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Bridging inventory and projection road transport emissions

17 May 2016,

TFEIP meeting 2016 Zagreb (Croatia)

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ENVIRONMENT
NATURE &
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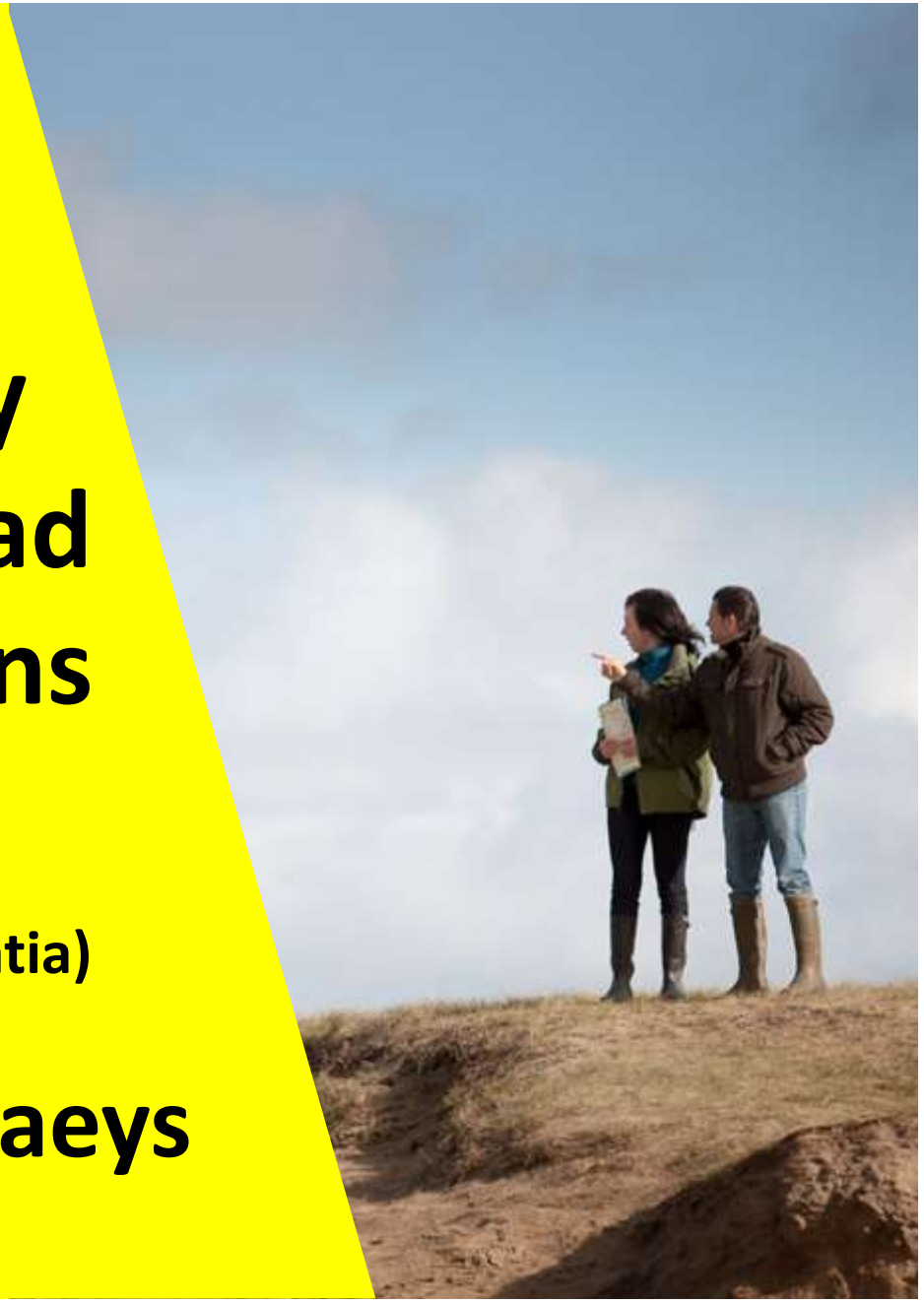
DEPARTMENT



Why are road transport emissions important?

- **Road transport sector**:
  → Important sector in the overall emissions

- **Actual emissions**
  → International reporting obligations
  - Air pollutants: LRTAP and NEC reporting
  - Greenhouse gases: CRF and MM reporting

  - Assessment of current ceilings, targets and standards :
    - E.g. NEC 2010 ceiling, non-ETS targets and Air Quality Standards.

Why are road transport projection emissions important?

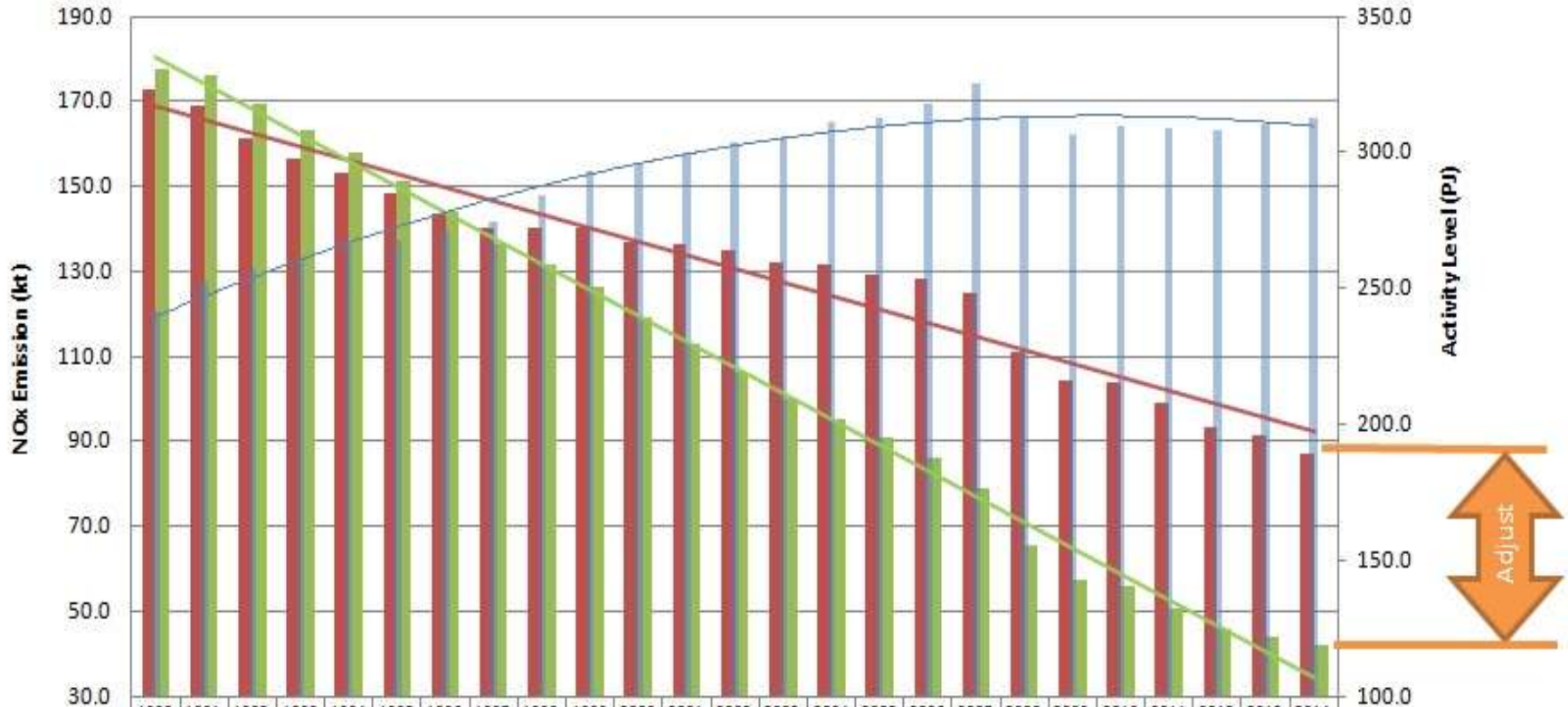
- **Road transport sector**:
  → Tomorrow still an important sector in the overall emissions.

- **Emission projections**
  → Policy assessment of futures targets and new proposals of emission reduction programs:
    - Examples:
      - National Emission Ceilings (Goteborg Protocol (2020) – NEC (2030)) and Non-ETS obligations (2030 and beyond)
      - Adjustment proceeding (failure of real driving emission factor of diesel cars)
      - Air Quality Directives (AQD)
      - Environmental Impact Assessment of new projects (e.g. Infrastructure projects)

Impact of NOx vehicle emission standards failure on Belgian NOx Emissions

_ NOX COPERT (kt)
_ NOX EF RAINS (kt)
_ Activity Level (PJ)
Linéaire (_ NOX COPERT (kt))
Linéaire (_ NOX EF RAINS (kt))

Comparison of NOx Removal Efficiencies of
COPERT (real world emissions) vs. RAINS (Euro Emission standard)
Road Transport NOx Emissions
Dataset 2014 1990-2014 - Fuel Used
COPERT 4v11.3
Belgium



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
_ NOX COPERT (kt)	172.9	169.2	161.4	156.5	153.1	148.2	143.7	140.2	140.3	140.1	137.0	136.4	134.7	132.0	131.4	129.2	128.2	124.7	111.0	104.2	104.0	98.8	93.4	91.6	87.2
_ NOX EF RAINS (kt)	177.7	175.9	169.3	163.3	158.0	151.0	144.3	136.4	131.5	126.4	119.3	113.0	106.1	99.9	95.2	90.9	86.2	78.8	65.3	57.6	55.8	50.8	46.1	44.0	42.1
_ Activity Level (PJ)	241.5	252.9	257.0	259.8	266.1	267.8	271.4	274.5	284.3	293.5	295.6	299.7	303.5	305.3	310.9	313.0	318.0	325.1	312.8	307.0	309.8	308.9	307.9	310.2	312.9

Example: Adjustment proceeding (failure of real driving emission factor of diesel cars)

Decision 2012/12 Guidance for adjustments under the 1999 Protocol to Abate Acidification, Eutrophication and Ground-level Ozone to emission reduction commitments or to inventories for the purposes of comparing total national emissions with them

ARTICLE 2.

A Party's supporting documentation for an adjustment to its emission inventory or emission reduction commitments shall include:

(c) An estimation of whether and when the reduction commitment is expected to be met based on emission projections without the adjustment, thereby using best available science;

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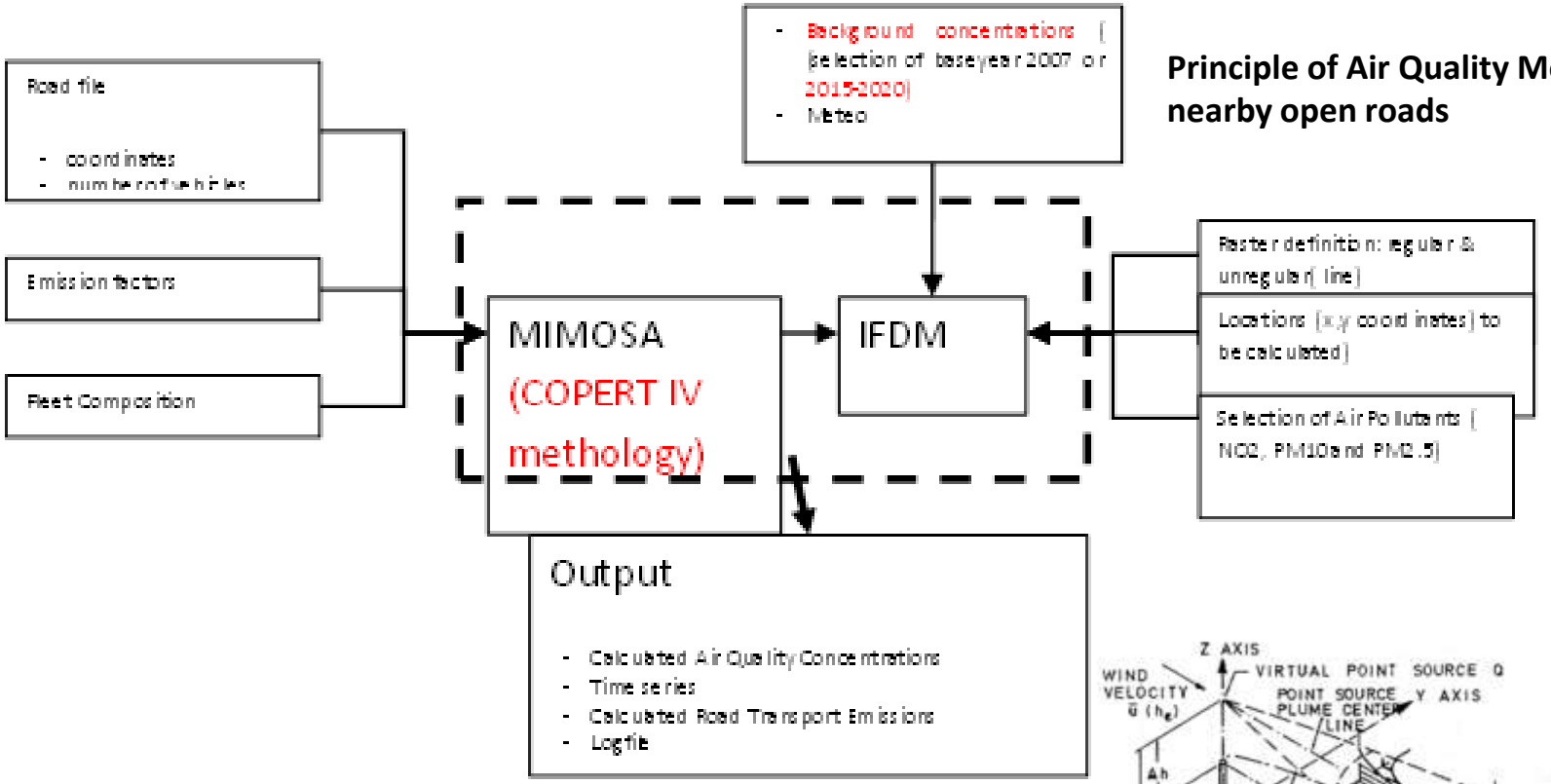
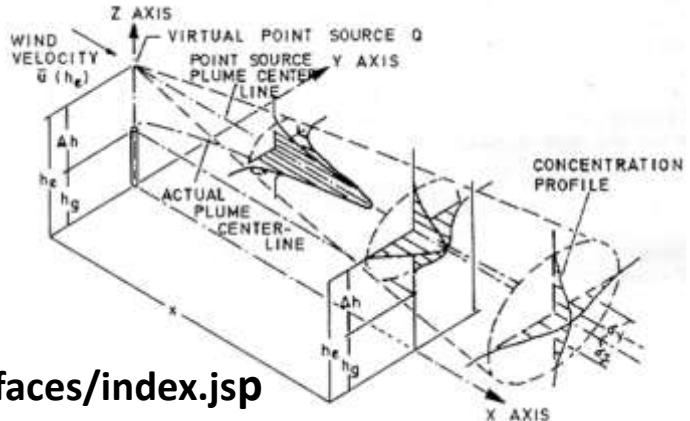
Example of air quality modelling nearby roads : Methodology



Principle of Air Quality Modelling nearby open roads



IFDM -Principle of bi-Gaussian Dispersion Plume model

Info about AQ -model:
http://ifdmtraffic.marvin.vito.be/faces/index.jsp

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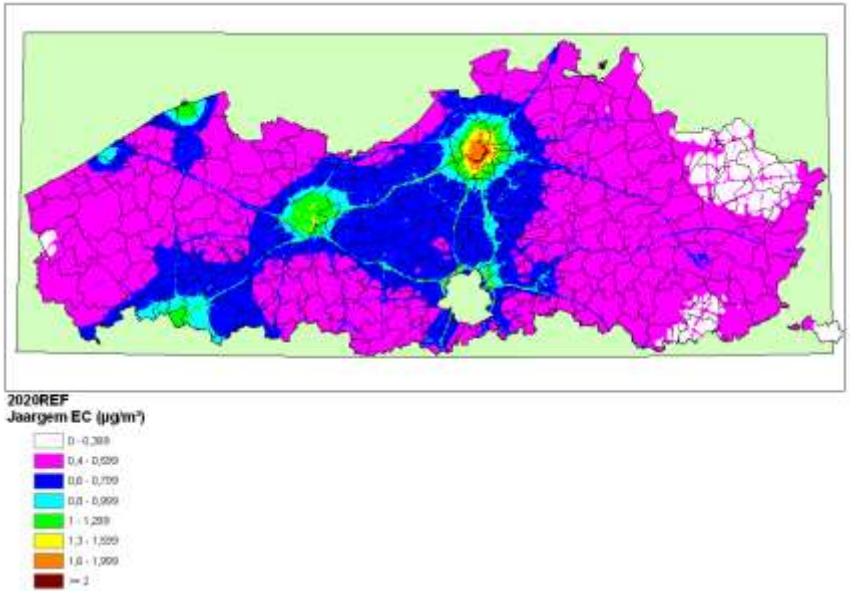
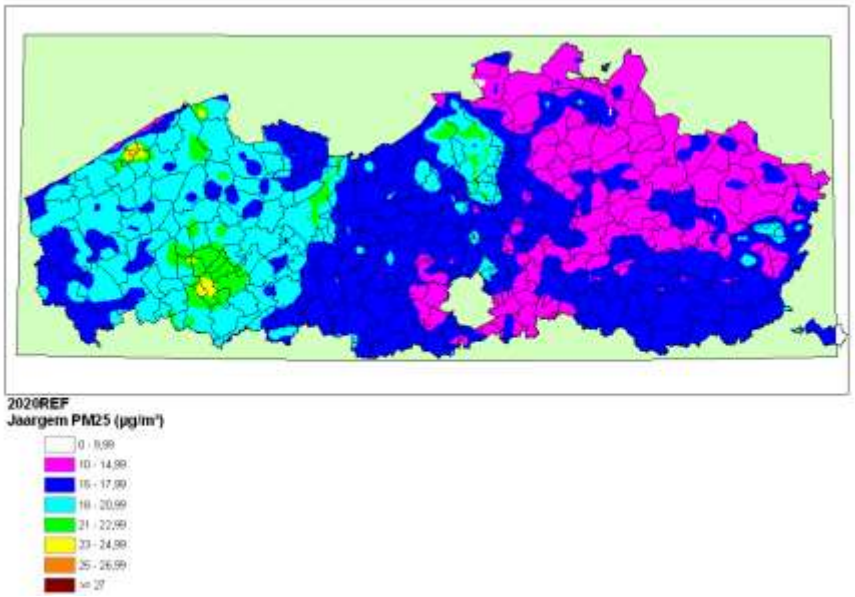
Example of air quality modelling nearby roads



Figures: For 2020 EC (figure left) and $PM_{2.5}$ (figure under) concentrations in the REFERENCE scenario.
Air Quality Modelling performed with IFDM-traffic-model



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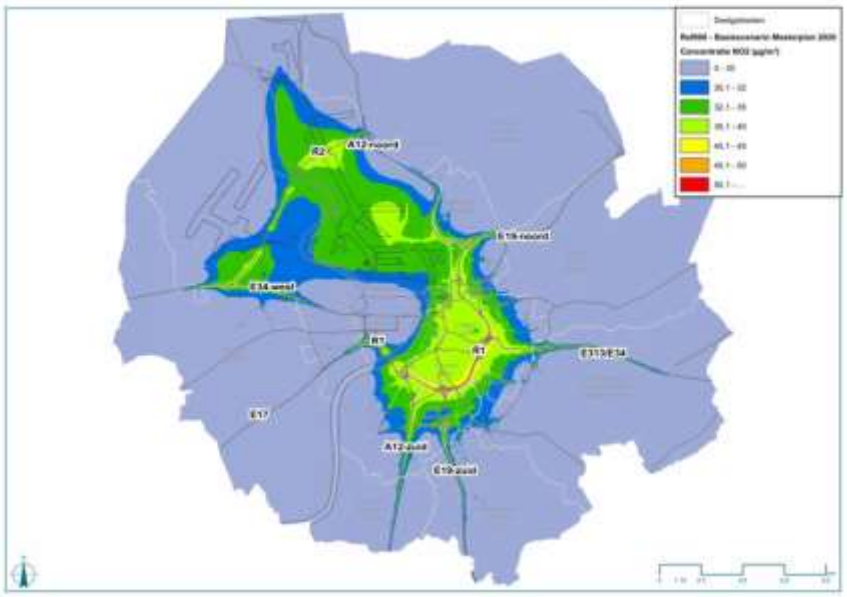
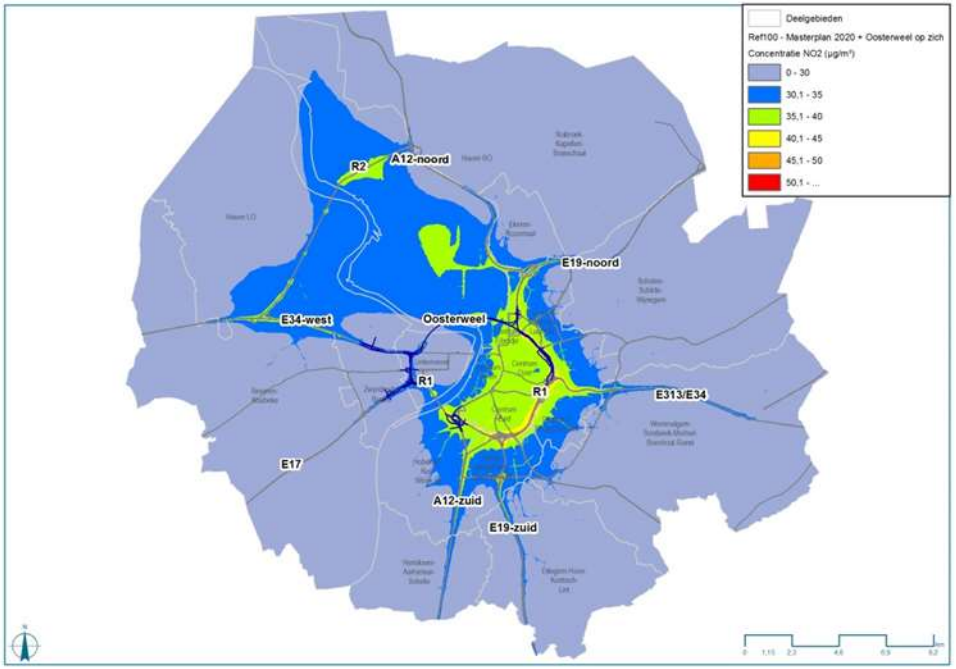
Example : Environmental Impact Assessment Study



E.g. Assessment of Air Quality Modelling of NO_2 concentrations from a infrastructure project (left without project/ right with project) (Vision year 2020) (Source: plan-MER - Derde Scheldekruising)



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Historical and actual versus projection road transport emissions

- Emission Inventory Reporting
  - → focus on reporting actual and historical emissions → Process is stringent (cfr. In depth reviews)
  - → projections are less stringent → Less guidelines and no review process.
- Policy
  - → Focus on actual and projection emissions:
  - → Why? Assessment of
    - × futures targets in current regulation
    - × futures targets in new proposals and amendments
    - × new regional/local measures (e.g. LEZ/ greening the vehicle tax)

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Why a national/regional projection model?

- No model available on the European market to fulfill all purposes.(cfr. COPERT)

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Why bottom up approach projections?

Why?

→ Complementary with the emission inventory.

→ Impact assessment of policy measures direct related to mobility projections.

vs PRIMES-TREMOVE-GAINS?

- EU-module not robust/ transparent for policy preparation and air quality forecasting.

- not in line with fleet and mobility assumptions in the actual/historical EIV reporting (COPERT methodology)

- not applicable for scenarios with measures

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Criteria for a good evaluation and assessment of projections

- Bottom- up approach
- One robust model for
  - → Greenhouse gasses and air pollutants
  - → Inventory and projections
- Fleet module with new technology vehicle classes
- Valid assumptions about abatement potential of futures technologies

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National Bottom-up model Methodology:

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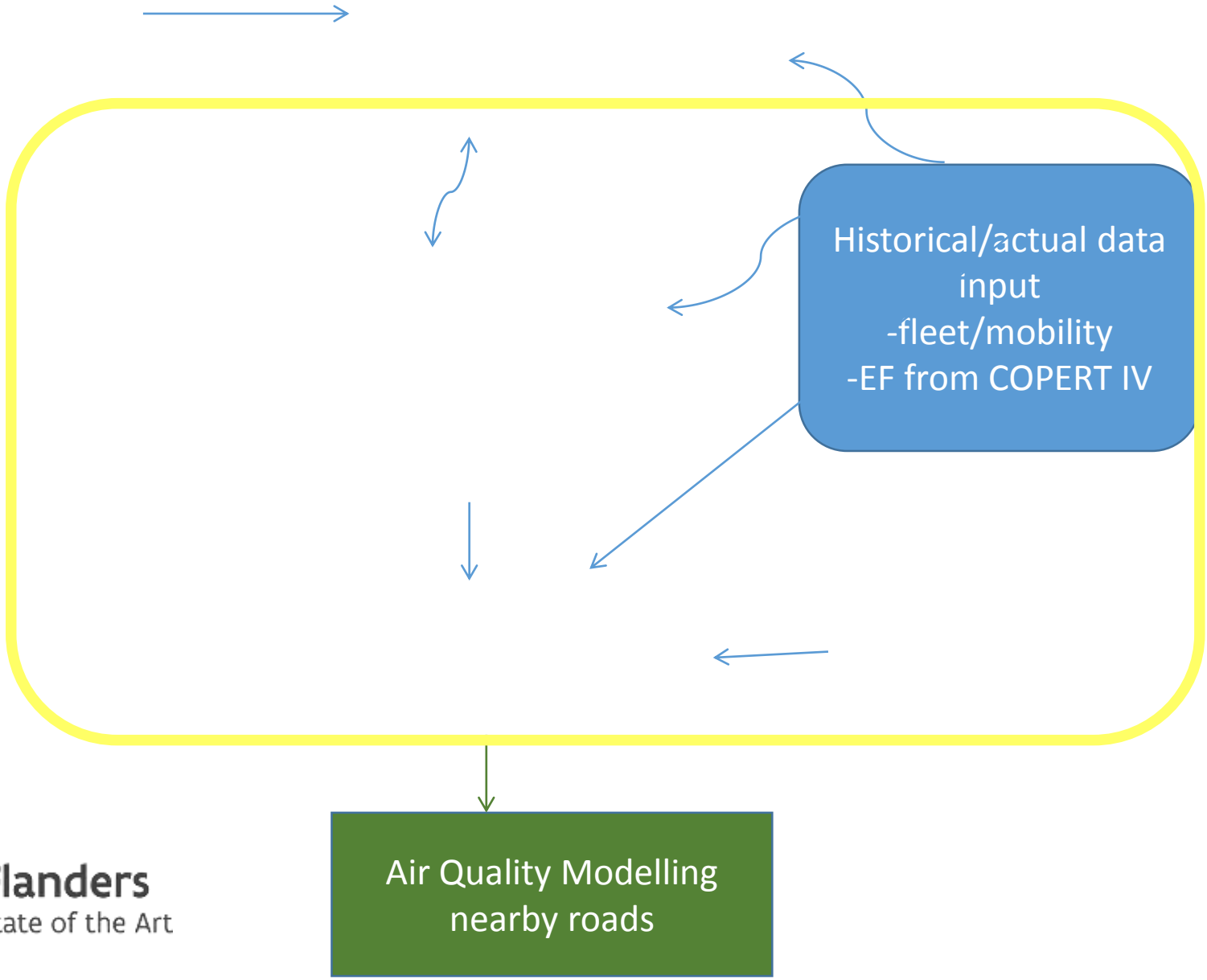

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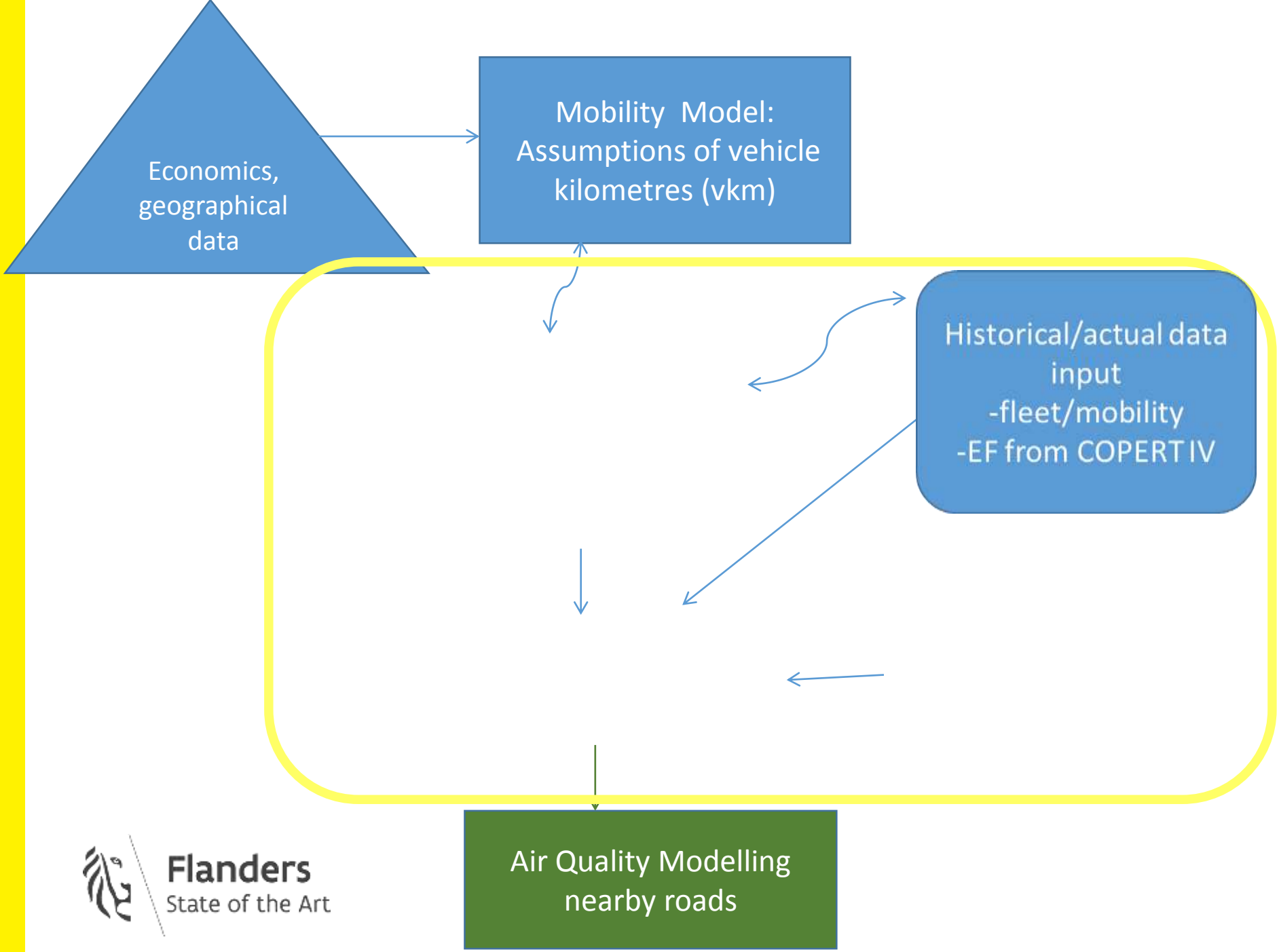

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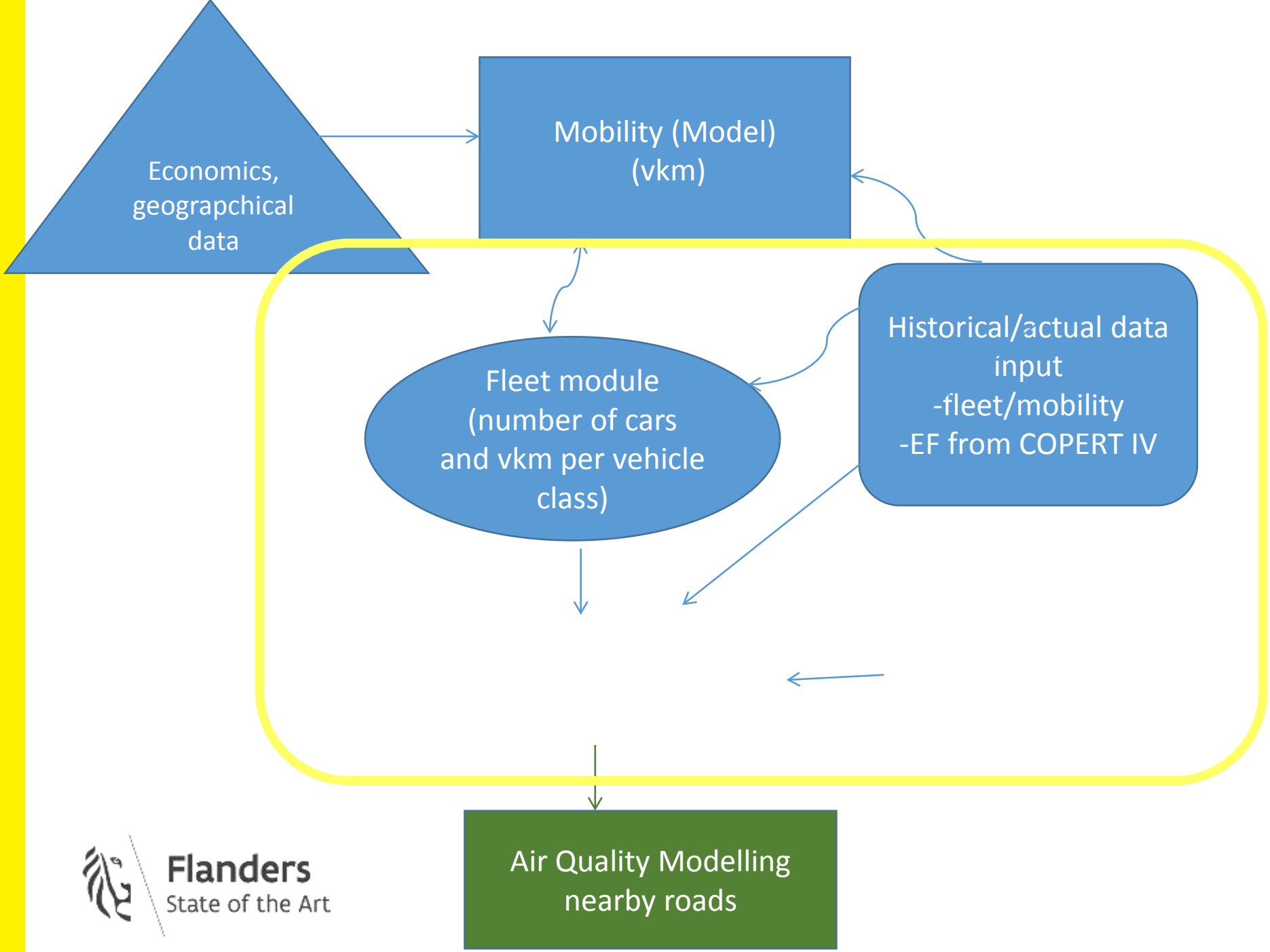
National Projection Model: **Mobility Model**

Sources or methodologies used to forecast the mobility:

- Strategic Traffic Propagation Models (with origin and destination matrices)
- Environmental energy cost model (cfr. PRIMES)
- Mobility assumptions from the Federal Forecasting Planning Bureau



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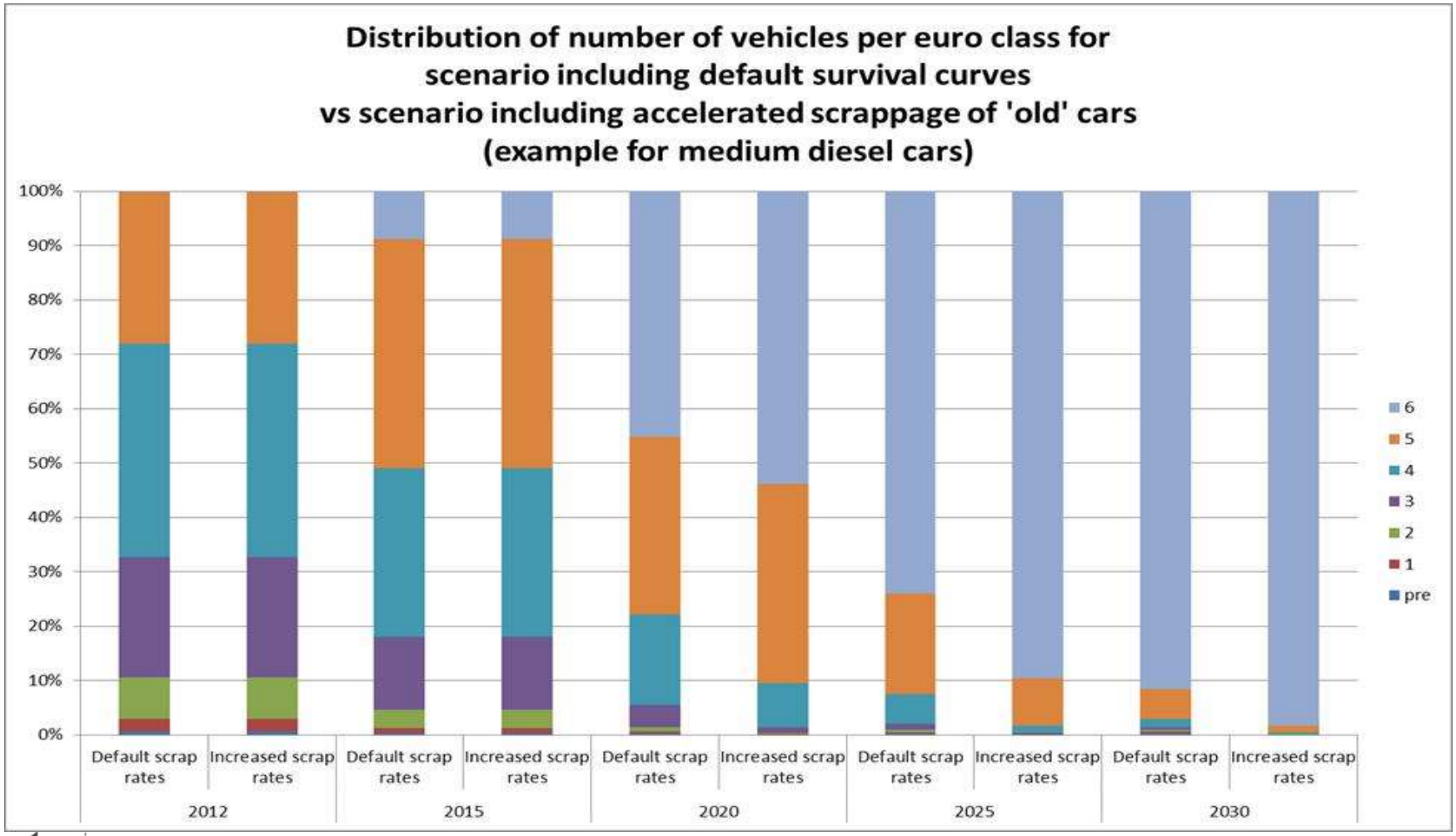
National Projection Model:
Fleet model combined with mobility

- Methodology based on survival rates
  - → Survival Curves (General survival curve for BAU or REFERENCE scenario and yearly dependent curves for measure scenario's (scrappage a old euro norm vehicles))
- Degree of detail is necessary for good projection calculations:
  - × Same COPERT classes
  - × Division in old/new and total number of vehicles
  - × Expected vehicle classes
    - → Hybrids CS+PHEV/ Full Electric/ H_2/ New Euro standards/ New Abatement (euro 6a and euro 6 c in two stages)
- CO_2 calculation for new vehicle fleet (validation of CO_2 targets of cars, in the future light duty vehicles)

Survival curves



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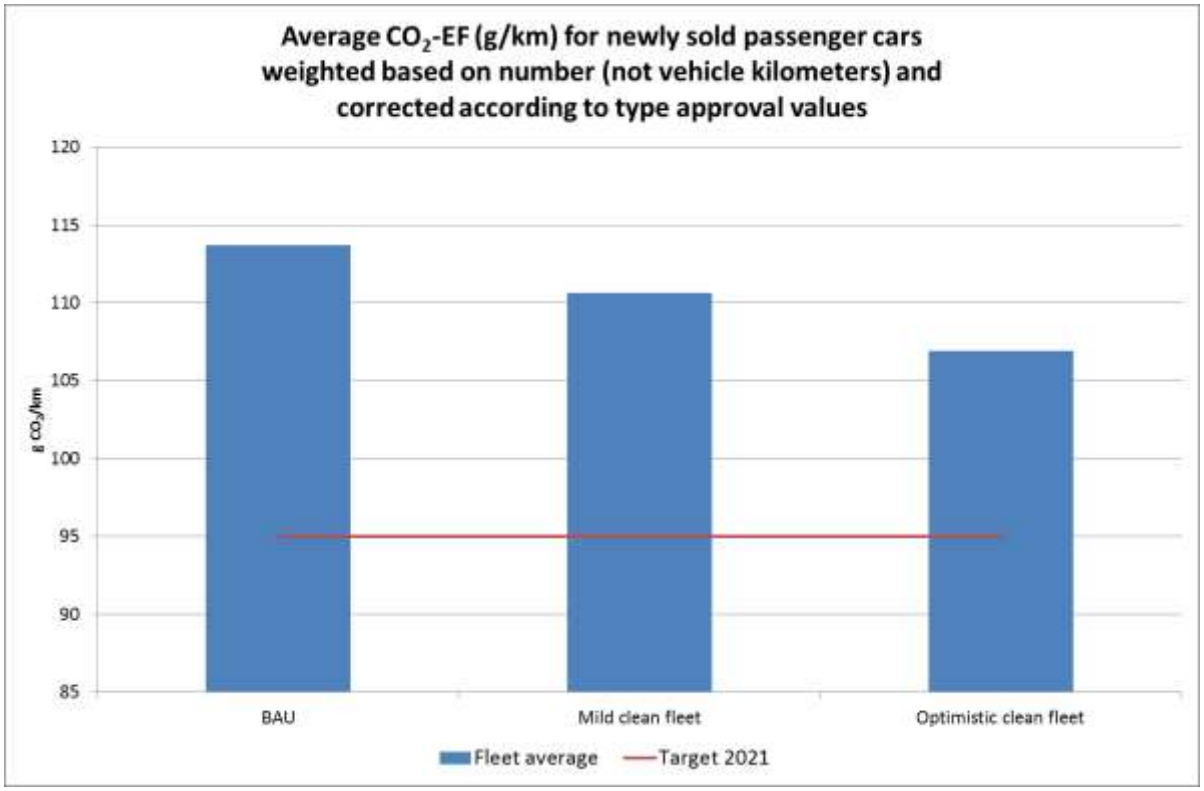
CO_2 evaluation in emission projection model

- Upcoming CO_2 targets :
  - for CARS 2021: 95 gCO_2/km
  - for LCV 2020: 147 gCO_2/km



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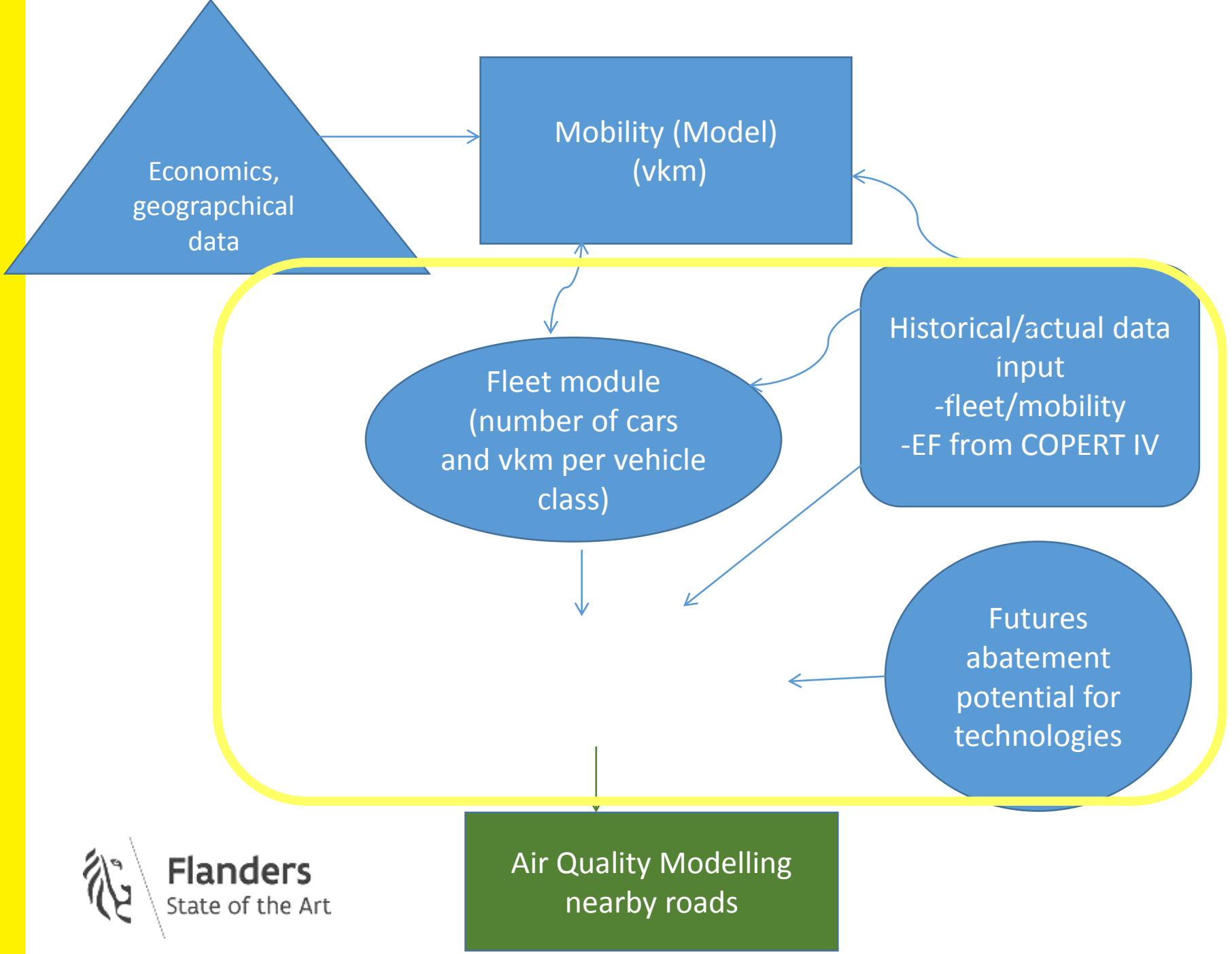

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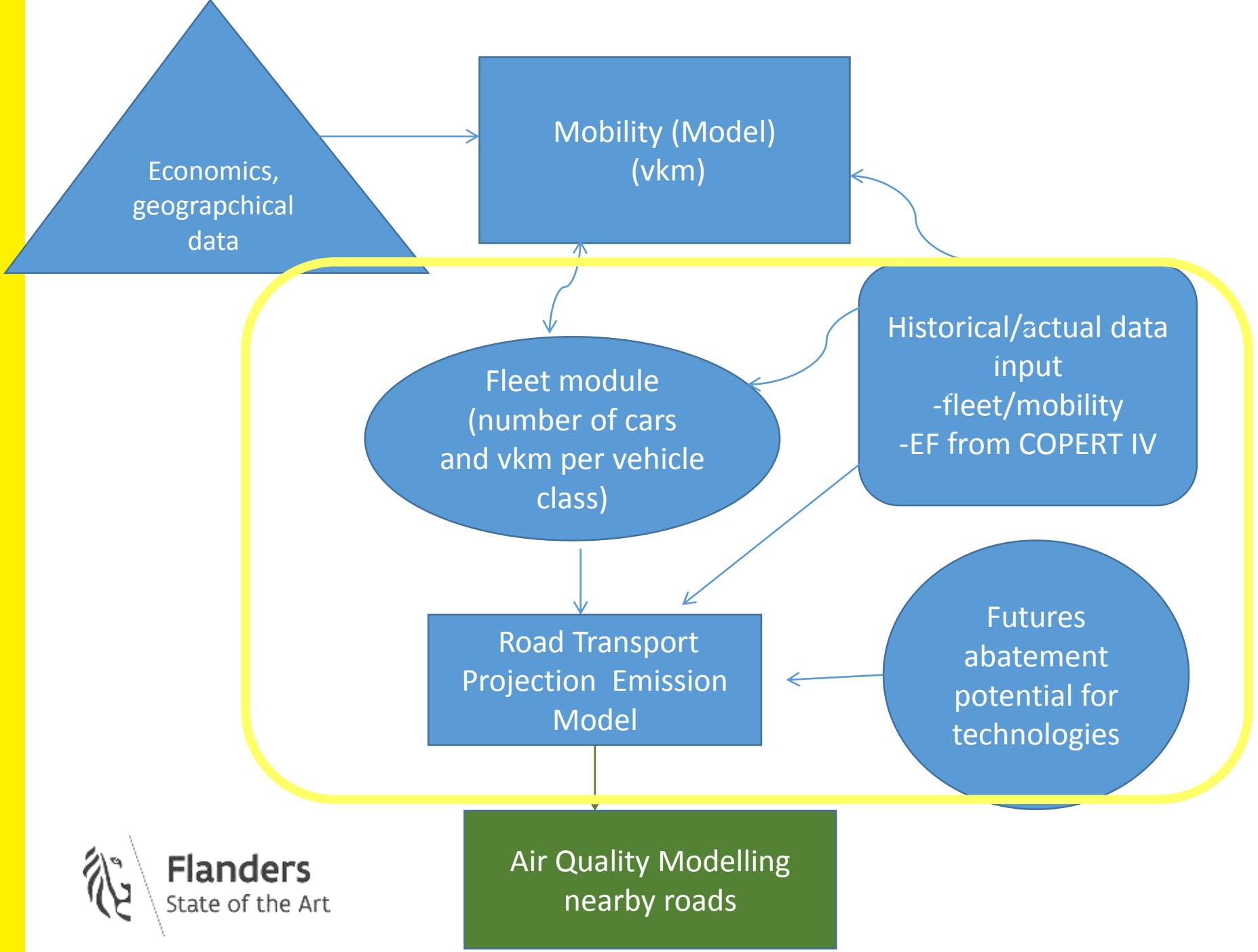

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National Projection Model: **Emission model for REFERENCE SCENARIO**

- Degree of detail necessary for good projection calculations:
  - Methodology similar to COPERT
  - New ‘solid’ emission factor for new technologies
  - Possibility to change the current EF based on COPERT IV
  - Flexibility to change the default settings

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National Projection Model: **Emission model for POLICY SCENARIO**

- Degree of detail necessary for good projection calculations:
  - See REFERENCE scenario
  - Extra tools for taking into account calculation of measures
    - in the fleet module (for e.g. scrappage, CO_2-target, LEZ),
    - in the mobility module (for e.g. traffic charging)
  - Extra tools for extra abatement calculation (for e.g. development of new policies (e.g. RDE-policy, new euro 7 standard, new CO_2 target))
  - Extra tool for AQ modelling, geographical distribution of total road transport emission

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Room for improvement

- Guidelines for methodology and introduction of new technologies;
- Implementation of direct link with inventory;
- Methodology for meeting CO_2 targets (95 g CO_2/km 2021 – and 70 g CO_2 from 20XX);
- Simple model for REFERENCE scenario and more detailed model (with extra modules) for fine tuning the forecast with new measures;
- Implementation of a FS module (to equalize with the energy balance)
- Possibility to obtain quickly sensitivity calculations (e.g. change of EF)
- Validation and uncertainty of the model
- Comparison and tuning with Environmental Cost Benefit Energy model (PRIMES_TREMOVE_GAINS)

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Example of fuel sold correction to equalize with the energy balance

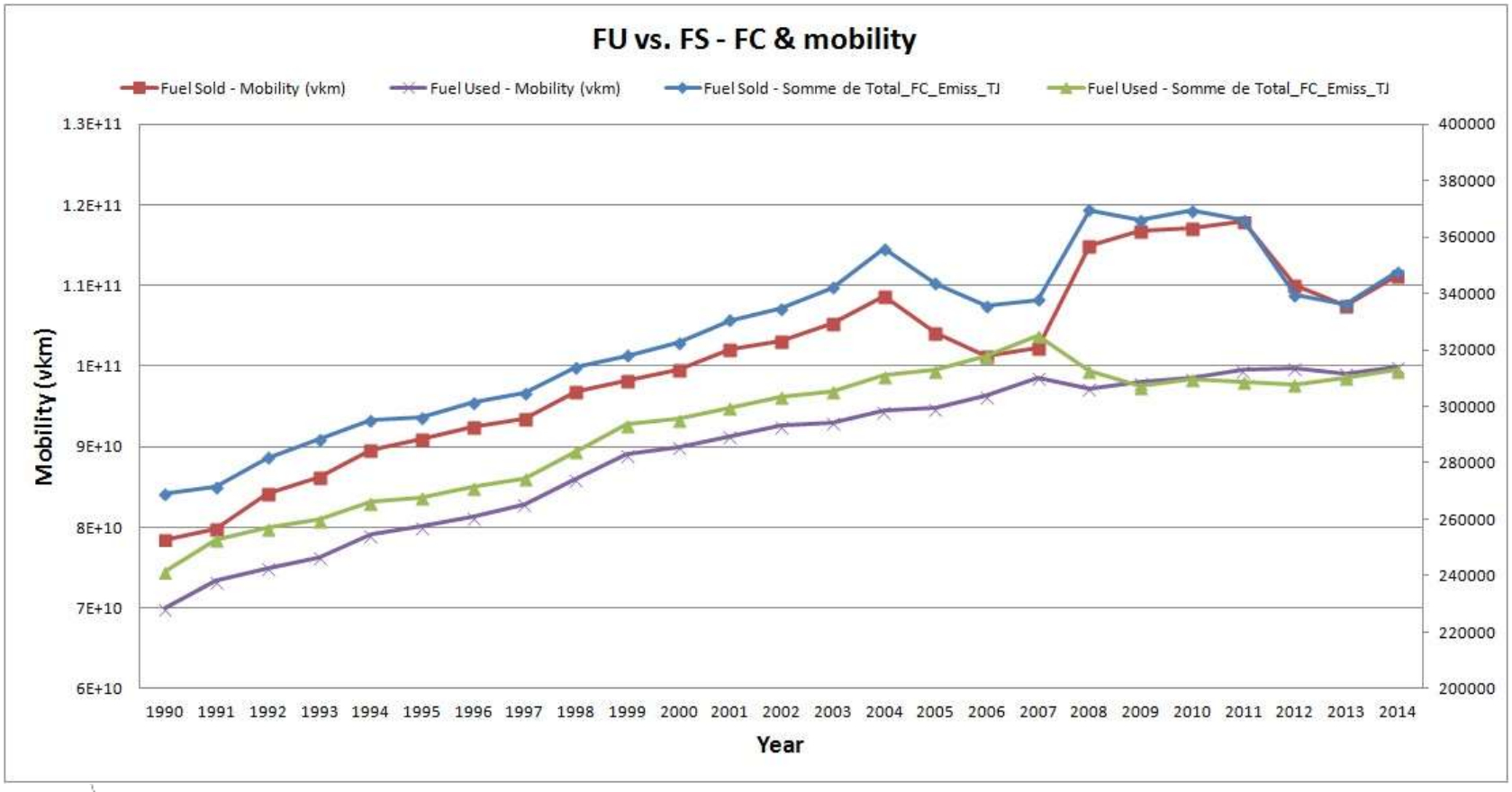

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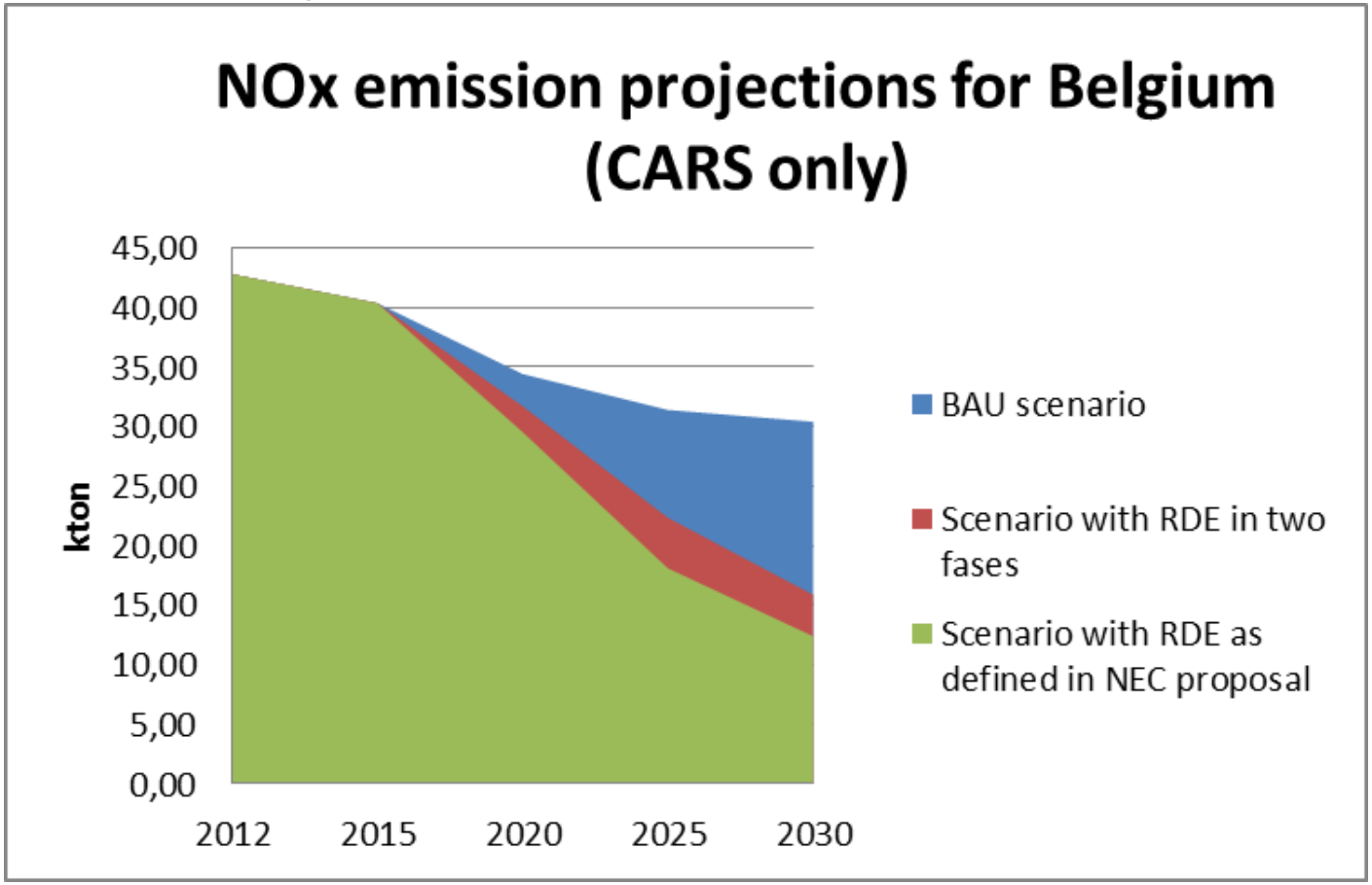
Figure. Evolution of the Belgium energy statistic for road transport (FS), of the calculated energy for road transport (FU) and vehicle kilometers driven (FU-FS) in Belgium between 1990-2013.

Example of sensitivity analysis for NOx EF (euro 6 and beyond)



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CONCLUSIONS & RECOMMENDATIONS

- Urgent need for a COPERT-like road transport projection model with the following characteristics:
  - robust and transparent
  - bottom-up approach
  - direct link between historical emissions and projections
  - reference scenario
  - guidance (in particular for new technologies)
- For policy approaches a more complicated model could be envisaged through add-in modules

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LET'S MOVE FORWARD ….. STEP BY STEP

Thanks to :
Marlies Vanhulsel (VITO)
Wim Verhoeven (AWAC)

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