies between gas, Renewable and Energy efficiency
  - Gas in improving urban and indoor air quality
  - Measuring and managing methane emissions in gas chain
  - Sustainable production and consumption of gas and LNG
  - Gas infrastructure and transition to hydrogen economy

UNITED NATIONS
ECONOMIC COMMISSION
FOR EUROPE

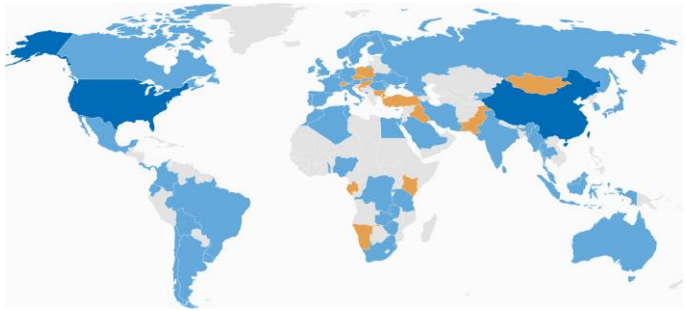
- OGCI Activities & Focus
  - Reducing Methane Leakage
  - Reducing Carbon Dioxide
  - Recycling Carbon Dioxide (CCUS)

OIL AND GAS CLIMATE INITIATIVE

ISO TC301 International Interface – Energy management & Energy Savings

ISO International Organization for Standardization

ISO TC301



- Energy Management & Energy Savings

  66 countries

- Standards

  <u>Top-down & button-up methodologies</u>

  Main related initiatives
  - 16 published standards
  - 7 under development
  - <u>ISO50000 Family</u>
  - Energy savings structure

ABNT ASSOCIAÇÃO BRASILEIRA DE NORMAS TÉCNICAS

- ABNT CB116 – CT-GEE

  Strategic coordination in Brazil
  - Following up international scenarios
  - Developing national Standards
  - Involvement of sectors

  (Sabesp / Comgas / Eletrobras)

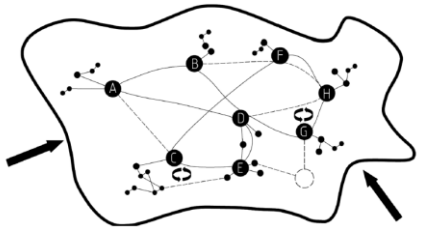
ISO TMB CCCC International Interface – Climate Change Coordination Committee

International Organization for Standardization

United Nations Framework Convention on Climate Change

ISO TMB CCCC

- Tools
  - GHG reduction – renewable and energy efficiency
  - Carbon capture and storage
  - Financing transition to a low carbon economy



- Other aspects
  - Organizational inventories
  - GHG monitoring projects

- Guidelines

Addressing climate change in standards

AVOID
- Can the standard help to identify / support GHG avoidence?
- Societal trends, innovations and developing policy provide opportunities
- Design options can consider alternatives for TAGS and their use context
- Can be integrated within change processes (may be longer term)

REDUCE
- Can the standard help to identify / support GHG reduction?
- Reduced use of fuels, fluorinated gases and wider efficiency (processes, waste etc)
- Opportunities exist across nearly all TAGS and their use context
- Quantification is important in GHG reduction (e.g. annual GHG accounting)

SUSTITUTE
- Can the standard help to identify / support substitution of GHGs?
- Includes use of alternative materials, fuels, renewable energy
- Can apply to TAGS directly, to components or across their life-cycle
- Quantification is important, including embodied carbon (in materials)

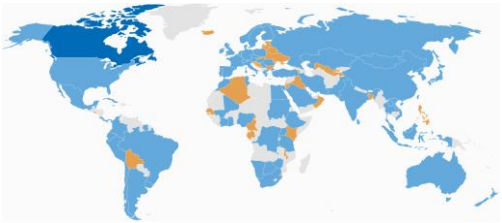
Compensate
- Can the standard help to identify / support GHG compensatation?
- Carbon capture and storage, nature-based sequestration, carbon offsets
- Can involve climate finance and quantification is important
- Positive opportunities after avoiding, reducing and substituting GHGs

ISO TC207 International Interface – Environmental management

ISO
TC207 – SC7

- GHG management and related activities

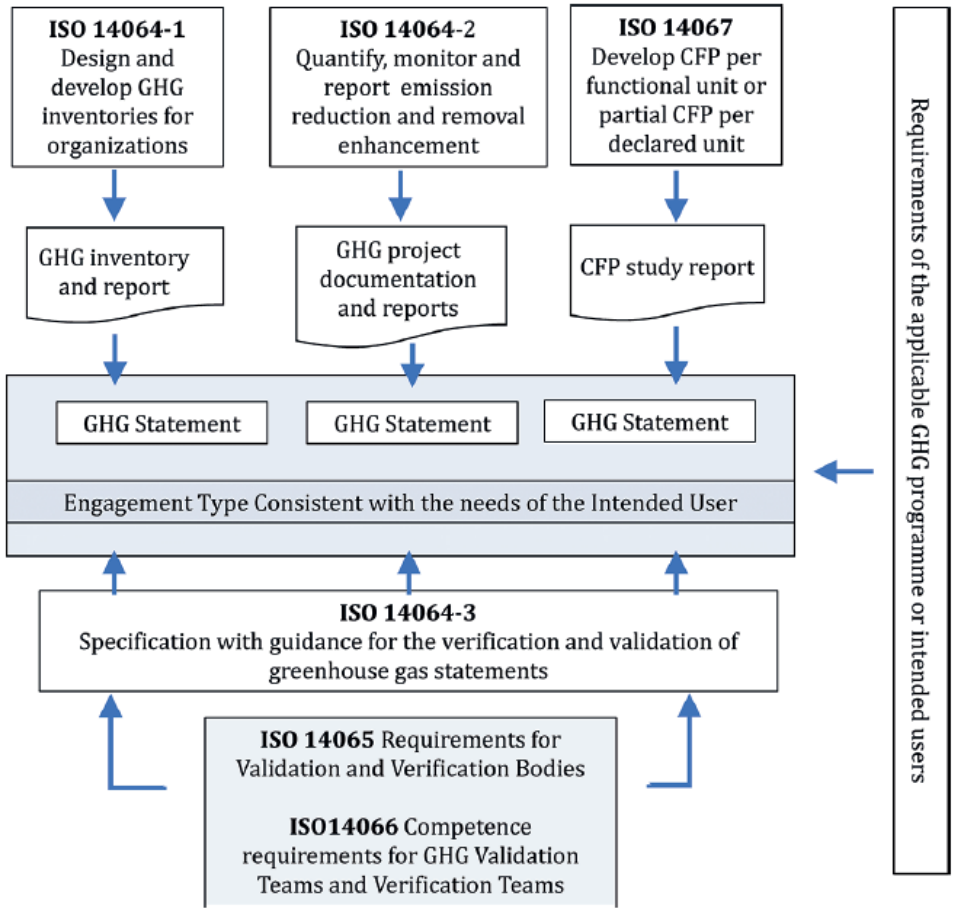
  62countries



- Standards

  Main related initiatives
  - 8 published standards
  - 9 under development
  - ISO14060 Family
  - GHG quantification methodologies

International Organization for Standardization



Carbon Measurement Methodologies & Models – Intergovernmental Panel on Climate Change

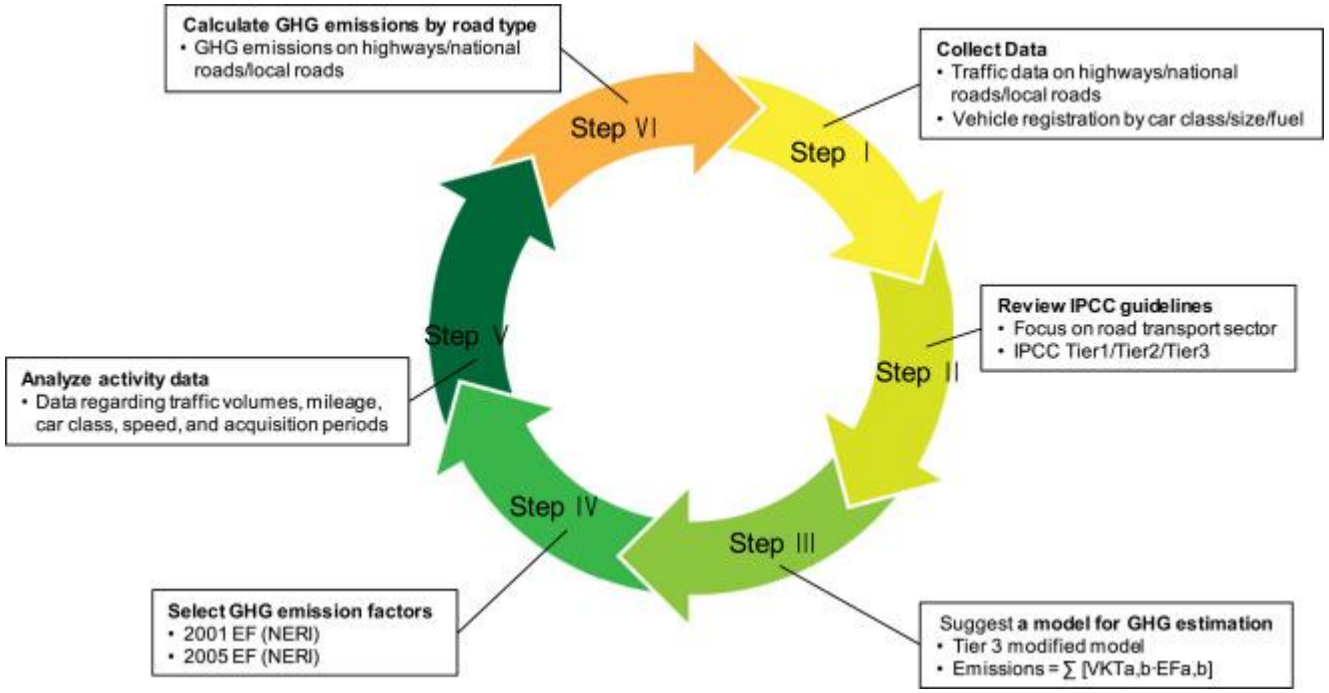
- CO2 emissions inventory

IPCC Tier 1 & ISO TC207

- Emissions are related to economic activities

Other methodologies

- World Business Council for Sustainable Development (WBCSD)
- World Reserach Institute (WRI)
- International Emission Trading Association (IETA)
- Americam Petroleun Institute (API)



UNIDO & CARBON TRUST – Brazilian Chalenges

- Energy efficiency programme in Brazil (proposal & outcomes)
  - Accelerated adoption of innovative tech and mgt practices for GHG emission reduction and CO2 abatement
  - Policy, planning and regulatory frameworks foster accelerated less CO2 and emissions mitigation

SE4ALL Goal #3

Double the rate of energy efficiency in the industrial sector by 2030

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Energy efficiency connections with Natural Gas – Impact from the industry

- Impact & Measurements

Indirect GHG emissions from Oil & Gas operations, including CO2 and CH4

- 2018: 5.2 billion tons of CO2eq (World Energy Outlook)

Accounting methodologies in initial stage for several economic activities

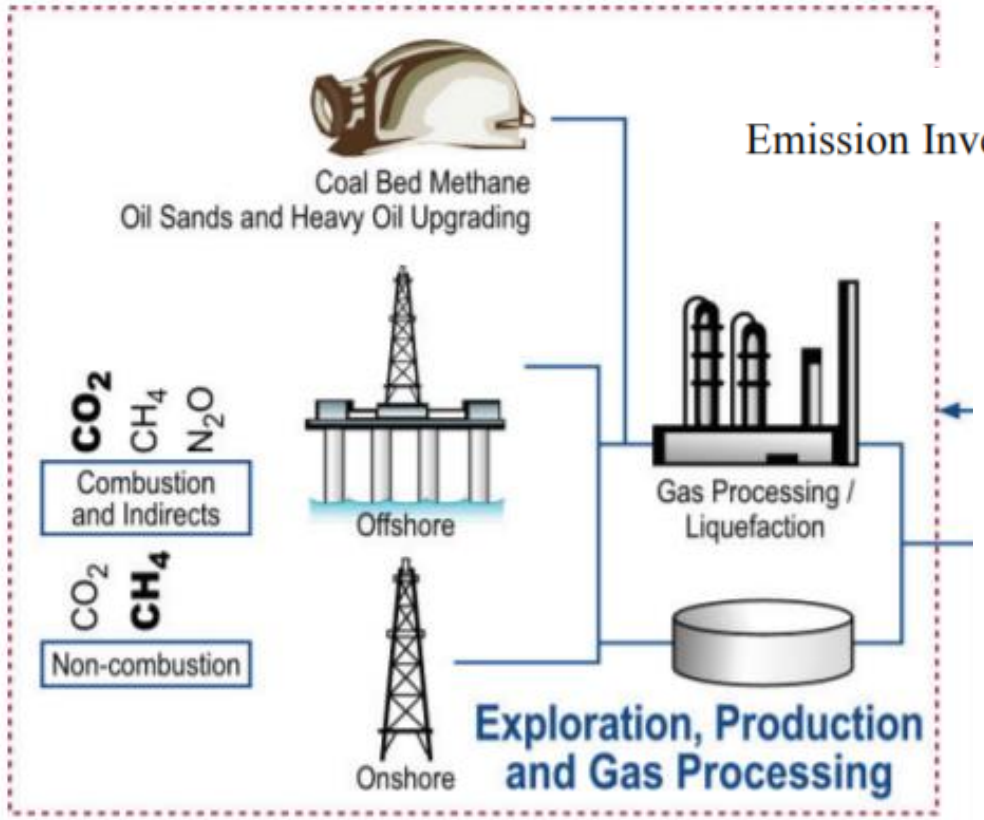
- IPCC & ISO standards base

Addressing CO2eq mitigation is connect with energy savings

- Energy performance & Energy management initiatives

GHG Methodologies for CO2 abatement – Problems and Barriers

- API Compendium of GHG
  - Direct emissions
    - Combustion source
    - Process emissions and vented sources
    - Fugitive sources
  - Indirect emissions
  - Barriers
    - Detais of the industry process
    - Emission factor identification
    - Activity factor selection

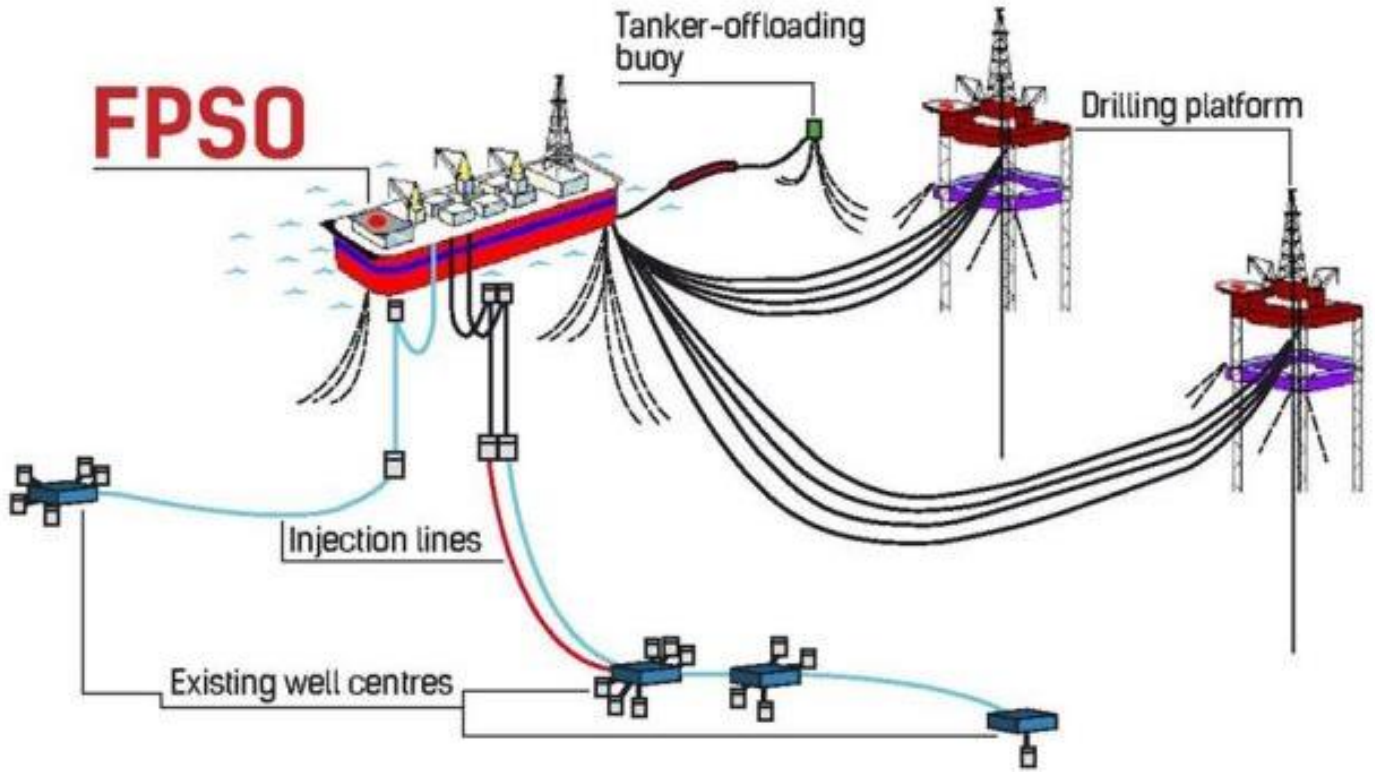


FPSO case study for energy efficiency opportunities – NG strategic focus

- Brazilian Oil & Gas Production

Floating, Production, Storage and Offloading (FPSO)

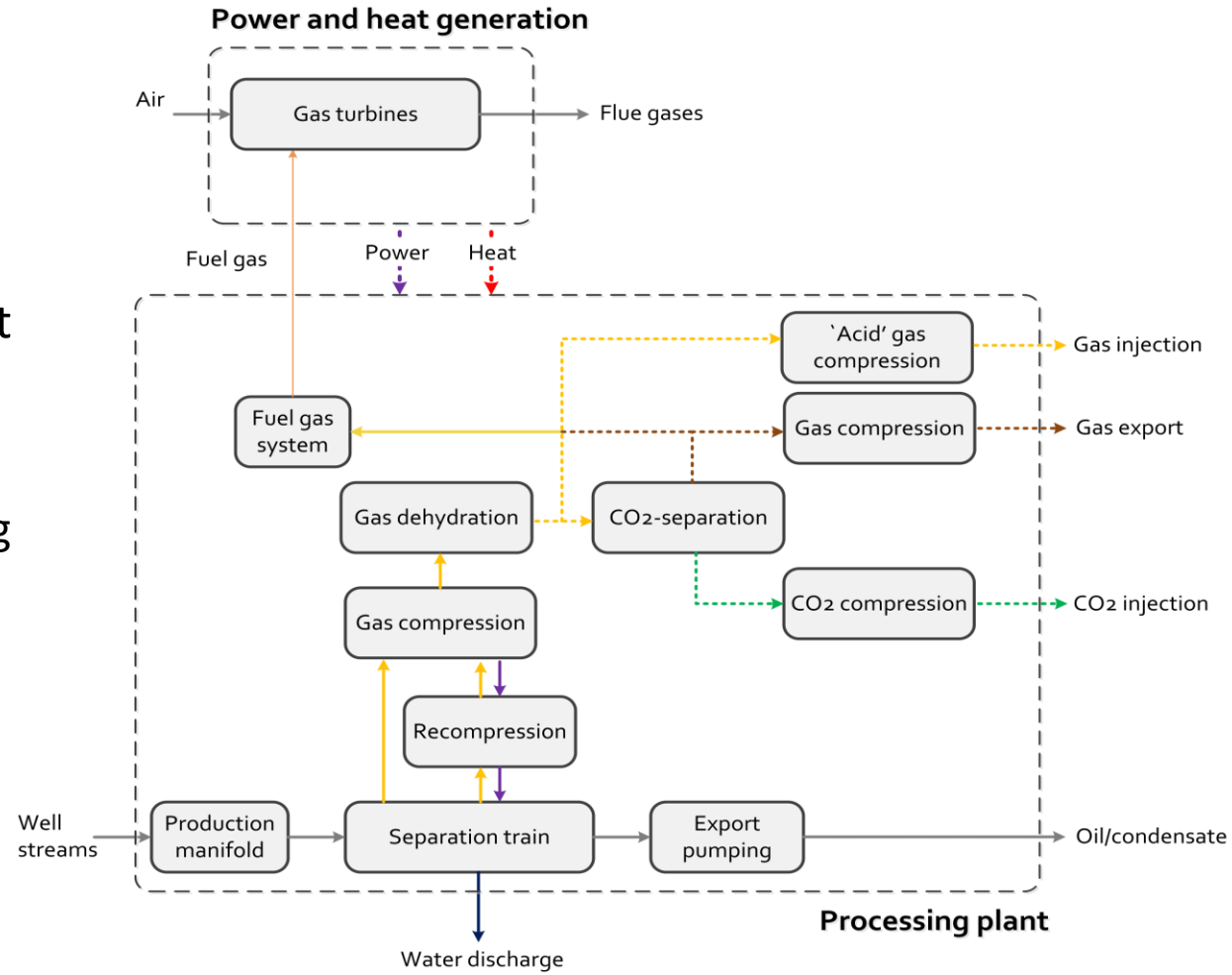
  - GHG Methodologies Update
    - ISO TC207 – SC7 / TMB CCCC
    - CO2eq calculations
  - FPSO production activities
    - Energy oportunities
    - Fugitive emissions



FPSO case study for energy efficiency opportunities – NG strategic focus

Brazilian Oil & Gas Production (FPSO)

- Reduce size of existing gas turbines to operate at higher average load;
- Cogeneration (SEVERAL OPTIONS):
  - A bottoming cycle can be added to an existing turbine;
  - Add smaller gas turbines with bottoming cycles.
- Heat recovery from the compressed gas



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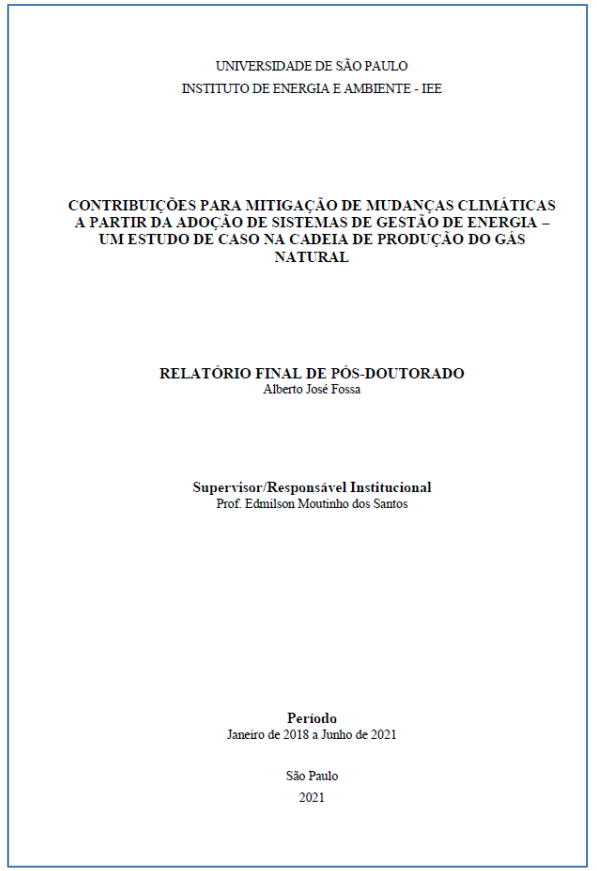
Future perspectives

- "Ways society can move towards a lower-carbon future include **improving energy efficiency**, switching from coal to natural gas, increasing electrification and the use of renewables." (Shell)

- Shell has announced by the end of 2017 that the company will aim to **reduce by 20% its GHG emissions by 2035** and to halve its emissions by 2050

- Research Project incorporated this scenario by **looking for GHG emission reduction through energy efficiency** and energy management inside the oil&gas industry



UNIVERSIDADE DE SÃO PAULO
INSTITUTO DE ENERGIA E AMBIENTE - IEE

CONTRIBUIÇÕES PARA MITIGAÇÃO DE MUDANÇAS CLIMÁTICAS A PARTIR DA ADOÇÃO DE SISTEMAS DE GESTÃO DE ENERGIA – UM ESTUDO DE CASO NA CADEIA DE PRODUÇÃO DO GÁS NATURAL

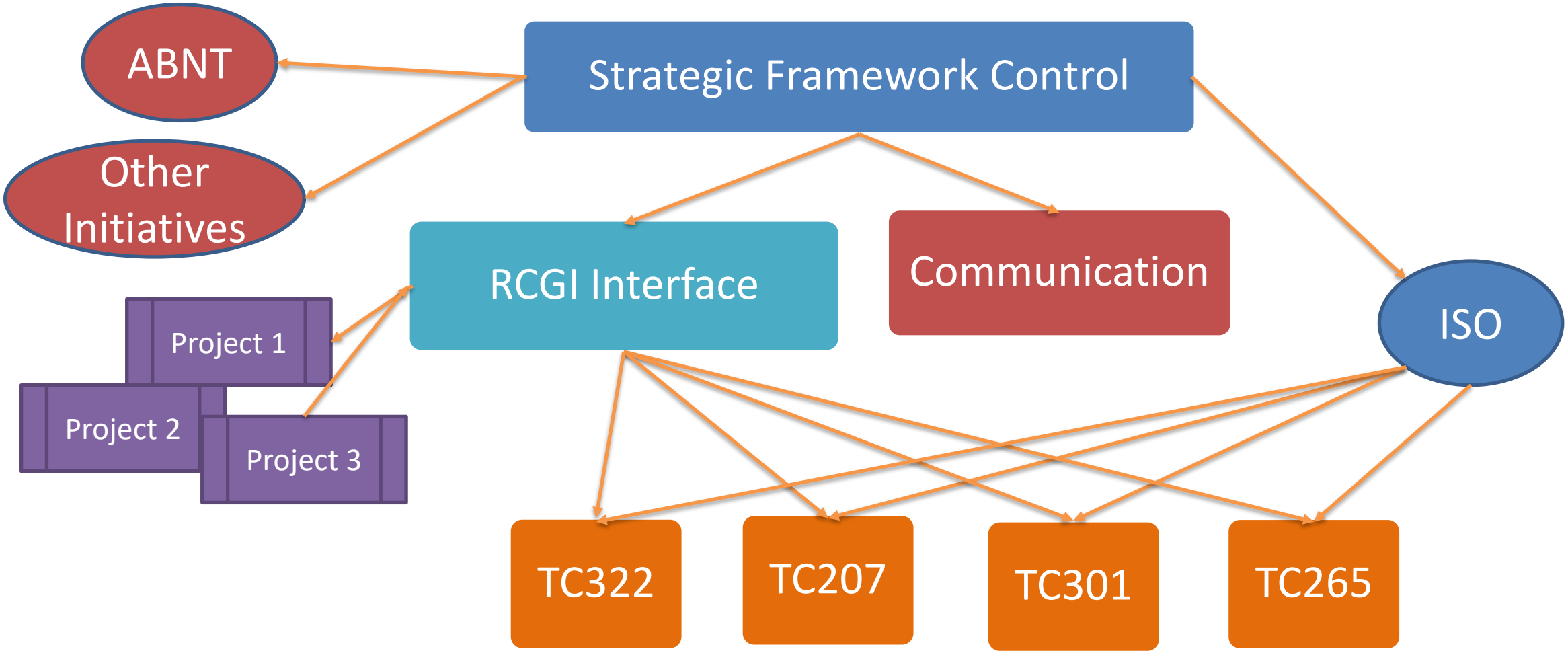
RELATÓRIO FINAL DE PÓS-DOUTORADO
Alberto José Fossa

Supervisor/Responsável Institucional
Prof. Edmilson Moutinho dos Santos

Período
Janeiro de 2018 a Junho de 2021

São Paulo
2021

The new approach – Activities & Operational Processes



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