CLIMATE ANALYTICS

1.5°C Compatible Emissions Pathways

EU and select member states

Climate Analytics, October 15, 2020

Agenda

1. Introducing the project & objectives
2. Global Paris Agreement compatible emissions pathways
3. Downscaling to national/EU28 pathways
4. Potential improvements to PAC scenario
5. Questions & discussion

1.
Introducing the project & objectives

Introduction to the National 1.5°C pathways Project

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Goal: Provide Paris Agreement compatible economy-wide and sectoral emissions pathways for the EU and 9 member states

Duration of the project: 2020 – 2021 // 1.5 years

Funded by the Swedish Postcode Foundation

Countries covered

Objective and outcomes

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Key Gaps

- Numerous **global and regional** Paris Agreement compatible pathways have been published however for many countries these are not available
- Current 2030 emission targets and policies are not sufficient to achieve 1.5°C long-term temperature goal

Objective

- Provide key resources for stakeholders and policy makers for use in developing
  - More stringent national emissions targets
  - Stronger policies in key emitting sectors

Outputs

- Final report including EU and national economy-wide and sectoral emissions pathways and discussion of current EU long-term strategy
- Country factsheets
- Communications/outreach

2.
Global Paris Agreement compatible emissions pathways

Paris Agreement - Temperature goal and zero emissions pathway

Article 2, Temperature Goal

Hold warming well below 2ºC, limiting increase to 1.5ºC

"Holding the increase in the global average temperature to **well below 2ºC** above pre-industrial levels and pursuing efforts to **limit the temperature increase to 1.5ºC** above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change"

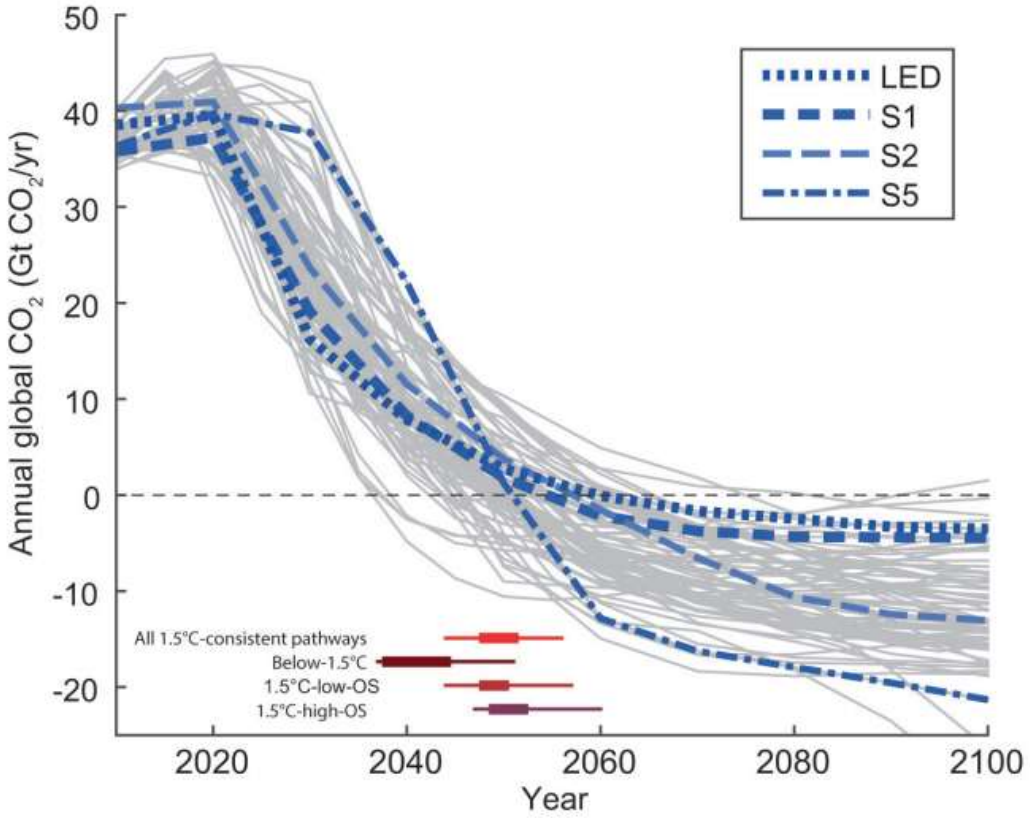
Article 4, Emission path

Zero GHG emissions in second half of century

"In order to achieve the long-term temperature goal set out in Article 2, Parties aim to reach a global peaking as soon as possible …, and to undertake rapid reductions thereafter in accordance with best available science, so as to achieve a balance between anthropogenic emissions by sources and removals by sinks of [GHGs] in the second half of this century"

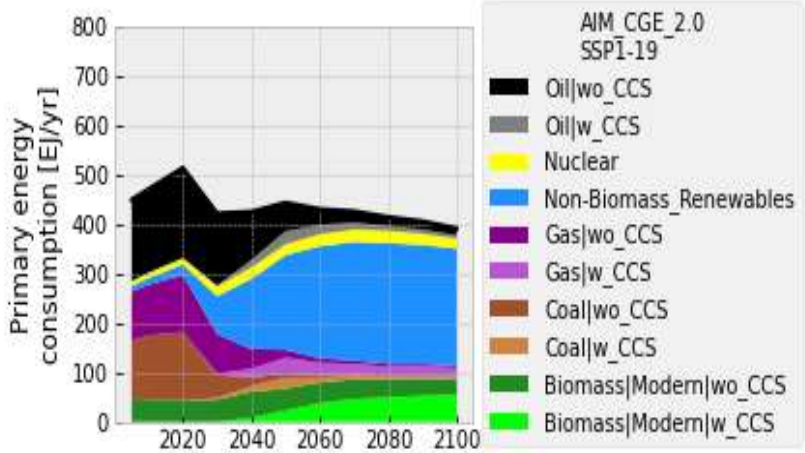
Integrated Assessment Models

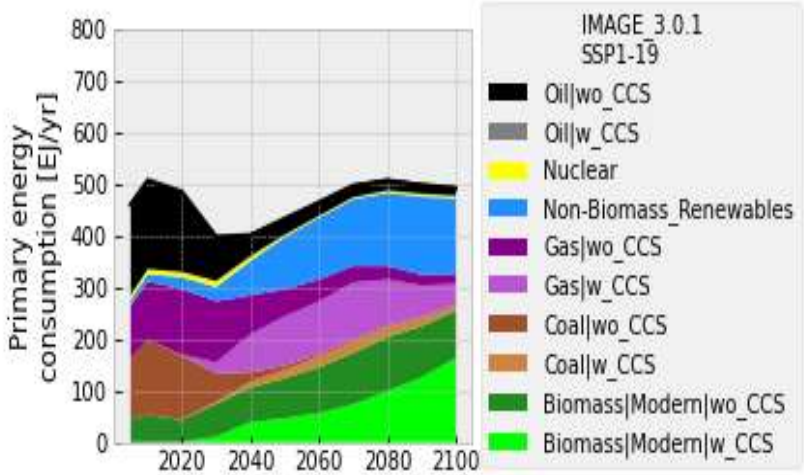
- By far the majority of mitigation pathways in SR1.5 were developed with detailed process-based **Integrated Assessment Models (IAMs)** covering all regions and sectors (energy, transport, industry, buildings and land-use sectors)
- From starting point to end of century the model framework "chooses" the mitigation options in any region, any sector, at any time, so that overall (globally and over the century), the climate target is achieved cost-effectively
- IAMs are designed to consider **gradual changes** to existing systems and are therefore not very good at capturing rapid technological advances and systemic tipping points
- Many IAMs depend on **high levels of late-century use of CDR and Bioenergy CCS** due to assumptions on technology availability and economic discounting
- CA pre-filters IPCC SR1.5 scenarios according to more stringent/realistic criteria (low overshoot, limited CCS, CDR)

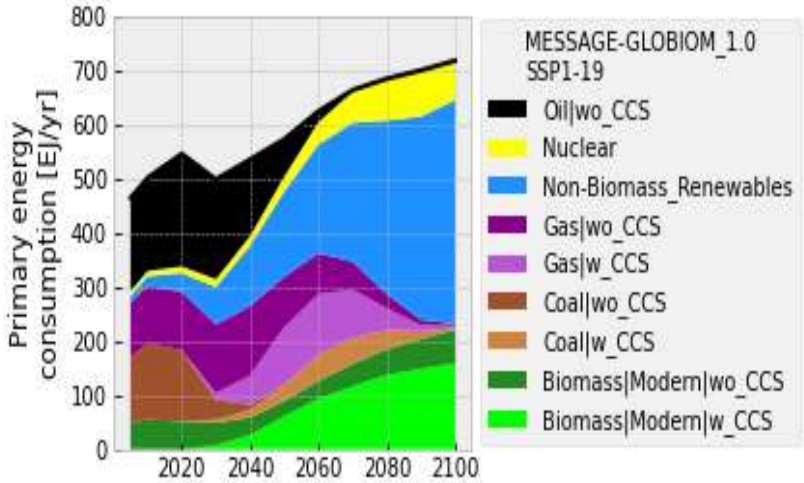


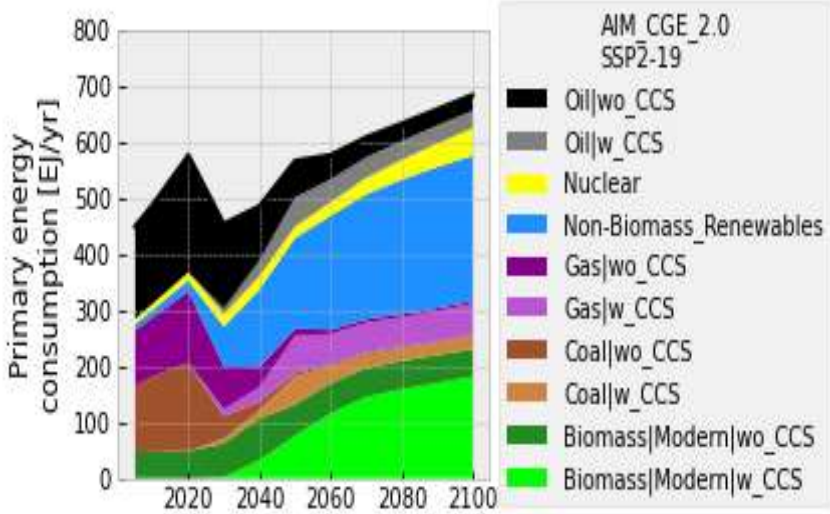
Calvin et al. (2019)

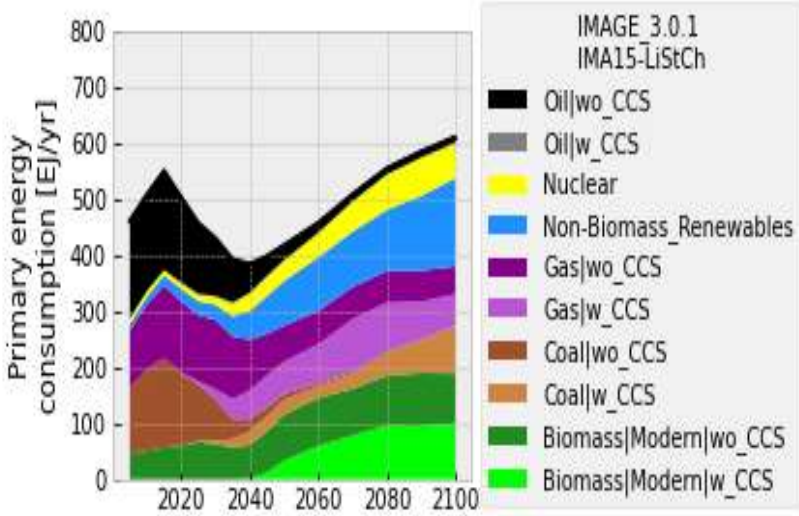
IAMs: Global Primary Energy Demand

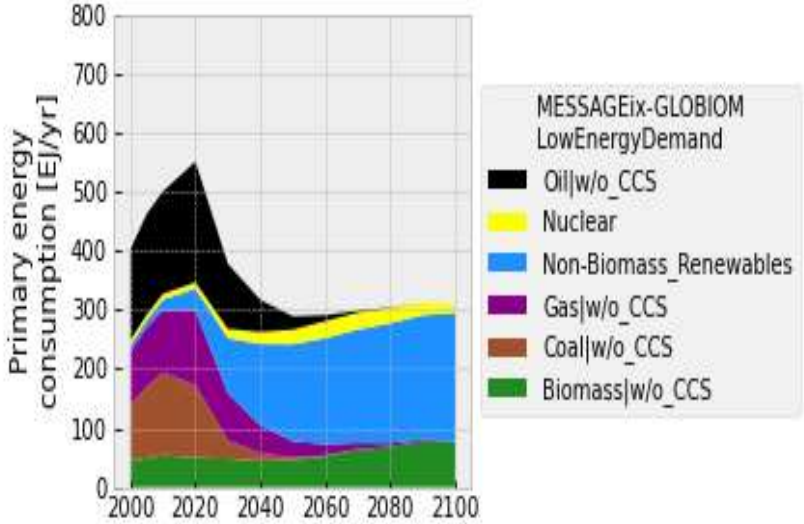








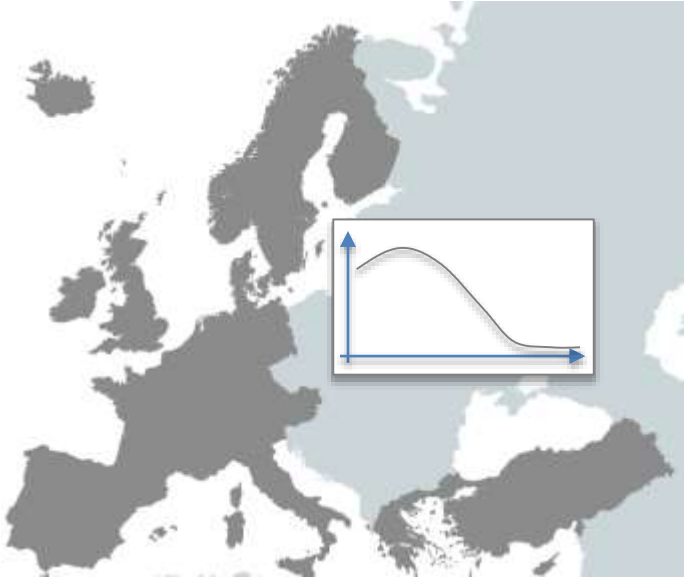




3.
Downscaling to national/EU28 pathways

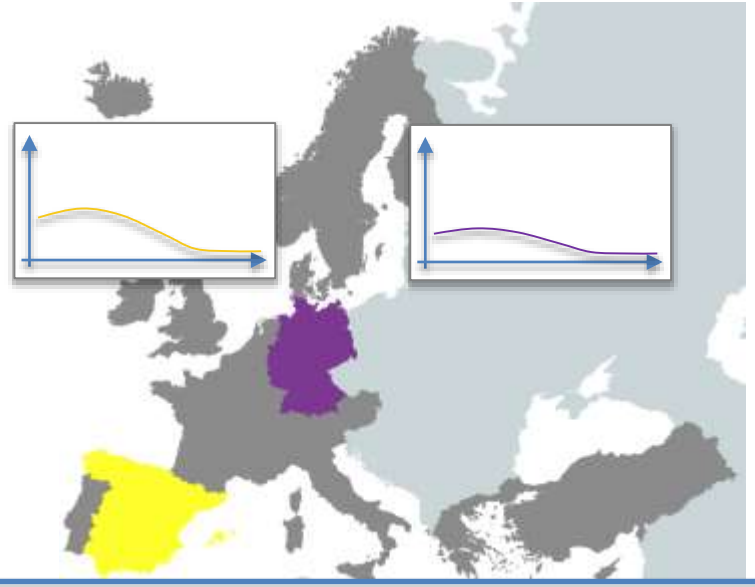
Scaling down IAM pathways to the national level

Model region "Western Europe" results from the IAM *MESSAGE*



Downscaling process

Country-level results e.g. Spain and Germany



Step 1:
Matching historical emissions for each country (sector)

Sectors: energy, industry, agriculture, waste

Step 2:
Downscaling future emissions for each country (sector)

Step 3
(for sectoral pathways)**:**
Assessing results

Stakeholder engagement (CAN Europe members)

Iterations to enhance country context

Building EU28 pathways from downscaled national pathways

e.g. model regions “Western Europe” and “Eastern Europe” results from the IAM *MESSAGE*

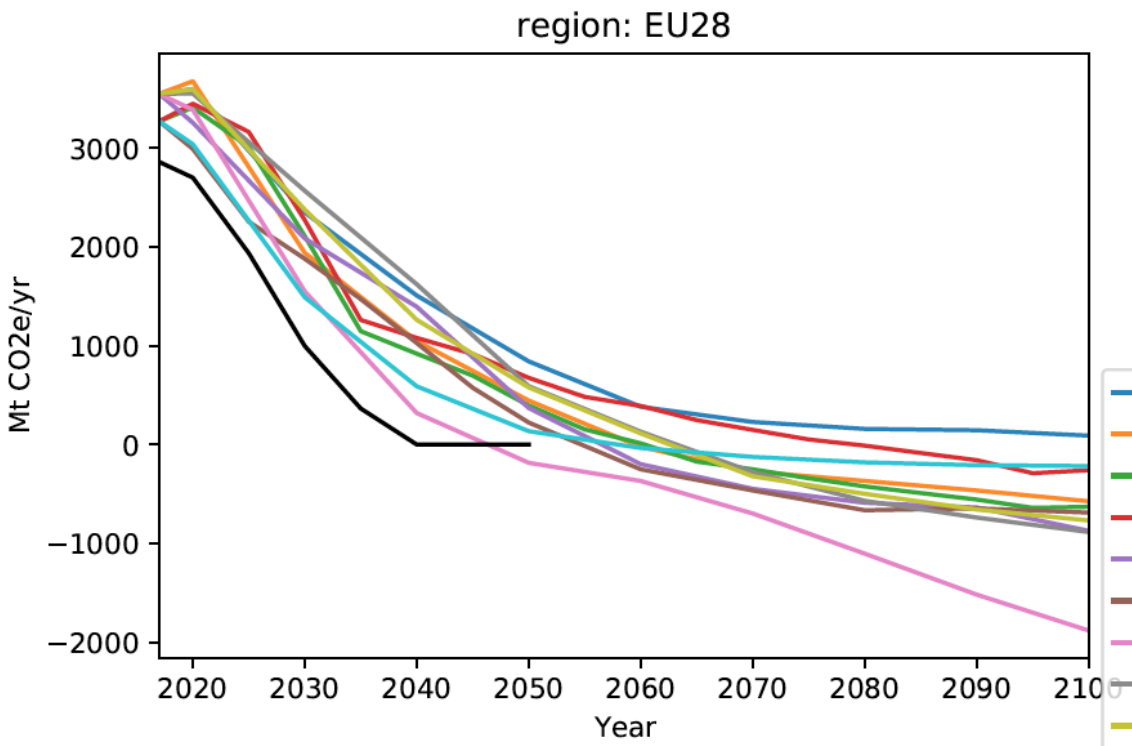
Construct EU28 results

Step 1:
Downscale economy-wide and sectoral emissions pathways for all countries in both regions

Step 2:
Sum national emissions pathways (economy-wide/sectoral) to EU28

Comparison: PAC vs downscaled 1.5°C IAM scenarios

CO_2 Emissions: Total Primary Energy Supply

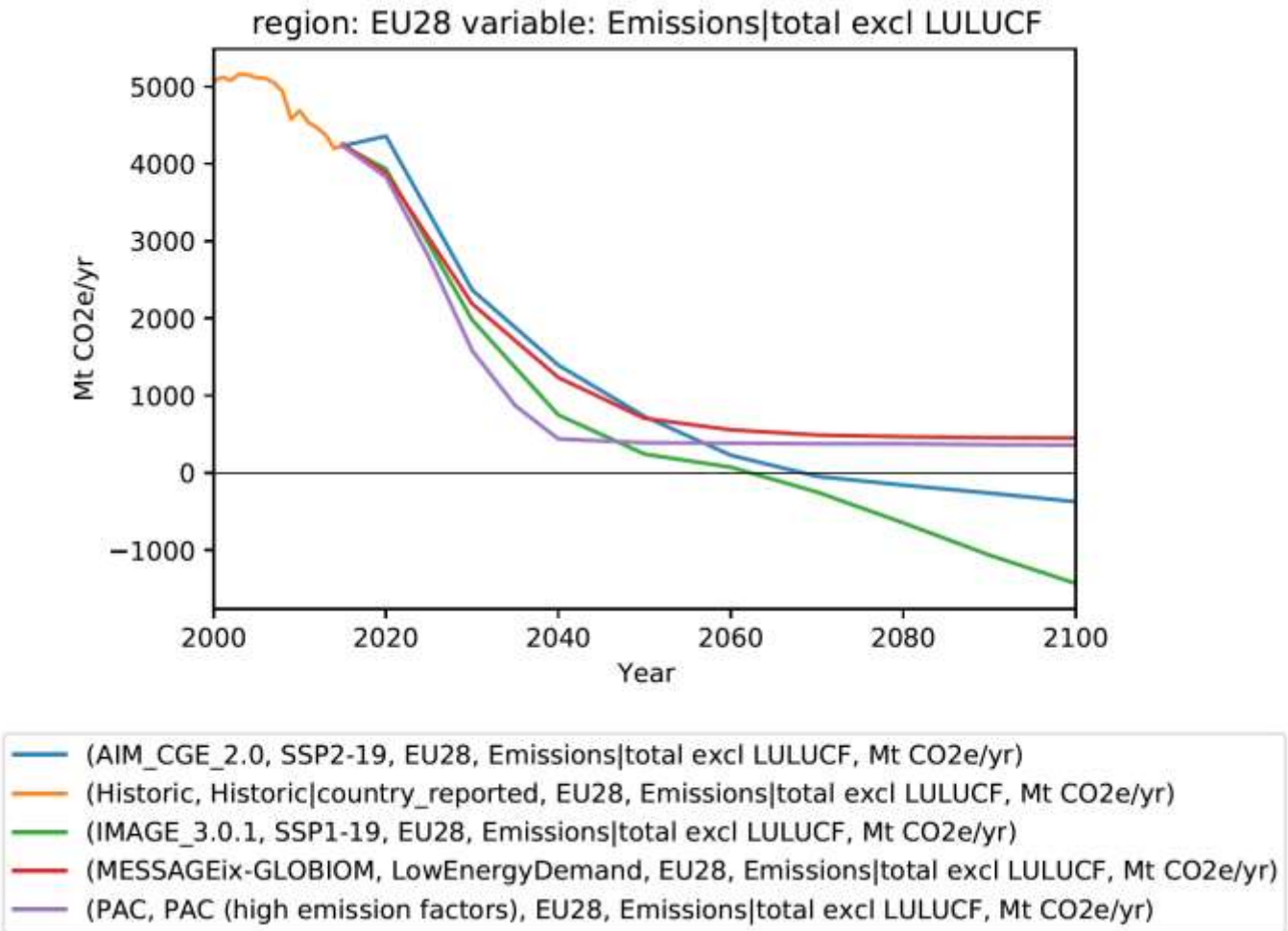


- CA pre-filtered 1.5°C compatible IAM scenarios used for comparison (low overshoot, limited CCS, CDR)
- These scenarios were downscaled to EU28 (shown)
- PAC scenario using ENTSO E emission factors resulted in lower CO_2 emissions in base year (2015)
  - 3.0 $GtCO_2e$ vs 3.28 $GtCO_2e$ (PRIMAP)
- Higher emission factors were therefore used to match base year emissions, but some demand data likely missing

(AIM_CGE_2.0, SSP1-19, EU28, Emissions|CO2|Energy_Industry, Mt CO2e/yr)
(AIM_CGE_2.0, SSP2-19, EU28, Emissions|CO2|Energy_Industry, Mt CO2e/yr)
(AIM_CGE_2.1, TERL_15D_LowCarbonTransportPolicy, EU28, Emissions|CO2|Energy, Mt CO2e/yr)
(AIM_CGE_2.1, TERL_15D_NoTransportPolicy, EU28, Emissions|CO2|Energy, Mt CO2e/yr)
(IMAGE, LOWLI_19_opf, EU28, Emissions|CO2|Energy_Industry, Mt CO2e/yr)
(IMAGE_3.0.1, IMA15-LiStCh, EU28, Emissions|CO2|Energy, Mt CO2e/yr)
(IMAGE_3.0.1, SSP1-19, EU28, Emissions|CO2|Energy_Industry, Mt CO2e/yr)
(MESSAGE-GLOBIOM_1.0, SSP1-19, EU28, Emissions|CO2|Energy_Industry, Mt CO2e/yr)
(MESSAGE-GLOBIOM_1.0, SSP2-19, EU28, Emissions|CO2|Energy_Industry, Mt CO2e/yr)
(MESSAGEix-GLOBIOM, LowEnergyDemand, EU28, Emissions|CO2|Energy, Mt CO2e/yr)

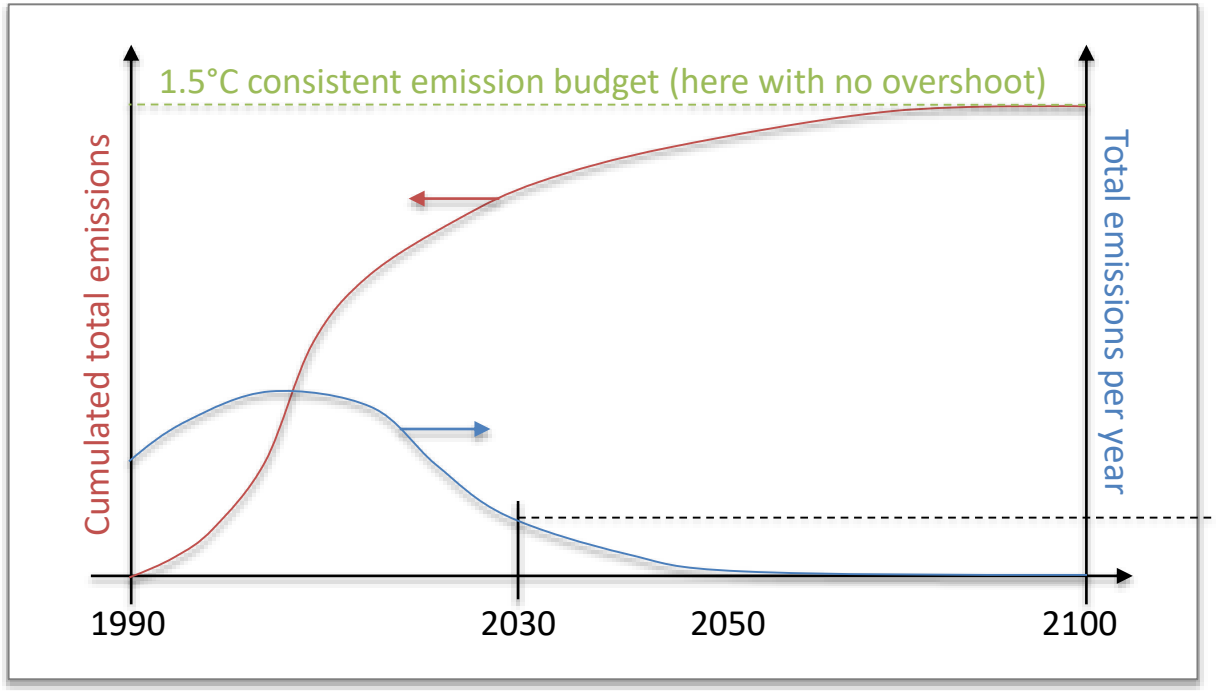
Comparison: PAC vs downscaled 1.5°C IAM scenarios

Economy-Wide GHG Emissions



- GHG emissions trajectory taken from most ambitious IAM scenario (IMAGE SSP1 1.9) and applied to PAC scenario
- PAC scenario still most ambitious scenario until 2040, but non-CO_2 emissions do not go to zero
- Most scenarios contain significant BECCS, which leads to net-negative GHG emissions
- Without CDR, not possible to bring total GHG emissions to zero using trajectories from IAMs
- Implicit assumption is that gap to zero is made up by LULUCF removals

Identifying 1.5°C consistent emission budgets and formulating national emissions targets

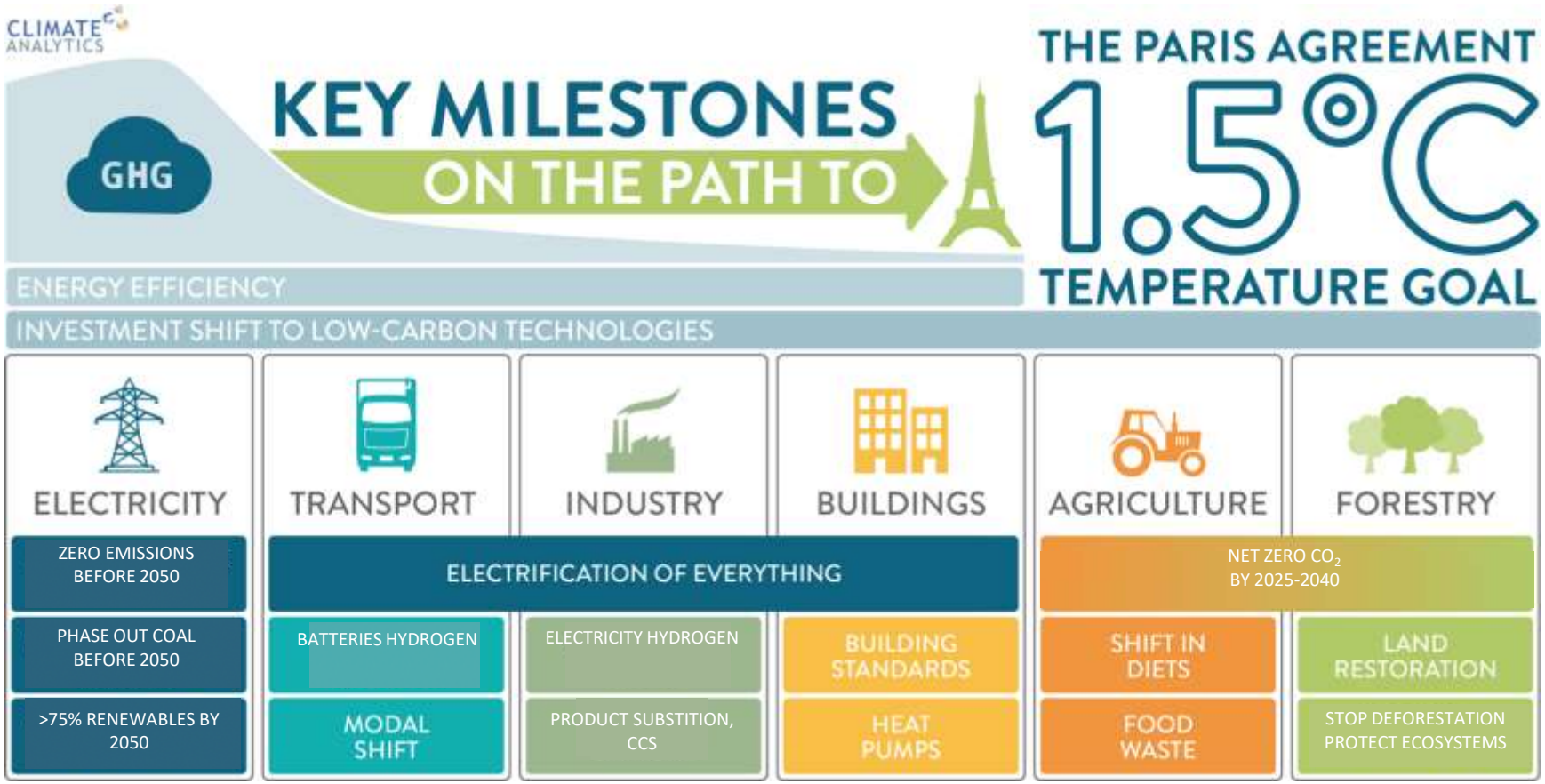


1.5°C consistent national emissions target for 2030

Downscaling of regional emission budgets (as assumed e.g. by an IAM) to national emissions budgets

Formulation of national emissions target, long-term GHG emission reduction strategies (LTS) and zero emission ranges for countries

1.5°C sector transformations



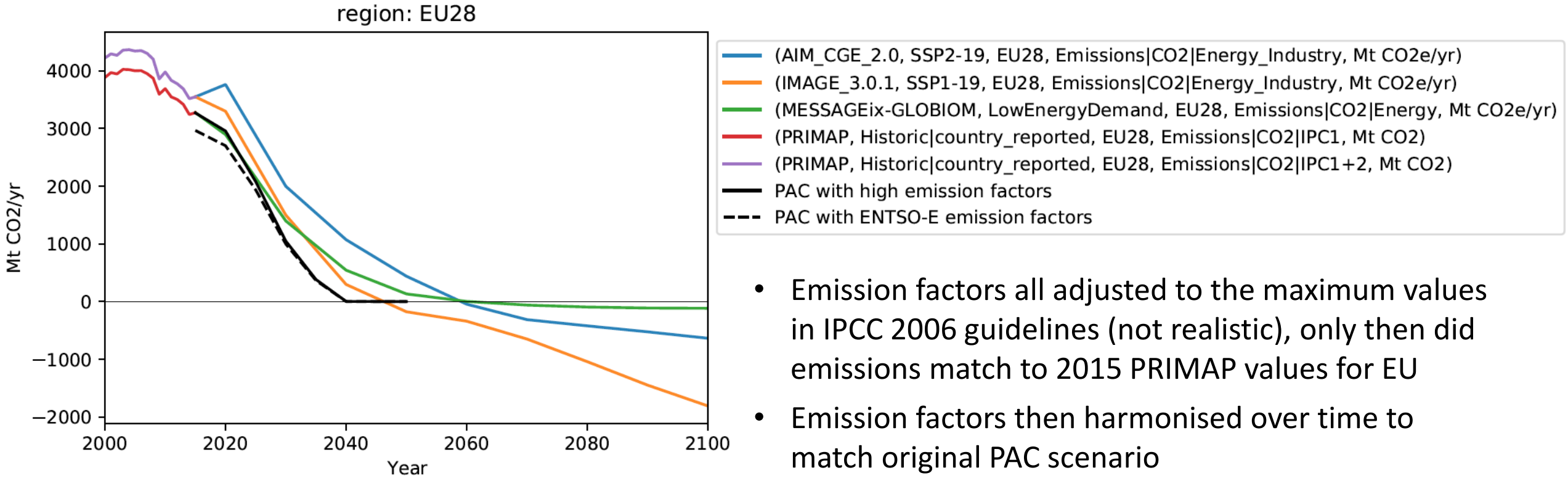
- Sectoral downscaling aims to provide more granular depiction of 1.5°C compatible emissions pathway
- Engagement with CAN Europe members needed to ensure important national context is captured

Source: Climate Analytics (2019); IPCC (2018)

4.
Potential improvements to PAC scenario

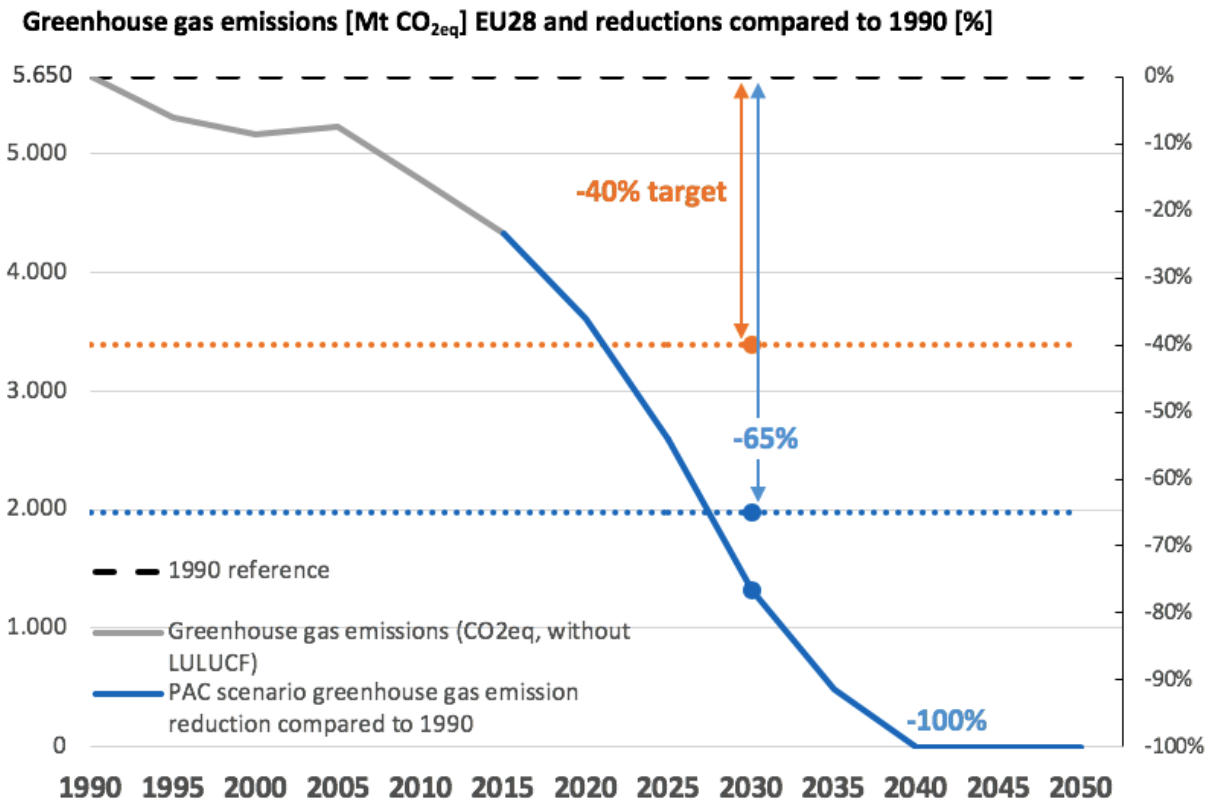
Missing demand data?

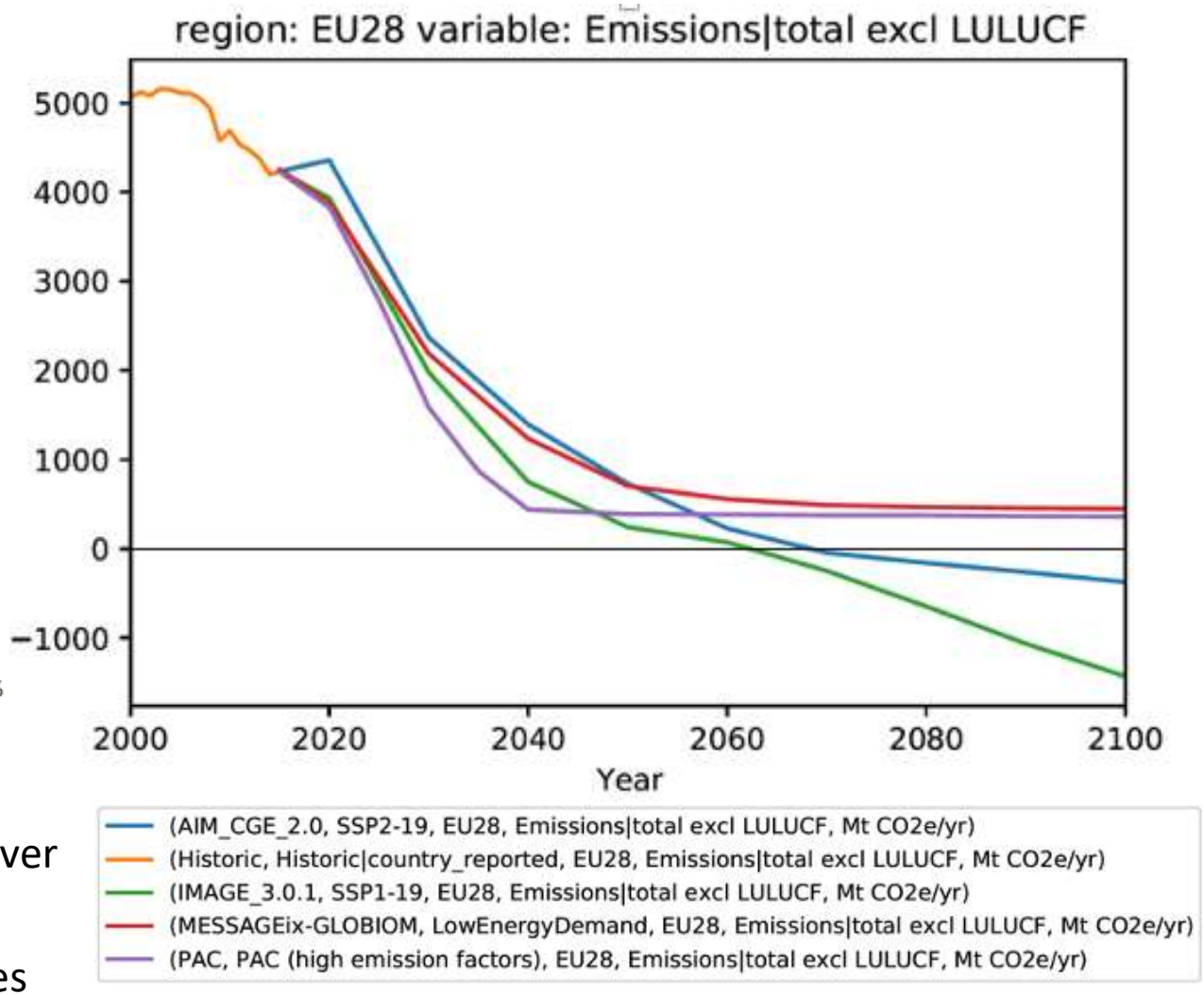
CO_2 Emissions: Total Primary Energy Supply



- Emission factors all adjusted to the maximum values in IPCC 2006 guidelines (not realistic), only then did emissions match to 2015 PRIMAP values for EU
- Emission factors then harmonised over time to match original PAC scenario
- Initial analysis of PAC demand data suggests there may be some 2015 coal and oil demand missing

Treatment of LULUCF and non-CO_2 emissions





- PAC scenario excluding LULUCF implies negative total GHG emissions in 2040, as EU LULUCF emissions likely negative over time
- Suggest further consideration of how PAC scenario addresses LULUCF and non-CO_2 emissions

5.
Questions and Discussion