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LIFE CYCLE ORIENTED DECISION SUPPORT FOR COMPANIES TO REDUCE ELECTRICITY-RELATED GREENHOUSE EMISSIONS

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Setting

GHG

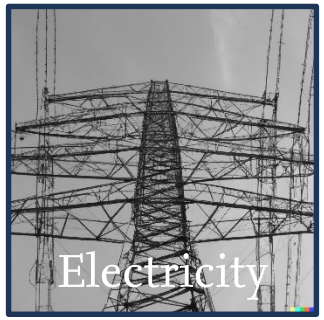
relate to

SCIENCE BASED TARGETS
DRIVING AMBITIOUS CORPORATE CLIMATE ACTION

committed to

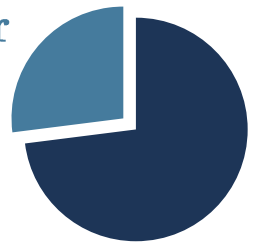
Company energy & environmental manager (EEM)

manages



Other uses

27 % other emissions



73 % of graphite production emissions from electricity*

*cradle-to-gate GHG emissions, data from Engels et al. 2022 (10.1016/j.jclepro.2022.130474)
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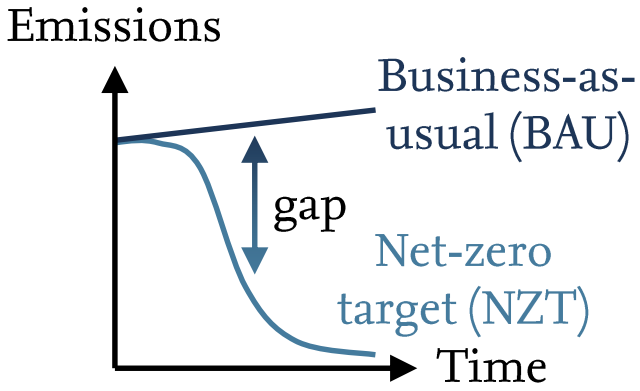
A portfolio of mitigation options enables the EEM to reach emission targets



Portfolio of mitigation options (MOs) to close the gap

GHG relate to SCIENCE BASED TARGETS (DRIVING AMBITIOUS CORPORATE CLIMATE ACTION) committed to EEM

Primary purpose of the concept I present today: Define and characterize a portfolio of MOs

Mitigation option: Measure that the EEM can implement and which has an impact on the company's electricity-related emissions (e.g. load-shifting, installing photovoltaics).

EEM: environmental & energy manager MO: mitigation option GHG: greenhouse gases

Overview & purpose of this presentation

- Present status of my PhD research (work in progress)
- Research consists of a concept for:
  - Assessing current GHG emissions
  - Projecting future emission pathways (BAU & NZT)
  - Generating MO portfolios to close emission target gap

I would be grateful to receive **general feedback**
& **answers to specific questions** (listed in the end) from you!

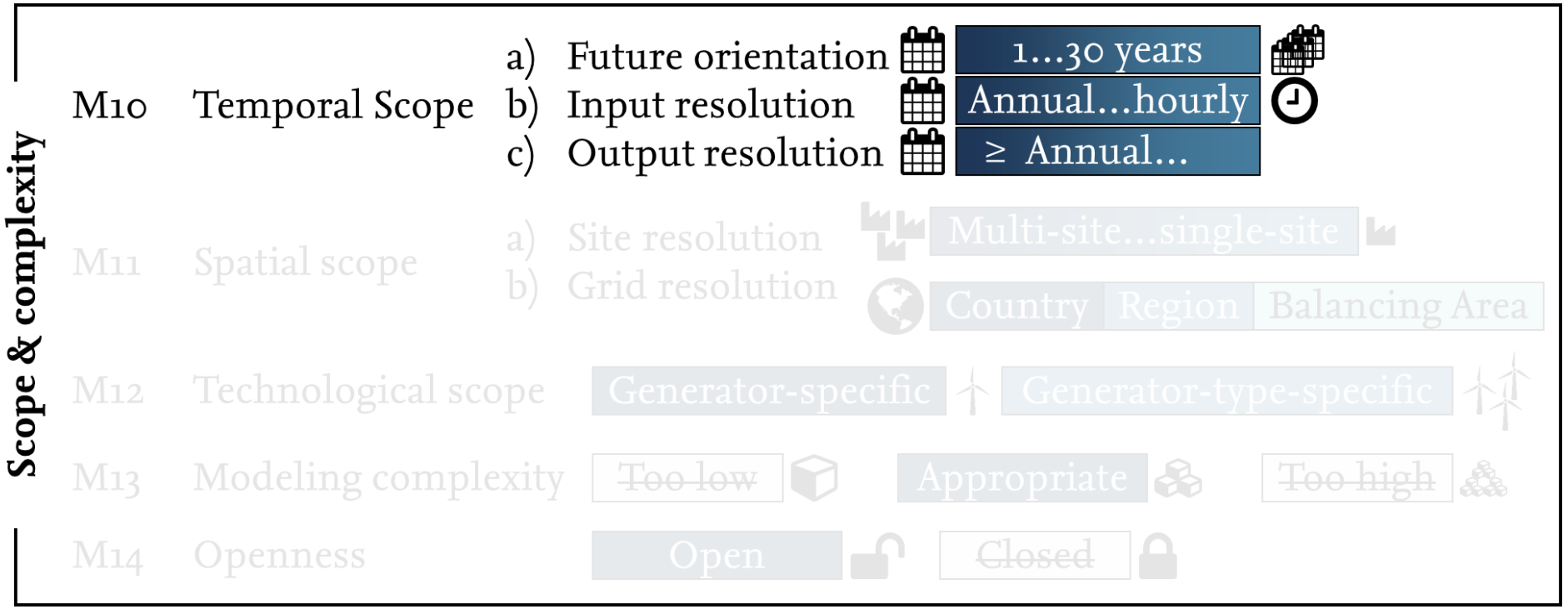
GHG: greenhouse gases, BAU: business-as-usual, NZT: net-zero targets, MO: mitigation option

The concept target audience: environmental & energy managers (EEM)

Color coding: Addressed | Addressed, but not primary focus | Not addressed

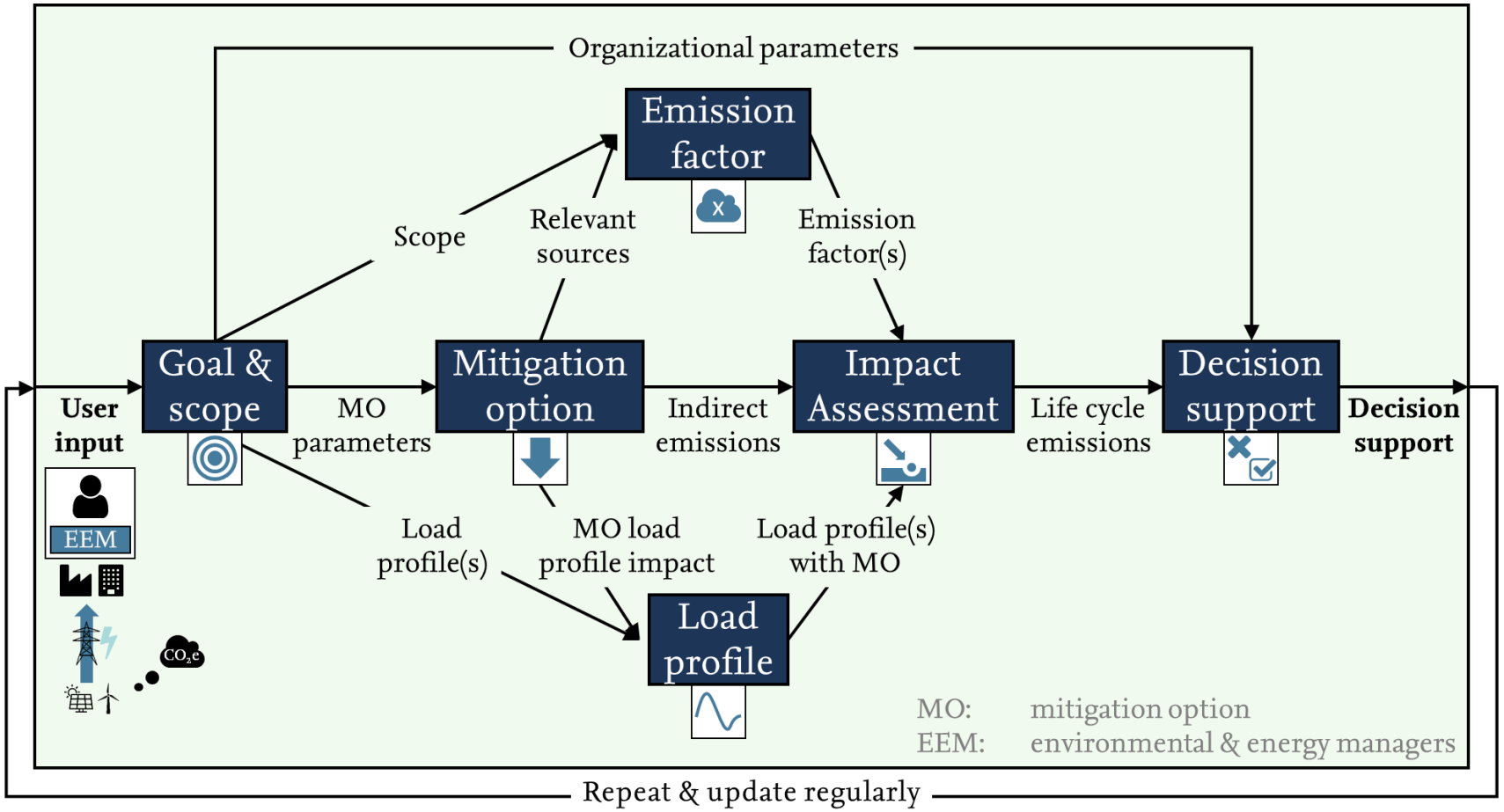
MO: mitigation option
EEM: environmental and energy manager
SME: small and medium-sized enterprise
MNC: multi-national company

Methodological concept requirements (II): scope & complexity



GHG: greenhouse gases SMEs: small & medium-sized enterprizes MNCs: multi-national corporations

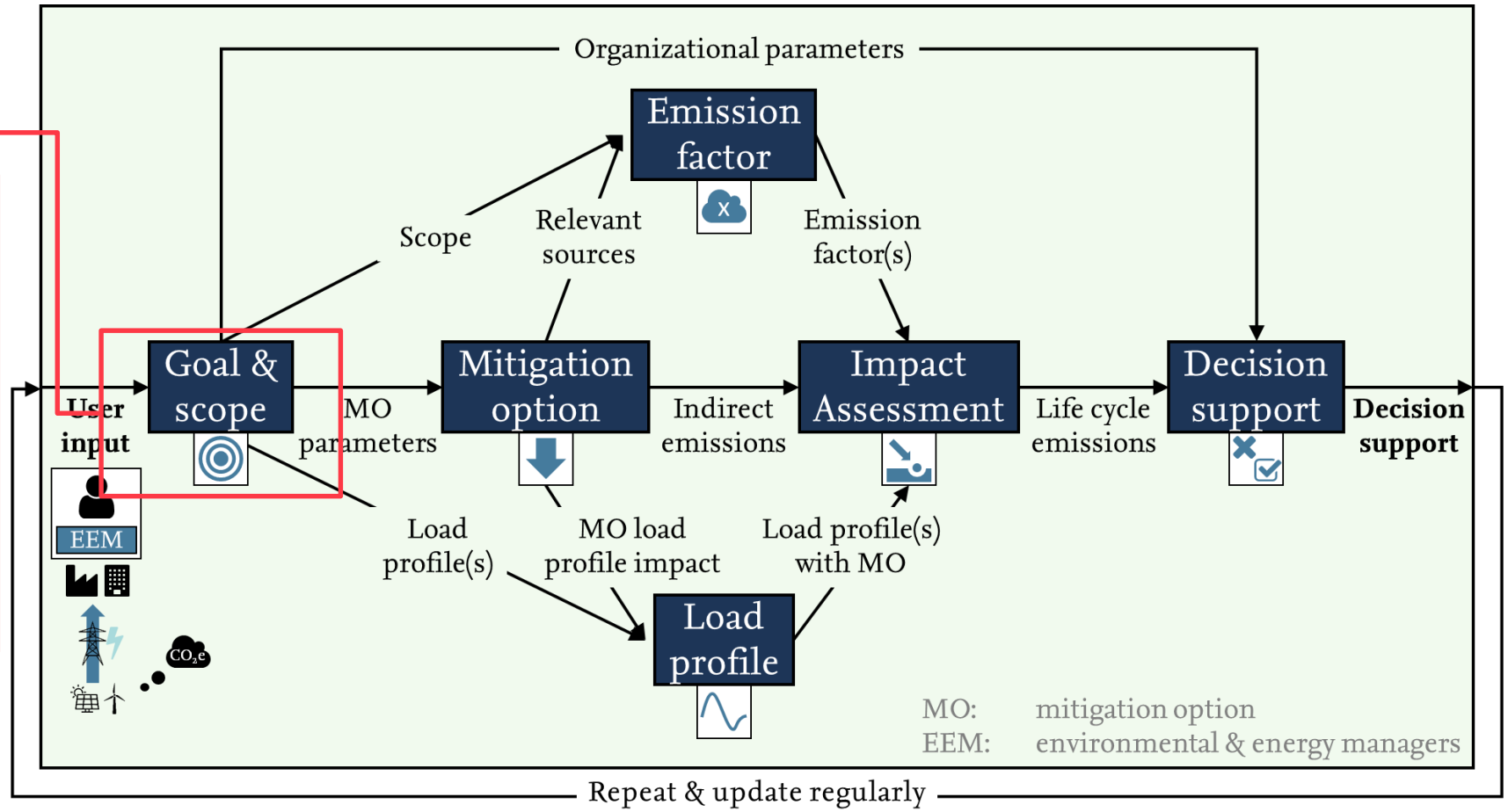
Overview of the concept: modules & information flows



The goal & scope module

Goal & scope module:

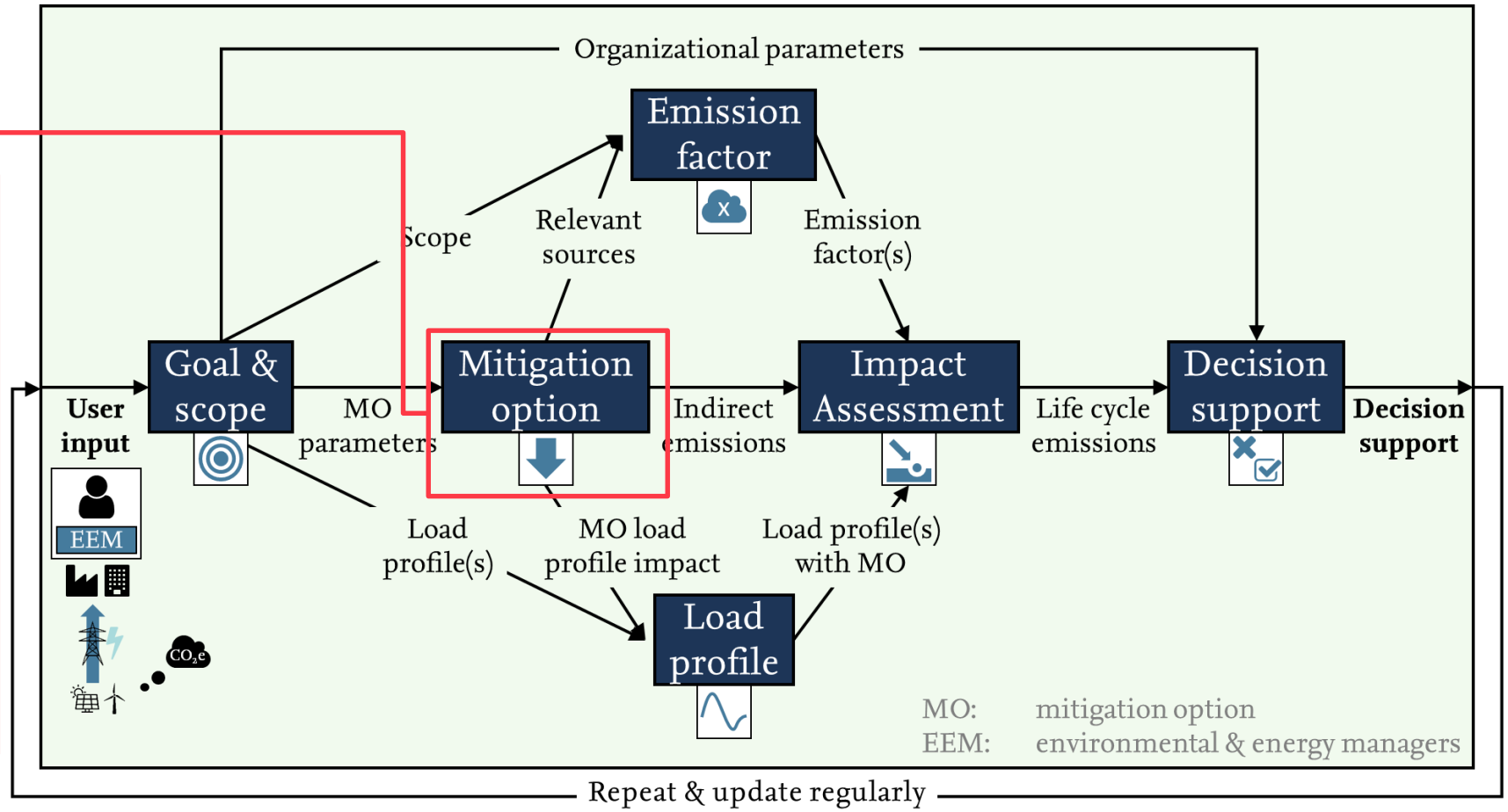
- Identifies relevant information
- Collects information from user
- Preprocesses information
- Passes information to other modules



The mitigation option module

Mitigation option module:

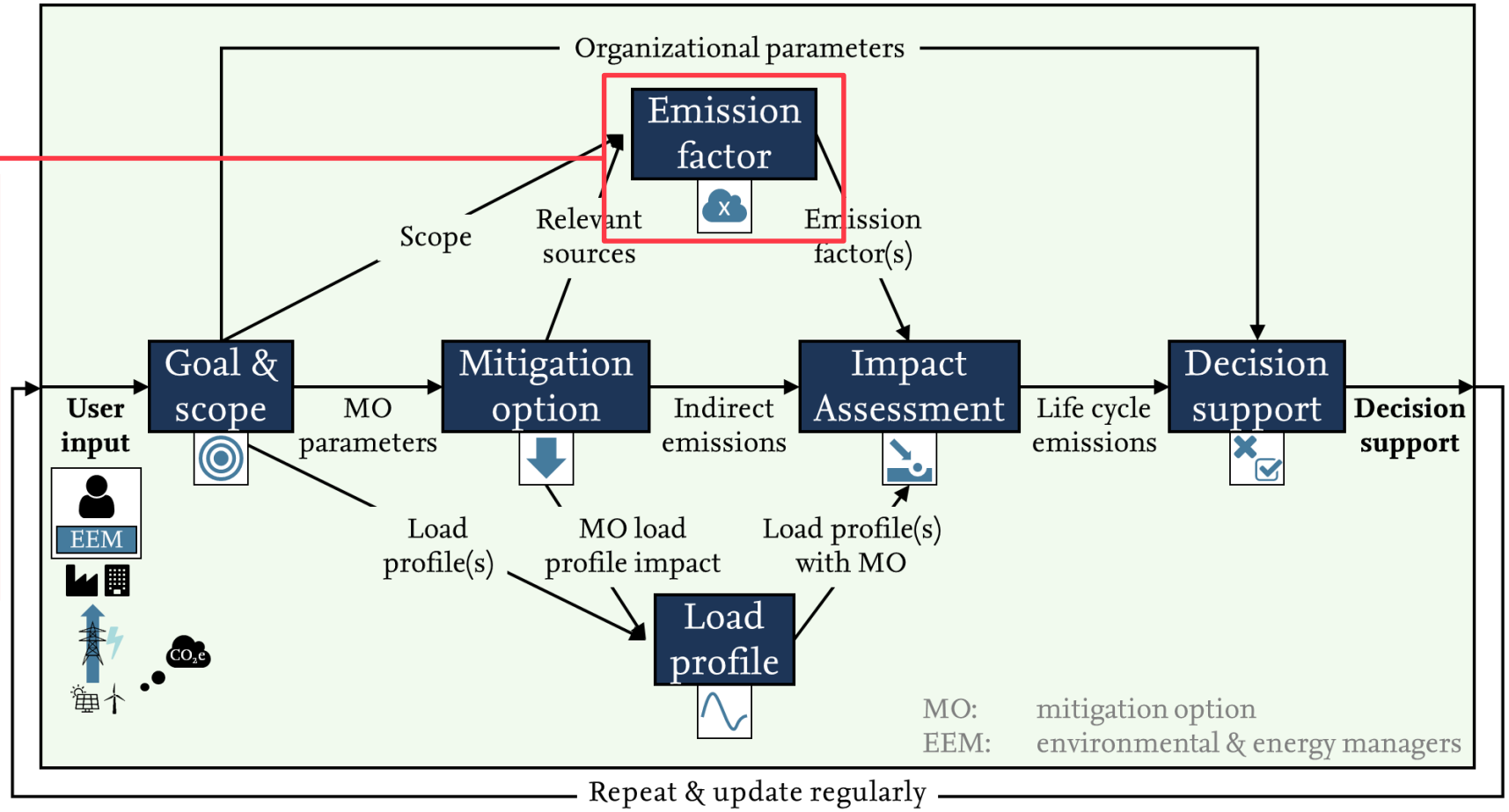
- Categorizes and characterizes MOs
- Identifies relevant sources of electricity
- Calculates indirect emissions of MOs
- Calculates the MOs' impact on load profile(s)



The emission factor module

Emission factor module:

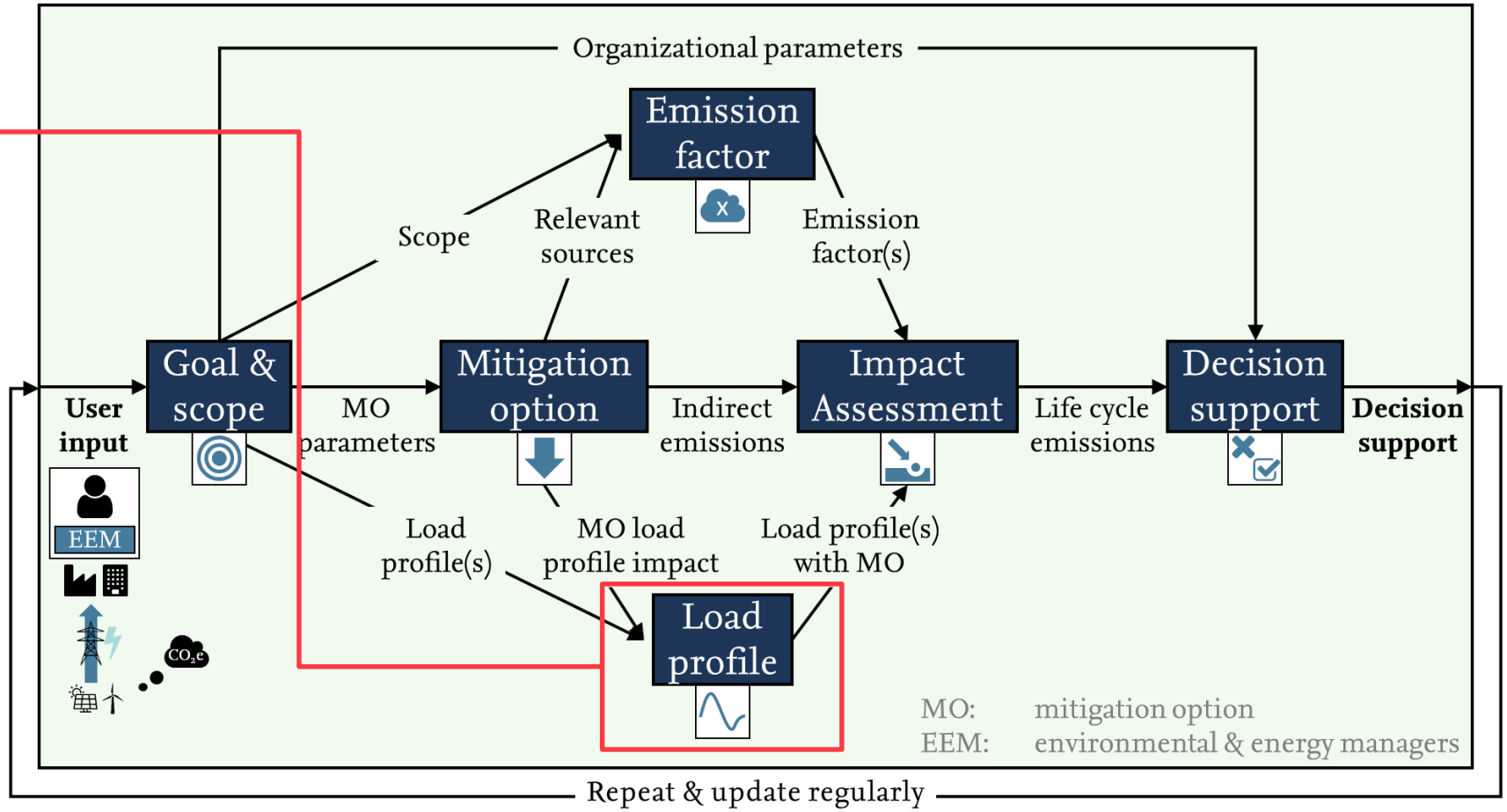
- Calculates the emission factors (g CO_2e/kWh_{el}) for all relevant sources of electricity (based on the scope)



The load profile module

Load profile module:

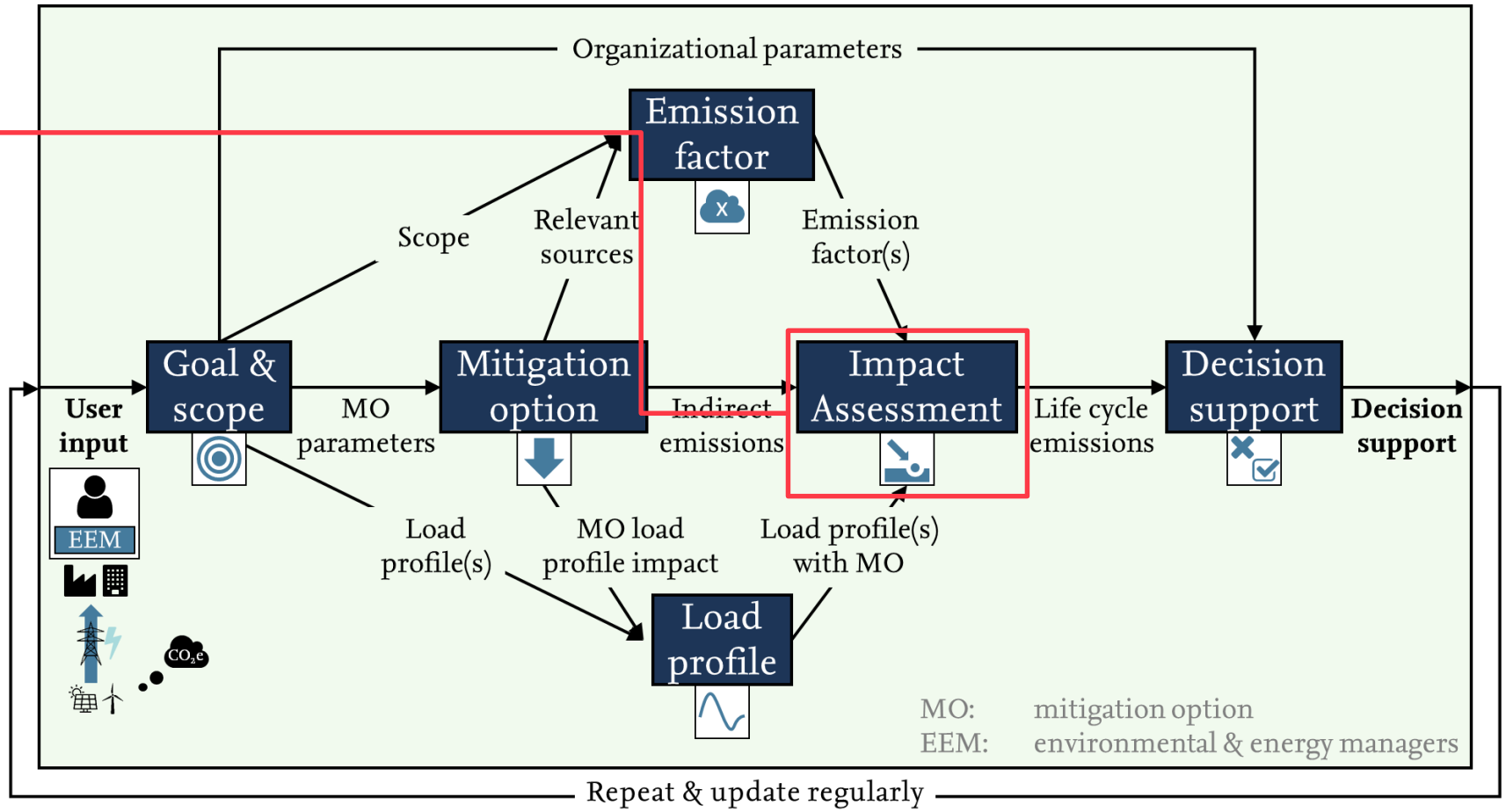
- Calculates the load profile(s) for all relevant consumers and producers
- Includes the load profile(s) with and w/o implementing MO(s)



The impact assessment module

Impact assessment module:

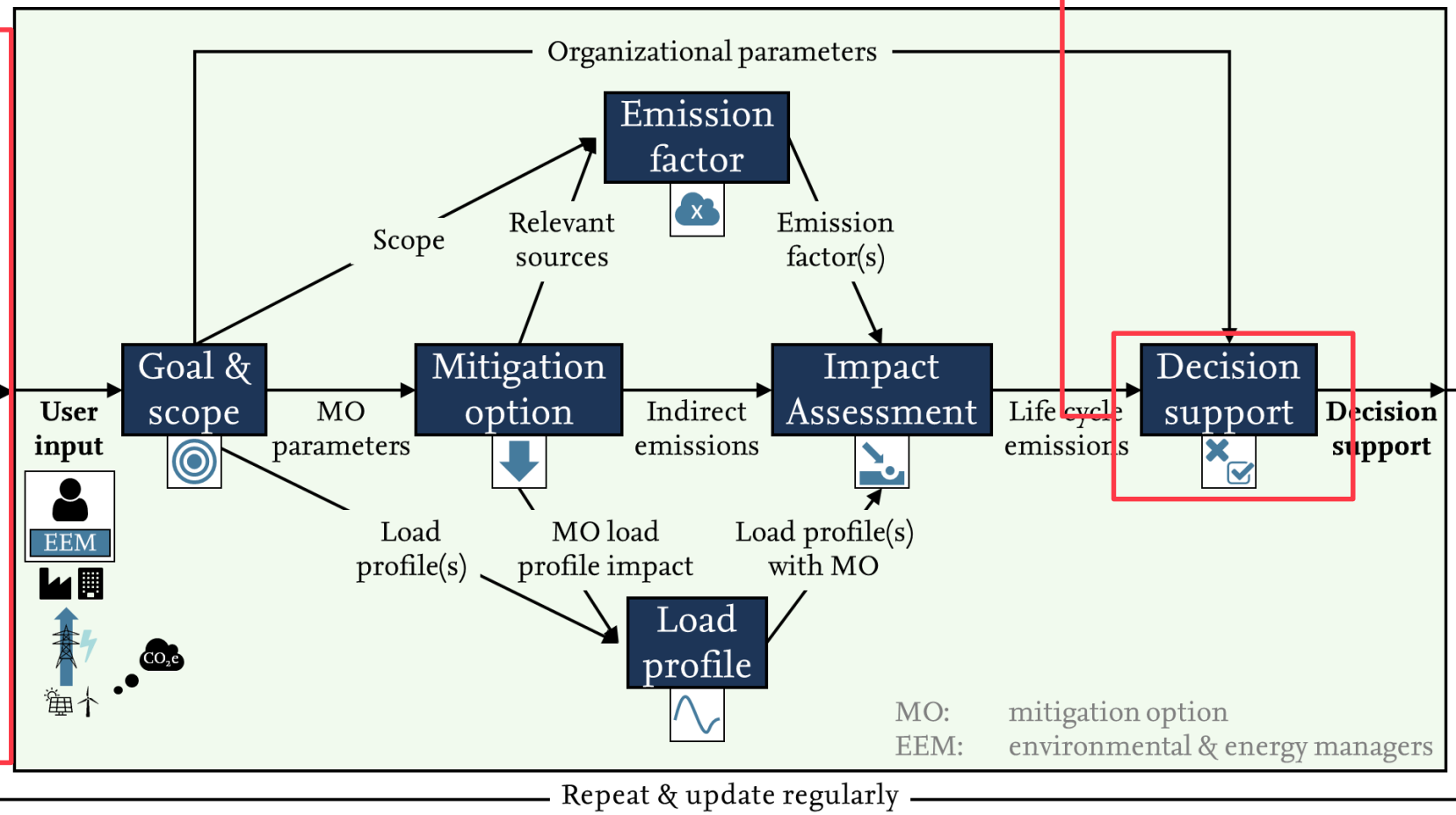
- Calculates the life cycle emissions (direct & indirect)
- Includes the emissions with and w/o implementing MO(s)



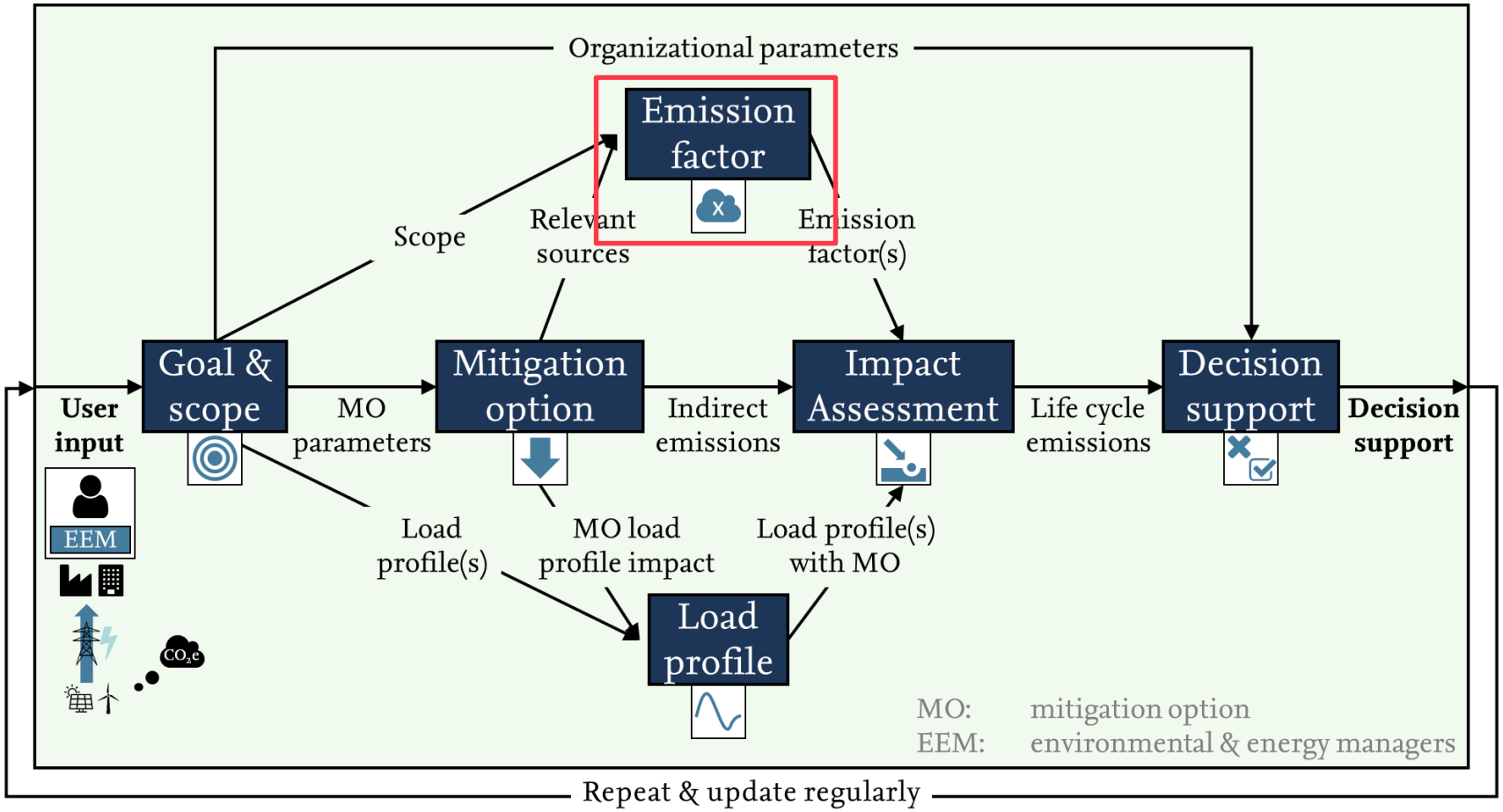
The decision support module

Decision support module:

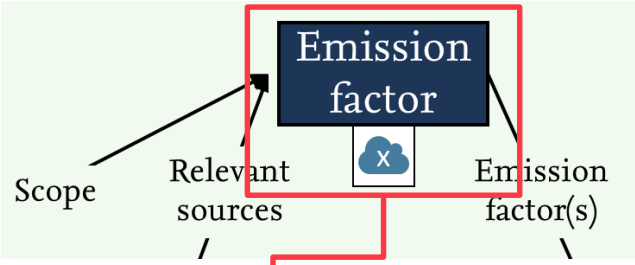
- Provides information on (depending on user preferences):
  - Current emissions
  - Projected future emissions (BAU & target)
  - Review and ranking of MOs
  - Portfolio of MOs to reach emission targets



Focus of this presentation is the emission factor module



The emission factor module – in detail (I)



Emission factor module:

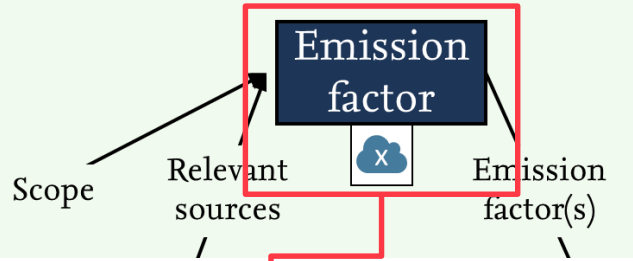
- Calculates the emission factors (g CO_2e/kWh_{el}) based on the scope for all relevant sources of electricity

Emission factor (EF) calculation:

- For **all sources** of electricity (e.g. grid, on-site PV)
- Considers **all GHG** (incl. CH_4, NO_2 etc.)
- **Life cycle** emissions (direct & indirect)
- High **temporal resolution** (hourly)
- Various **spatial resolutions** (e.g. country, bidding zone)
- Includes electricity **trading** (consumption-based EF)
- Excludes **autoproducers** (not connected to grid)
- Considers **heat-coproduction** (e.g. exergy-based)
- Includes **grid losses** (transmission, distribution, storage)
- A / M **Average** and **marginal** emission factors
- For both the **past** and the **future**

PV: photovoltaics GHG: greenhouse gases

The emission factor module – in detail (II)



Emission factor module:

- Calculates the emission factors (g CO_2e/kWh_{el}) based on the scope for all relevant sources of electricity

Emission factor (EF) calculation:

For all sources of electricity (e.g. grid, on-site PV)

Considers all GHG (incl. CH_4, NO_2 etc.)

Consi… …oproduction (e.g. exergy-based)

Includes g… losses (transmission, distribution, storage)

A / M **Average** and **marginal** emission factors

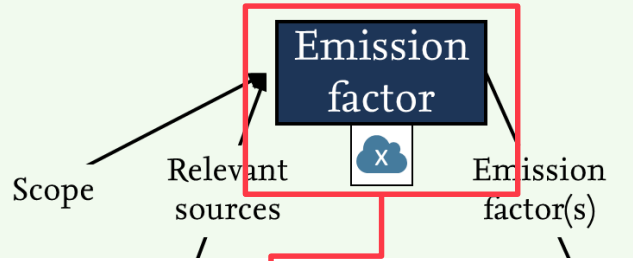
For both the past and the future

Which one is more appropriate, in you opinion, for:

- Accounting vs. planning an intervention (e.g. installing PV)?
- Calculating past vs. future emissions?
- …other differentiations?

PV: photovoltaics GHG: greenhouse gases

The emission factor module – in detail (III)



Emission factor module:

- Calculates the emission factors (g CO_2e/kWh_{el}) based on the scope for all relevant sources of electricity

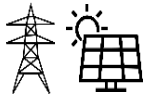
Emission factor (EF) calculation:

- For **all sources** of electricity (e.g. grid, on-site PV)
- Considers **all GHG** (incl. CH_4, NO_2 etc.)
- **Life cycle** emissions (direct & indirect)
- Excl… …ers (not connected to grid)
- Conside… …**production** (e.g. exergy-based)
- Includes g… …es (transmission, distribution, storage)
- A / M **Average** and **M**…**rginal** emission factors
- For both the **past** and the **future**

Can you recommend data & information sources for future emission factors (both average and marginal)?

PV: photovoltaics GHG: greenhouse gases

Limitations of my concept

- Only addresses electricity related emissions 
  (primarily scope 2)
- Only addresses consumers
  (not policy-makers/grid operators/power plant operators)
- Only considers GHG 

  (ignoring e.g. local air pollution)

GHG: greenhouse gases

I'm looking forward to your feedback!

Which one (average or marginal emission factor) is more appropriate, in you opinion, for:

- Accounting vs. planning an intervention (e.g. installing PV)?
- Calculating past vs. future emissions?
- …other differentiations?

?

!

Can you recommend data & information sources for future emission factors (both average and marginal)?

General comments, feedback and questions!

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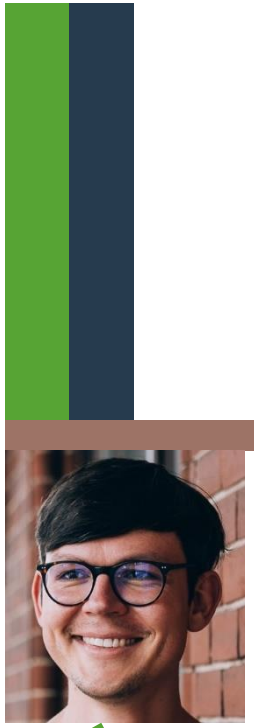

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Feel free to get in touch!