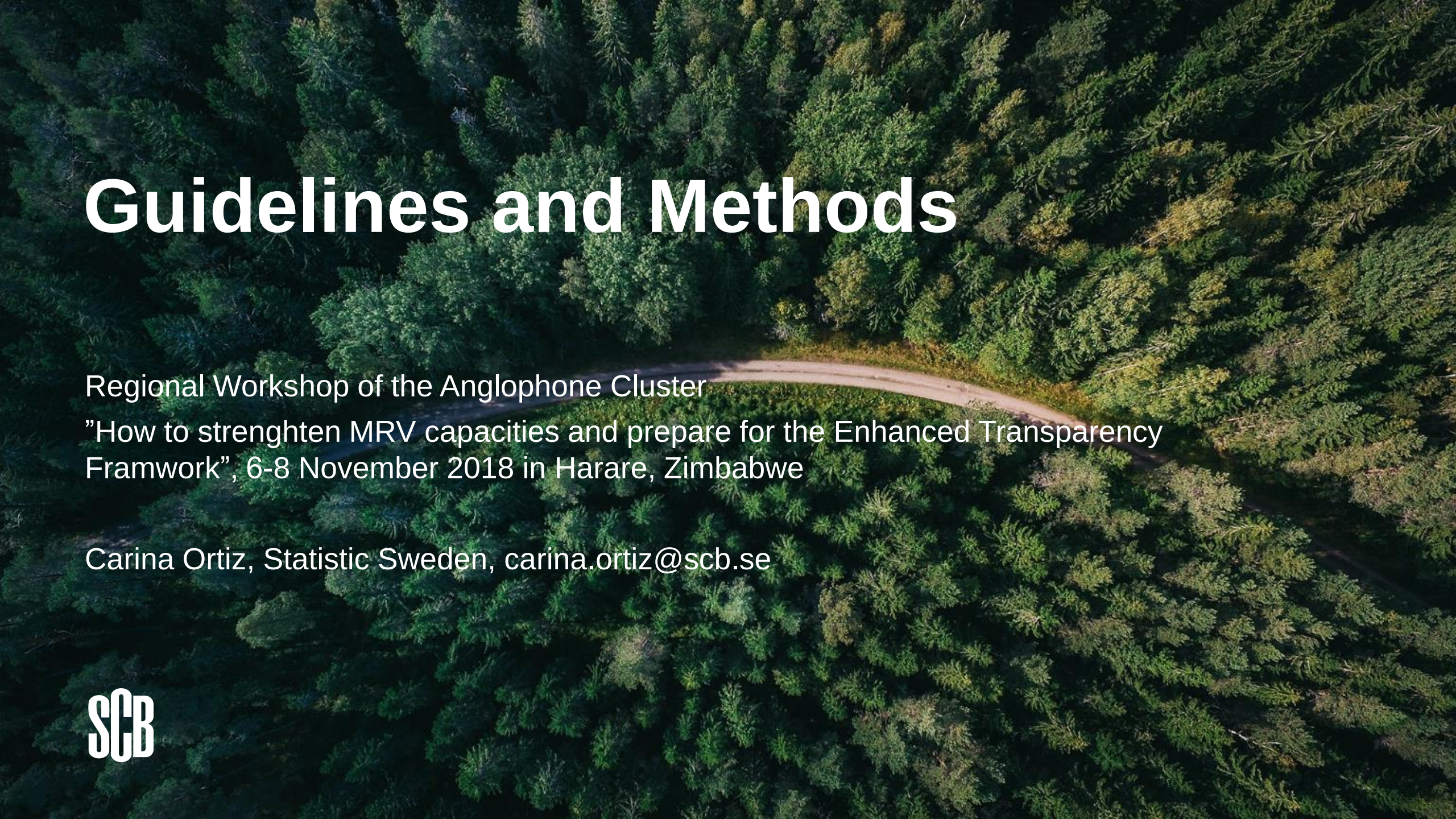


Guidelines and Methods

Regional Workshop of the Anglophone Cluster

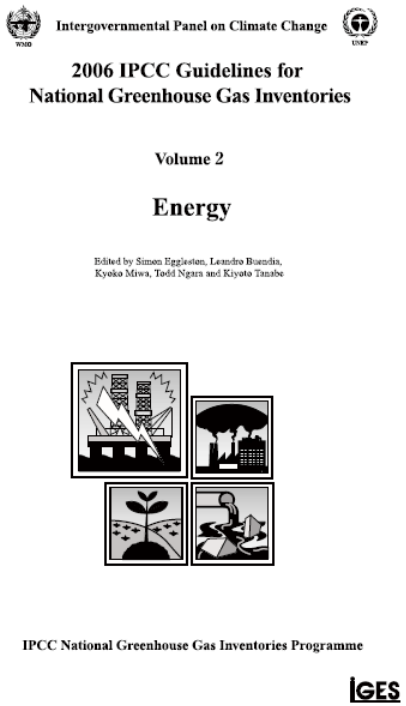
”How to strenghten MRV capacities and prepare for the Enhanced Transparency Framwork”, 6-8 November 2018 in Harare, Zimbabwe

Carina Ortiz, Statistic Sweden, carina.ortiz@scb.se

Guidelines and Methods GHG inventory

Available guidance

- IPCC Guidelines for GHG Inventory Estimates
- Policy and Action Standard for Policy effects



The GHG inventory

- CRF1. Energy
  - Stationary combustion
  - Transports
- CRF2. Industrial processes & Solvent and product use
- CRF3. Agriculture
- CRF4. Land use, land use change and forestry
- CRF5. Waste

The reporting of emissions to air

- UNFCCC
  - National Inventory Report – annually
  - Biennial Report – biennially
  - National Communication – every fourth year

  - Emissions of CO_2, CH_4, N_2O, CO, SO_2, NO_x, NMVOC, (HFCs, PFCs, SF_6, PAHs, HCBs, PCBs)

- UNFCC FCCC/CP/2002/7/Add.2 28 March 2003
  - For further guidelines
- "2006 IPCC Guidelines for National Greenhouse Gas Inventories" regulates how the climate gases should be estimated and reported

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UNITED NATIONS

UNFCCC Framework Convention on Climate Change

Distr.
GENERAL

FCCC/CP/2002/7/Add.2
28 March 2003

Original: ENGLISH

CONFERENCE OF THE PARTIES

REPORT OF THE CONFERENCE OF THE PARTIES ON ITS EIGHTH SESSION, HELD AT NEW DELHI FROM 23 OCTOBER TO 1 NOVEMBER 2002

FCCC/CP/2002/7/Add.2
English
Page 11

Table 1. National greenhouse gas inventory of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol[a] and greenhouse gas precursors

Greenhouse gas source and sink categories	CO_2 emissions (Gg)	CO_2 removals (Gg)	CH_4 (Gg)	N_2O (Gg)	CO (Gg)	NO_x (Gg)	NMVOCs (Gg)	SO_x (Gg)
Total national emissions and removals	X	X	X	X	X	X	X	X
1. Energy	X	X	X	X	X	X	X	X
A. Fuel combustion (sectoral approach)	X		X	X	X	X	X	X
1. Energy industries	X		X	X	X	X	X	X
2. Manufacturing industries and construction	X		X	X	X	X	X	X
3. Transport	X		X	X	X	X	X	X
4. Other sectors	X		X	X	X	X	X	X
5. Other (please specify)	X		X	X	X	X	X	X
B. Fugitive emissions from fuels	X		X		X	X	X	X
1. Solid fuels			X		X	X	X	X
2. Oil and natural gas			X		X	X	X	X
2. Industrial processes	X	X	X	X	X	X	X	X

And under the Paris Agreement

- National GHG Inventory report
- Progress made in implementign and achieving nationally determined contribution (NDC)

Methods Energy sector

- Emissions form the energy sector is divided in three main groups
  - Stationary combustion (energy, industry, small scale)
  - Mobile combustion (transport, working machinery)
  - Diffuse emissions (flaring, leakage etc.)
- In addition the fuel consumption from the supply side is reported in the ”Reference Approach”

Example of grouping the energy sector for GHG inventories and their CRF code

- Emissions are reported by CRF/NFR code:
- Coarse division of emissions from branches of industry within stationary combustion

1A. Fuel Combustion Activities (Sectoral Approach)
1A1. Energy Industries
1A1a. Public Electricity and Heat Production
1A1b. Petroleum Refining
1A1c. Manufacture of Solid Fuels and Other Energy Industries
1A2. Manufacturing Industries and Construction
1A2a. Iron and Steel
1A2b. Non-Ferrous Metals
1A2c. Chemicals
1A2d. Pulp, Paper and Print
1A2e. Food Processing, Beverages and Tobacco
1A2f. Non-metallic minerals
1A2g. Other
1A2g\ Machinery
1A2g\ Stationary
1A3. Transport
1A3a. Civil Aviation
1A3b. Road Transportation
1A3c. Railways
1A3d. Navigation
1A3e. Other Transportation
Off-road vehicles and other machinery
1A4. Other Sectors
1A4a. Commercial/Institutional
1A4b. Residential
1A4c. Agriculture/Forestry/Fisheries

Methods Energy sector

- Emissions within the energy sector is normally estimated with the equation formula
- AD*NCV*EF where,
  - AD = Activity Data , here energy consumption in physical measures
  - NCV = Net Calorific Values for conversion to TJ
  - EF = Emission Factor for the substance , often in kg/GJ

Descision tree for Tier/method

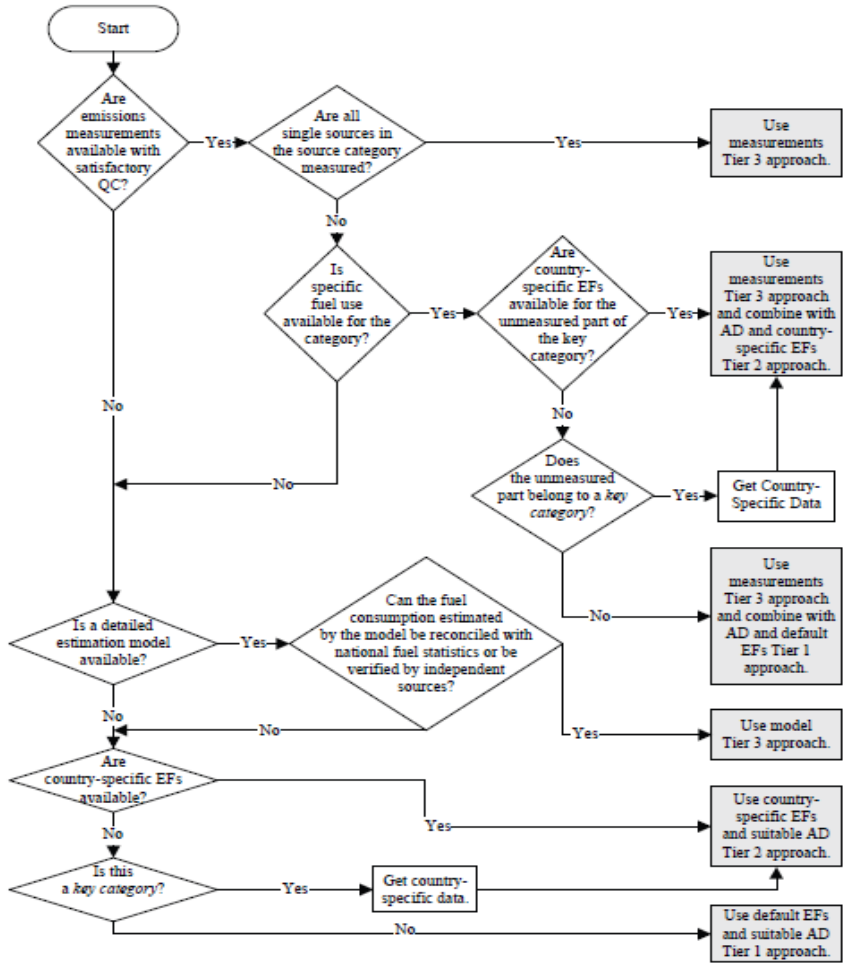
Tier 1

Tier 2

Tier 3

Increased complexity
Decreased uncertainty

Figure 2.1 **Generalised decision tree for estimating emissions from stationary combustion**



Note: See Volume 1 Chapter 4, "Methodological Choice and Key Categories" (noting section 4.1.2 on limited resources) for discussion of *key categories* and use of decision trees.

Tier 1

$$Emissions_{GHG,fuel} = Fuel\ Consumption_{fuel} * Emission\ Factor_{GHG,fuel}$$

- Emission GHG, fuel=emissions of a given GHG type of fuel (kg GHG)
- Fuel Consumption fuel= amount of fuel combusted (TJ)
- Emission Factor GHG, fuel=default emission fctor of a given GHG by type of fuel (kg gas/TJ)

Tier 2

$$Emissions_{GHG,fuel} = Fuel\ Consumption_{fuel} * Emission\ Factor_{GHG,fuel}$$

- Data on the amount of fuel combusted in the source category
- A country-specific emission factor for the source category and fuel for each gas

Tier 3

$$Emissions_{GHG,fuel} = Fuel\ Consumption_{fuel} * Emission\ Factor_{GHG,fuel}$$

- Fuel type used
- Combustion technology
- Operating conditions
- Control technology
- Quality of maintenance
- Age of equipment used to burn the fuel
- facility level information on fuel use and emissions

Emission factors

- IPCC default
- Country specific
- Sector specific
- Facility specific

TABLE 2.2
DEFAULT EMISSION FACTORS FOR STATIONARY COMBUSTION IN THE ENERGY INDUSTRIES
(kg of greenhouse gas per TJ on a Net Calorific Basis)

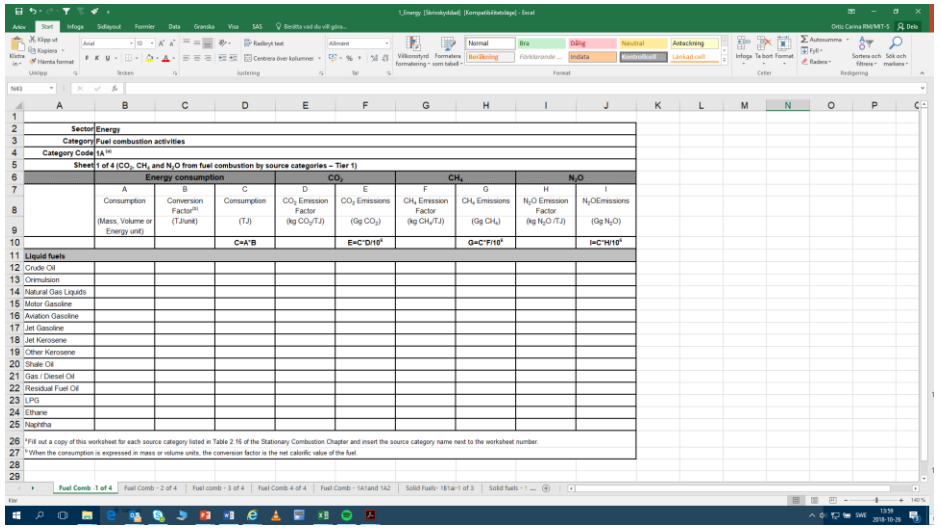
Fuel		CO_2			CH_4			N_2O		
		Default Emission Factor	Lower	Upper	Default Emission Factor	Lower	Upper	Default Emission Factor	Lower	Upper
Crude Oil		73 300	71 100	75 500	r 3	1	10	0.6	0.2	2
Orimulsion		r 77 000	69 300	85 400	r 3	1	10	0.6	0.2	2
Natural Gas Liquids		r 64 200	58 300	70 400	r 3	1	10	0.6	0.2	2
Gasoline	Motor Gasoline	r 69 300	67 500	73 000	r 3	1	10	0.6	0.2	2
	Aviation Gasoline	r 70 000	67 500	73 000	r 3	1	10	0.6	0.2	2
	Jet Gasoline	r 70 000	67 500	73 000	r 3	1	10	0.6	0.2	2
Jet Kerosene		r 71 500	69 700	74 400	r 3	1	10	0.6	0.2	2
Other Kerosene		71 900	70 800	73 700	r 3	1	10	0.6	0.2	2
Shale Oil		73 300	67 800	79 200	r 3	1	10	0.6	0.2	2
Gas/Diesel Oil		74 100	72 600	74 800	r 3	1	10	0.6	0.2	2
Residual Fuel Oil		77 400	75 500	78 800	r 3	1	10	0.6	0.2	2
Liquefied Petroleum Gases		63 100	61 600	65 600	r 1	0.3	3	0.1	0.03	0.3
Ethane		61 600	56 500	68 600	r 1	0.3	3	0.1	0.03	0.3
Naphtha		73 300	69 300	76 300	r 3	1	10	0.6	0.2	2
Bitumen		80 700	73 000	89 900	r 3	1	10	0.6	0.2	2
Lubricants		73 300	71 900	75 200	r 3	1	10	0.6	0.2	2
Petroleum Coke		r 97 500	82 900	115 000	r 3	1	10	0.6	0.2	2
Refinery Feedstocks		73 300	68 900	76 600	r 3	1	10	0.6	0.2	2
Other Oil	Refinery Gas	n 57 600	48 200	69 000	r 1	0.3	3	0.1	0.03	0.3
	Paraffin Waxes	73 300	72 200	74 400	r 3	1	10	0.6	0.2	2
	White Spirit and SBP	73 300	72 200	74 400	r 3	1	10	0.6	0.2	2
	Other Petroleum Products	73 300	72 200	74 400	r 3	1	10	0.6	0.2	2
Anthracite		98 300	94 600	101 000	1	0.3	3	r 1.5	0.5	5
Coking Coal		94 600	87 300	101 000	1	0.3	3	r 1.5	0.5	5
Other Bituminous Coal		94 600	89 500	99 700	1	0.3	3	r 1.5	0.5	5
Sub-Bituminous Coal		96 100	92 800	100 000	1	0.3	3	r 1.5	0.5	5
Lignite		101 000	90 900	115 000	1	0.3	3	r 1.5	0.5	5
Oil Shale and Tar Sands		107 000	90 200	125 000	1	0.3	3	r 1.5	0.5	5

Time series consistency

- 1990, 1994 initial communication
- 2000 second national communication
  - UNFCC FCCC/CP/2002/7/Add.2 28 March 2003
- Keep same data source as long as possible

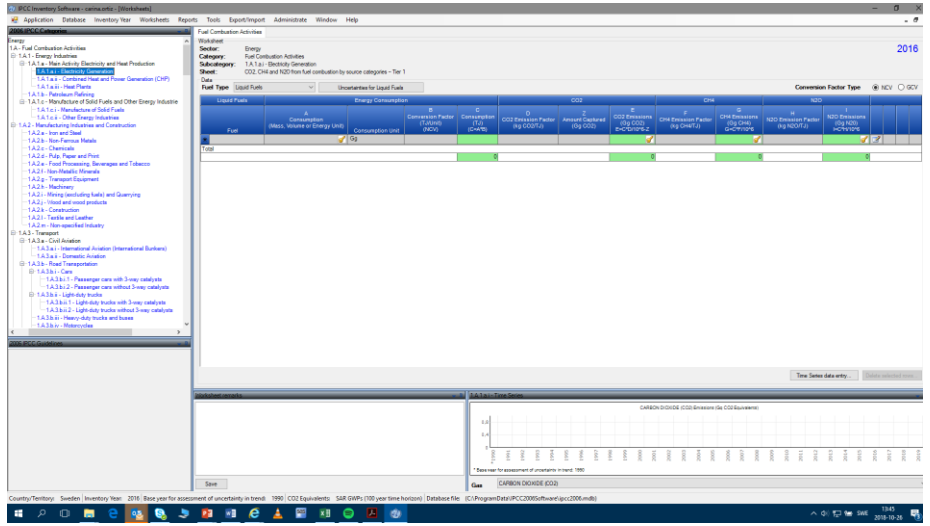
Typical tools and models

- IPCC working sheets
- IPCC Software



Sector	Energy								
Category	Fuel combustion activities								
Category Code	1.A [a]								
Sheet	1 of 4 (CO_2, CH_4 and N_2O from fuel combustion by source categories – Tier 1)								
	Energy consumption			CO_2		CH_4		N_2O	
	A Consumption (Mass, Volume or Energy unit)	B Conversion Factor[b] (TJ/unit)	C Consumption (TJ)	D CO_2 Emission Factor (kg CO_2/TJ)	E CO_2 Emissions (Gg CO_2)	F CH_4 Emission Factor (kg CH_4/TJ)	G CH_4 Emissions (Gg CH_4)	H N_2O Emission Factor (kg N_2O /TJ)	I N_2OEmissions (Gg N_2O)
			C=A*B		E=C*D/10^6		G=C*F/10^6		I=C*H/10^6
Liquid fuels									
Crude Oil									
Orimulsion									
Natural Gas Liquids									
Motor Gasoline									
Aviation Gasoline									
Jet Gasoline									
Jet Kerosene									
Other Kerosene									
Shale Oil									
Gas / Diesel Oil									
Residual Fuel Oil									
LPG									
Ethane									
Naphtha									

[a] Fill out a copy of this worksheet for each source category listed in Table 2.16 of the Stationary Combustion Chapter and insert the source category name next to the worksheet number.
[b] When the consumption is expressed in mass or volume units, the conversion factor is the net calorific value of the fuel.



Typical indicators to measure mitigation (Swedish Example)

- Renewable energy share in the total final energy consumption
- Energy intensity measured in terms of primary energy and GDP
- Share of household waste for energy production
- Find more examples

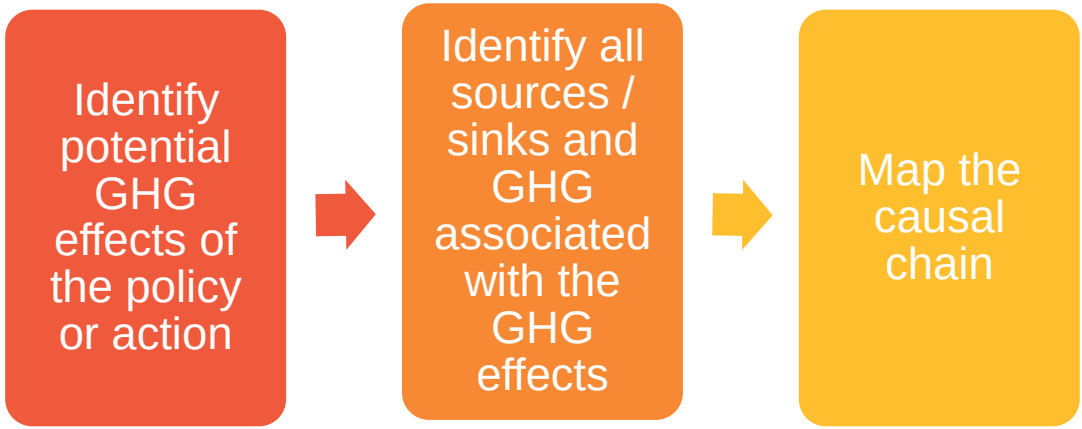
Guidelines and Methods
Policy effects

Policy and action standard and application to Energy sector

- A guideline (accounting and reporting standard) for estimating the GHG effects of policies and actions
- To help users **assess** GHG effects of specific policies and actions in an accurate, consistent, transparent, complete, and relevant way
- To help policymakers **develop effective strategies** for managing and reducing GHG emissions
- Additional guidance for different sectors is provided
- https://ghgprotocol.org/policy-and-action-standard

How to assess the impacts of a Mitigation Action?

- A policy or action can have GHG effects (GHG emission reductions or increases) and non-GHG effects (improvement in air or water quality, job creation, etc)
- In order to estimate and measure the GHG and non-GHG effects of a policy or action, it is necessary to first gain an understanding on the effects that the measure will have



Identify potential GHG effects of the policy or action

Identifying potential effects of a policy or action

1. Identify all **inputs and activities** related to the implementation of the action in order to understand its effects
2. Identify **intermediate effects** of the action
3. Identify **GHG effects**
4. Identify **non-GHG effects**

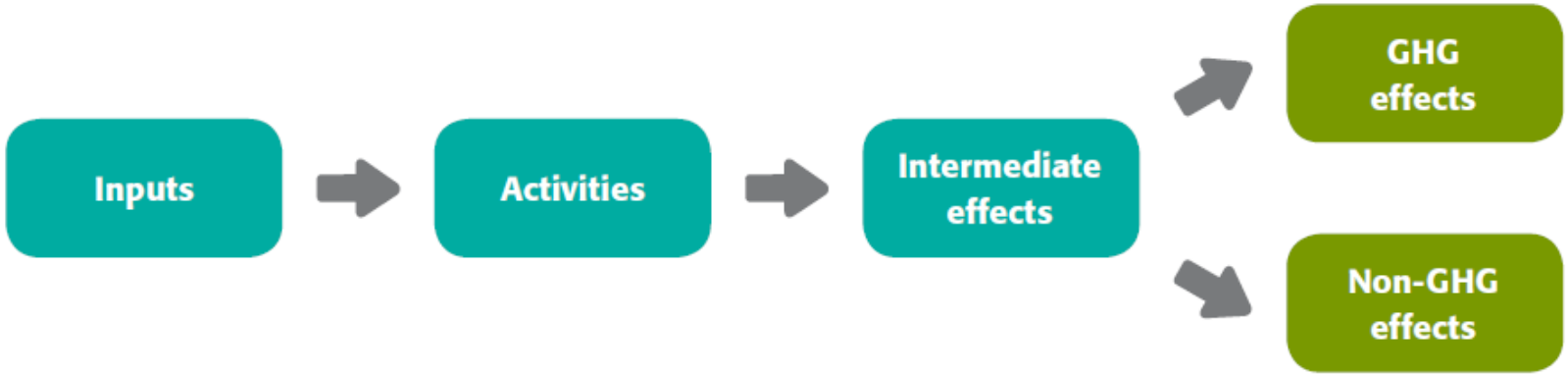
Table 6.1 Summary of inputs, activities, and effects

Indicator types	Definitions	Examples for a home insulation subsidy program
Inputs	Resources that go into implementing a policy or action, such as financing	Money needed to implement the subsidy program
Activities	Administrative activities involved in implementing the policy or action (undertaken by the authority or entity that implements the policy or action), such as permitting, licensing, procurement, or compliance and enforcement	Energy audits, provision of subsidies
Intermediate effects	Changes in behavior, technology, processes, or practices that result from the policy or action	Consumers purchase and install insulation, home natural gas and electricity use are reduced
GHG effects	Changes in greenhouse gas emissions by sources or removals by sinks that result from the intermediate effects of the policy or action	Reduced CO_2, CH_4, and N_2O emissions from reduced natural gas and electricity use
Non-GHG effects	Changes in relevant environmental, social, or economic conditions other than GHG emissions or climate change mitigation that result from the policy or action	Increase in disposable income due to energy savings

Identify potential GHG effects of the policy or action

Identifying potential effects of a policy or action

- Relationship of inputs, activities, intermediate effects, GHG effects, and non-GHG effects



Identify potential GHG effects of the policy or action

Identifying potential effects of a policy or action

- The next step is to identify the largest possible number of effects of a policy or action.
- Users should consider all possible types of effects:
  - In-jurisdiction and out-of-jurisdiction
  - Short- and long term
  - Intended and unintended
  - Likely, possible, and unlikely
  - GHG increasing and GHG decreasing

Identify potential GHG effects of the policy or action

Identifying potential effects of a policy or action

- Users should also consider potential GHG effects in terms of the following:
  - Technology effects: Design or deployment of new technologies
  - Infrastructure effects: Development of new infrastructure
  - Consumer / Business behavior and practices: Changes in purchasing / manufacturing decisions or other practices
  - Market effects: Changes in supply and demand, in prices, in market structure or market share resulting from the policy or action
  - Life-cycle effects: Changes in upstream and downstream activities, such as extraction and production of energy and materials, or effects in sectors not targeted by the policy or action
  - Macroeconomic effects: Changes in macroeconomic conditions (GDP, income, employment, or structural changes in economic sectors)
  - Trade effects: Changes in imports and exports, such as leakage

Identify potential GHG effects of the policy or action

Identifying potential effects of a policy or action

- There are several ways to identify GHG and non-GHG effects, such as:
  - Literature reviews of previous evaluation of similar policies under similar circumstances
  - Consultations, enquiries or panels with experts and other relevant stakeholders
  - Review of existing decrees, development plans, environmental impact assessments and economic studies
  - Sector specific methodologies or guidelines
  - Expert judgement

Identify all sources / sinks and GHG associated with the GHG effects

Identifying the key source and sink GHG emission categories and the GHG associated to the GHG effects of a policy or action

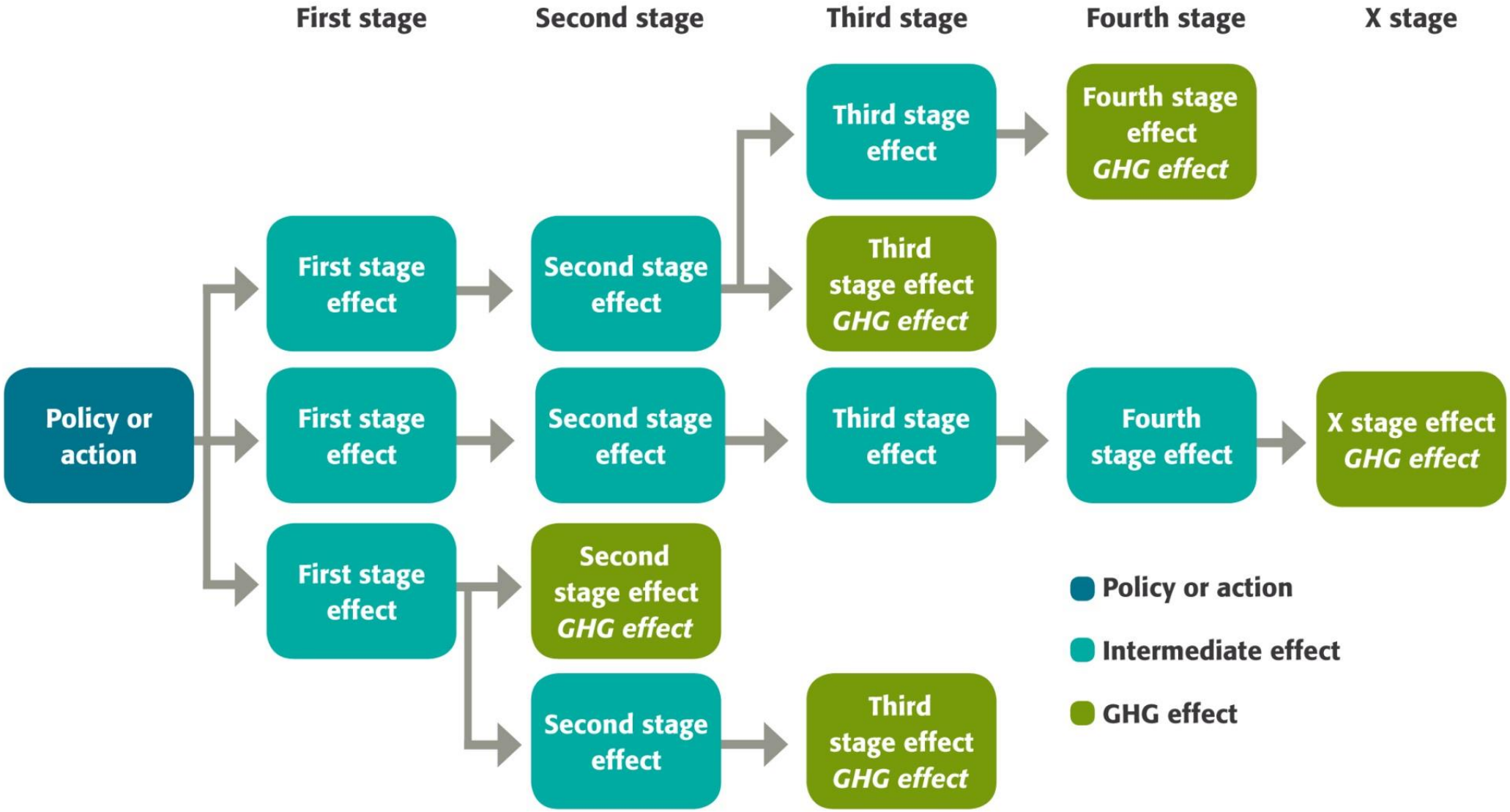
- Once all effects of a policy or action have been identified, the next step is to identify the categories and GHG associated to its effects
- It is recommended to use the IPCC GHG inventory guidelines

Map the causal chain

Mapping the causal chain

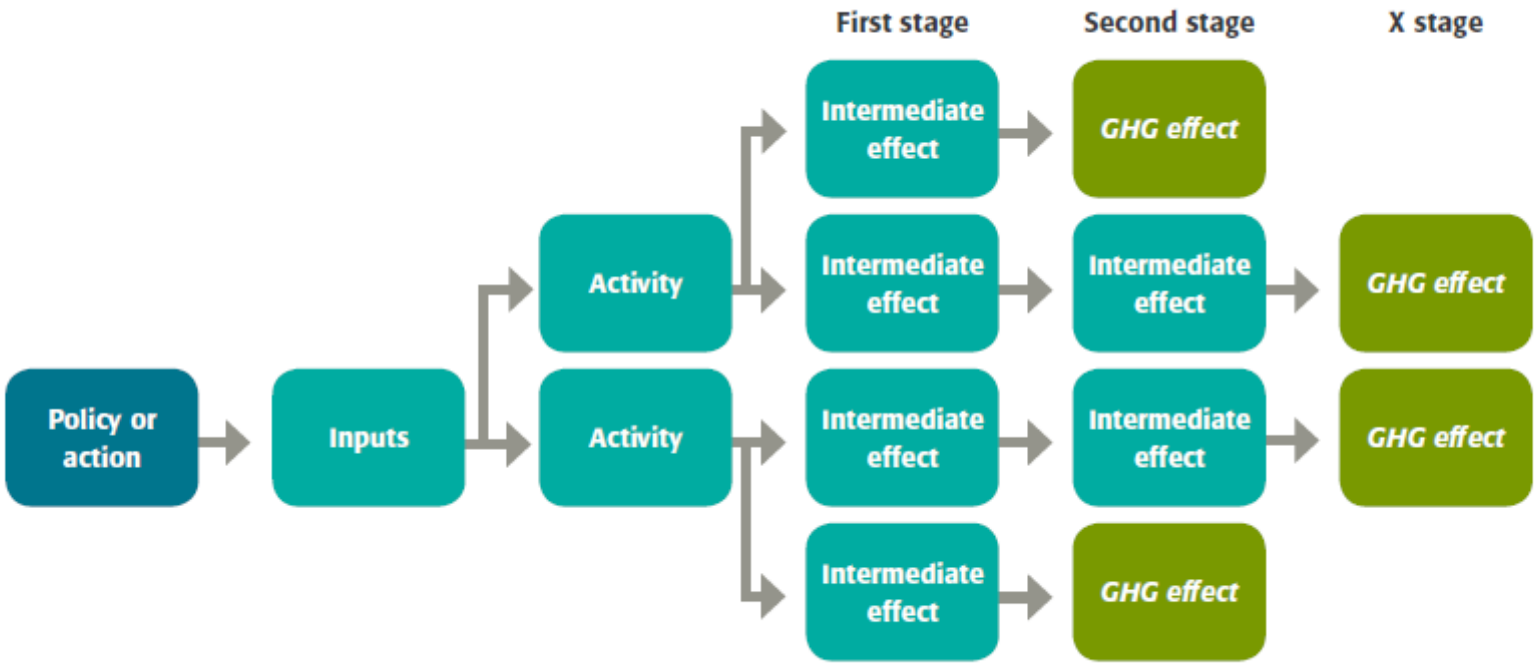
- The next step is to map and document a causal chain of the policy or action assessed on the base of the identified effects and the identified GHG sources and removals
- It can be decided whether:
  - A single causal chain is developed for an overall (sectoral) strategy
  - Independent causal chains are developed for each policy or action included in the (sectoral) strategy
  - As a minimum, the causal chain has to include all intermediate effects and GHG effects identified

Map the causal chain



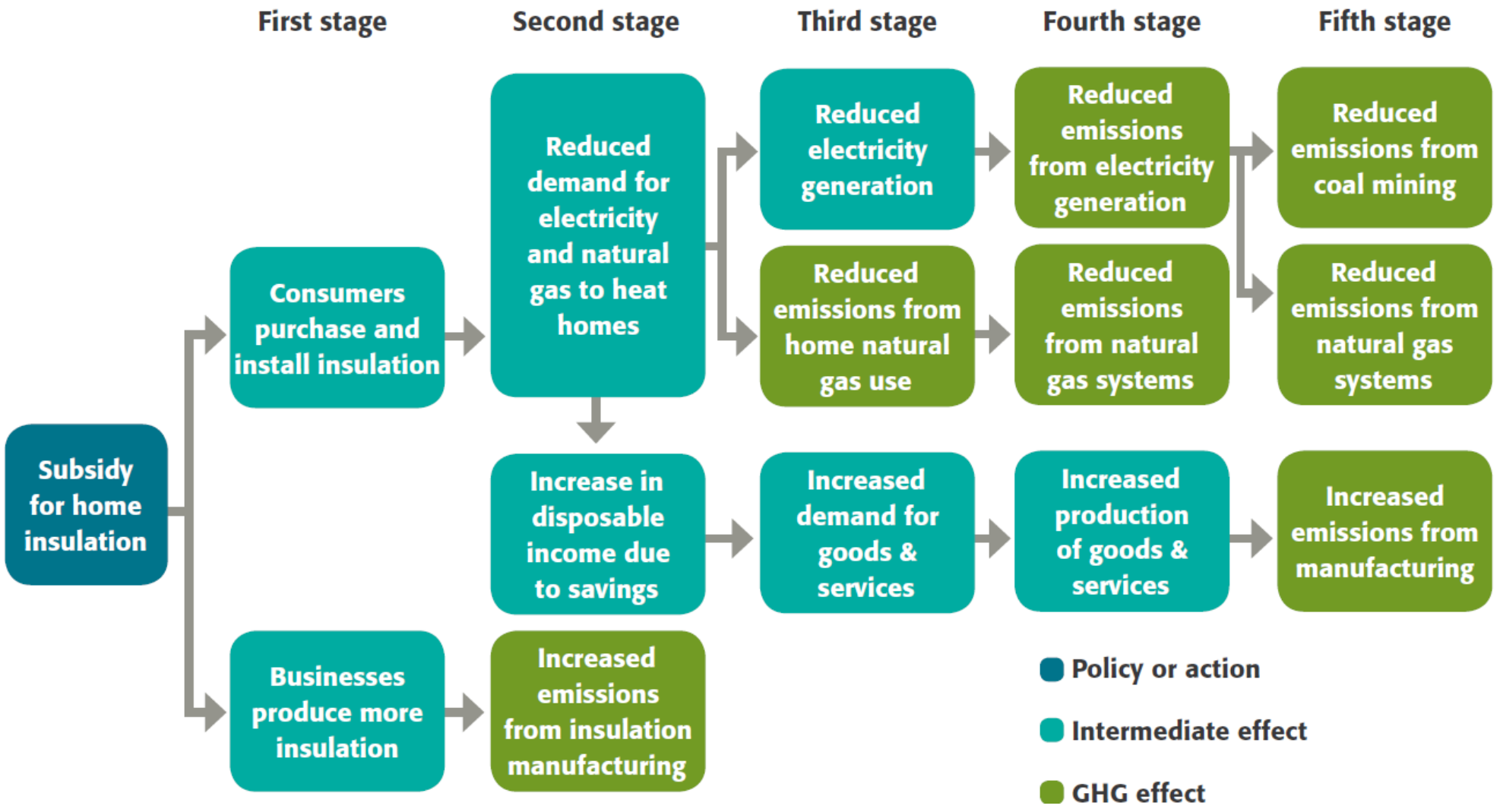
Map the causal chain

Mapping the causal chain



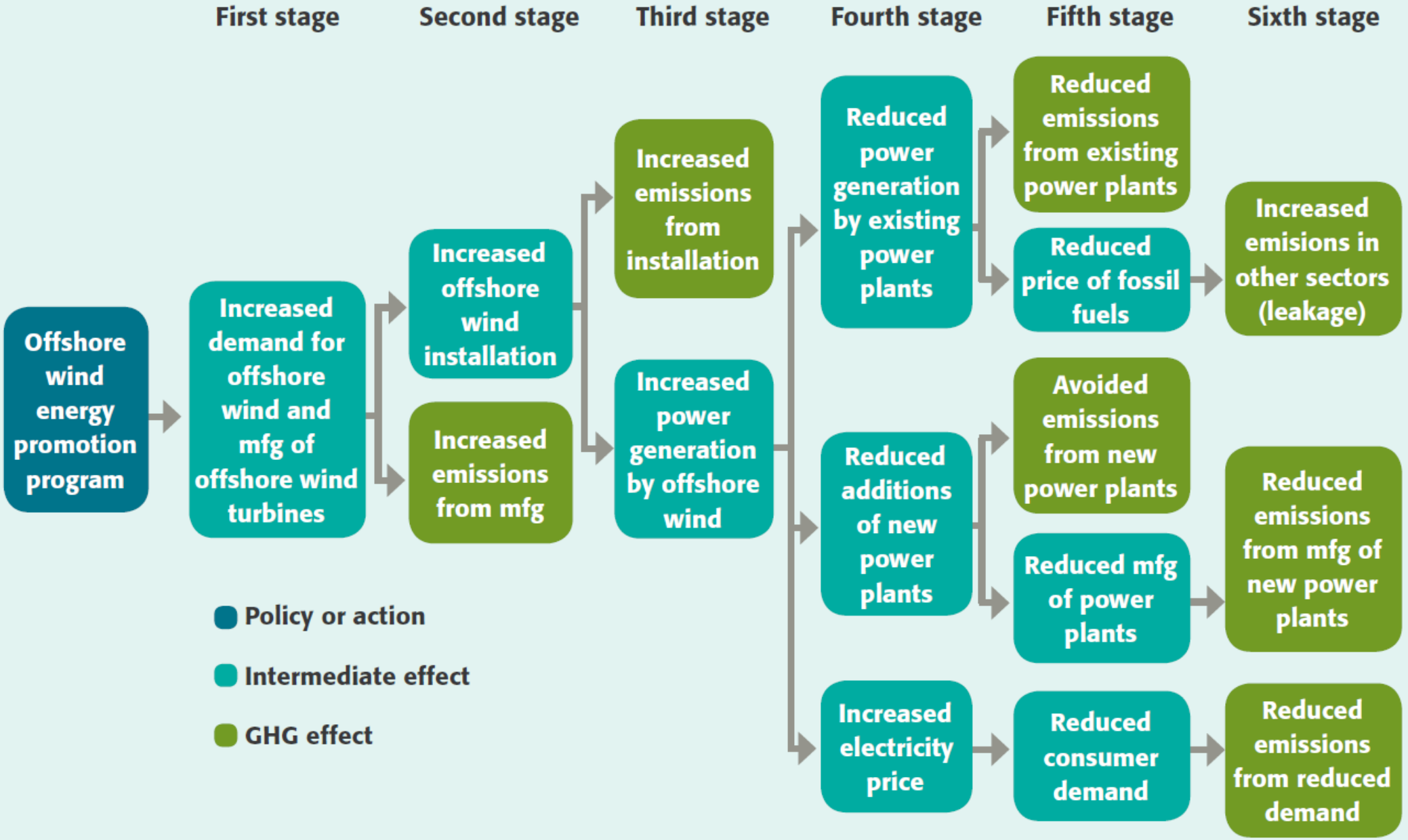
Map the causal chain

Figure 6.6 Example of a causal chain for an illustrative subsidy for home insulation



Map the causal chain

Figure 6.7 Causal chain of Belgium's offshore wind energy promotion program



Excercises

Excercise on mapping the causal chain for policy mitigation action

Exercise 1 on Causal Chain for policy
30 min

- Develop a causal chain for policies in the Energy sector.
- Pick a policy and develop a causal chain showing likely impacts, and deciding which ones are more important for monitoring

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Exercise 2 on Causal Chain for policy
30 min

- 1. Discussion of possible indicators for Energy sector
- 2.Make a list.
- 3. Pick indicators from your list which could be best used to describe different impacts in the causal chain from earlier exercise

Exercise 3 on Causal Chain for policy
30 min

- How to evaluate the effects.
- What type of data is needed and how to get it?
- Who owns the data? Participants look at the indicators they've selected and think about which institutions would need to be involved in providing and checking/validating this data.