



Explore sustainable European futures



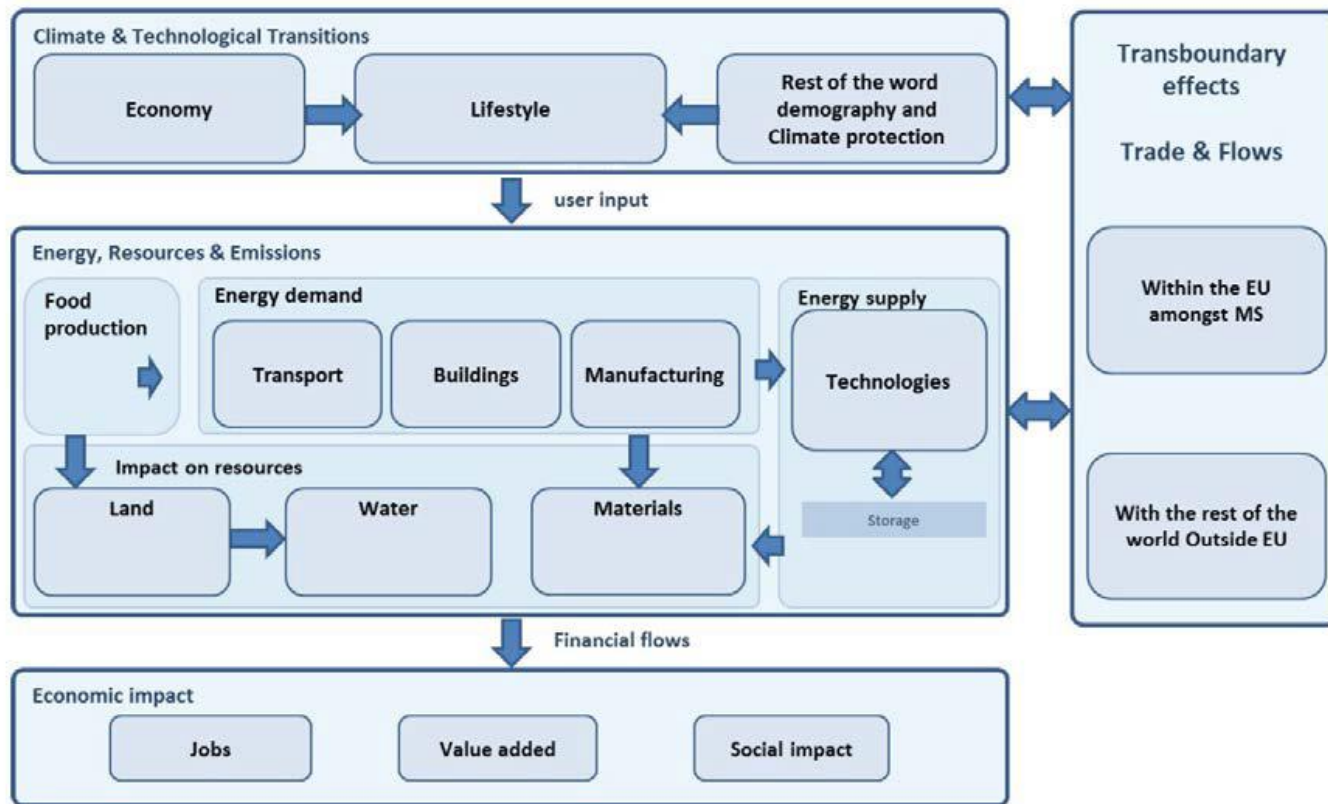
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Expert consultation on transboundary effects of EU decarbonization pathways

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- Introducing WP7 on transboundary effects
 - Modelling approach
 - Model
 - Baseline
 - GTAP-EUCalc interaction
 - Conceptual framework
 - Practical implementation
 - Pre-simulated scenarios
 - Questions for discussion at the workshop
 - Baseline and model development
 - Scenario design and implementation
 - Results exploitation
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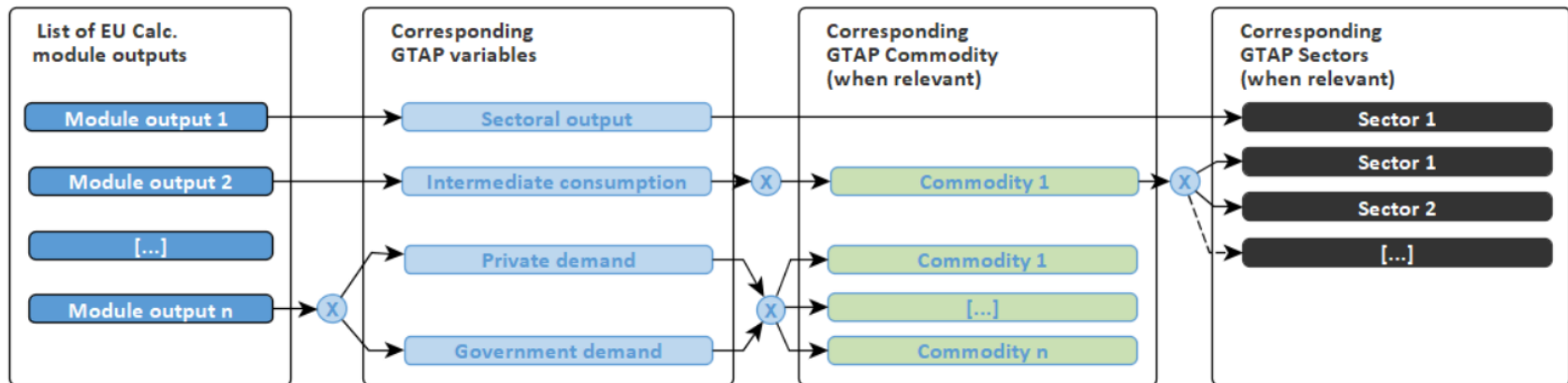
Symbiotic relationship between the “core” modules and the transboundary effects module



- EU de-carbonization pathways imply changes in energy demand/supply/technologies from a future BaU base case
 - alter economic structures of individual MSs & trade linkages among them and between them and the R.O.W.
 - Modelling intra-EU & EU-ROW trade effects requires economic models with inter-sectoral & international linkages
 - GTAP, a global CGE model/database well suited for this purpose
 - We adopt its energy-climate focused version (GTAP-E) as the starting point of our modelling exercises
 - The basic approach
 - Establish a baseline scenario of world economy (incl. all EU MSs)
 - Use inputs from EUCalc 'core' modules to formulate alternative EU de-carbonization pathways as CGE model scenarios
 - Impose alternative scenarios onto the CGE model to simulate trade effects, to be included in EUCalc pathway explorer
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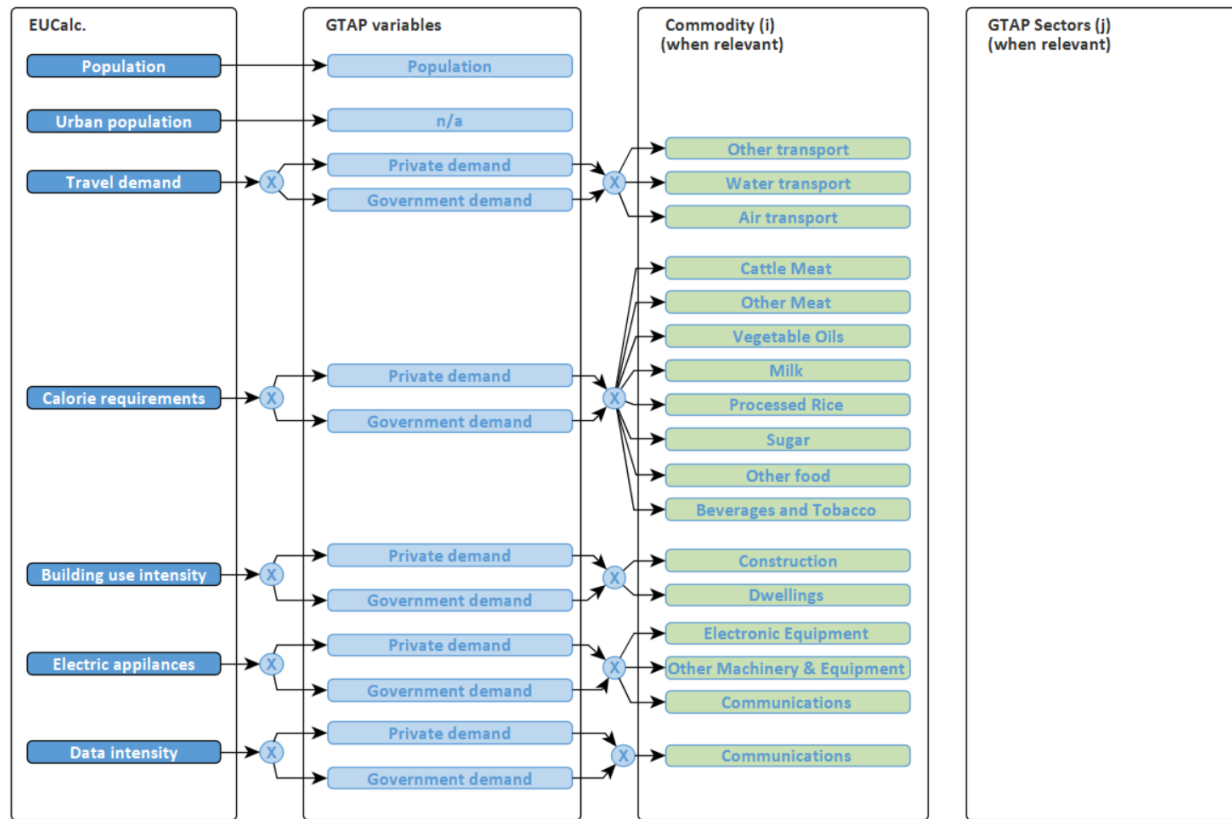
- A baseline data set towards 2050
 - **GDP:** EU Reference Scenario 2016 (European Commission et al., 2016) and OECD-SSP2 (Dellink et al., 2017);
 - **Population:** EUROSTAT, EU 2015 Ageing Report and SSP2 projections for IIASA (Kc and Lutz, 2017);
 - **Labor force:** EUROSTAT, EconMap2.4 (Fouré and Fontagné, 2016) and EU 2015 Ageing Report
 - **Capital stock:** EconMap2.4 (Fouré and Fontagné, 2016);
 - **Total factor productivity (TFP):** EconMap2.4 (Fouré and Fontagné, 2016) and EU 2015 Ageing Report
 - Issues with implementing the baseline in the model
 - Sectoral productivity differentials
 - Trade policy and trade costs trends
 - Trade elasticities, trade-income relationship
 - Treatment of land and natural resource supply
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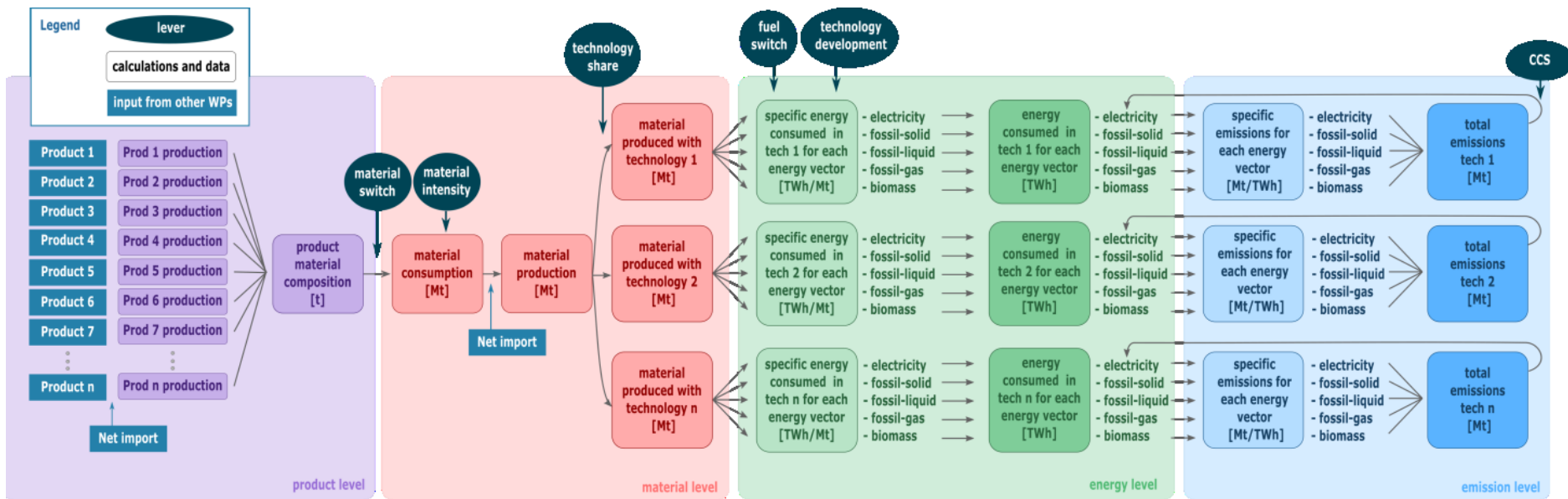
- Develop “connection points” between core modules of EUCalc and GTAP
 - **EUCalc core modules:** bottom-up, engineering model
 - **GTAP:** top-down, economic model
- Conceptual linkages developed in Deliverable 7.2



Projected transformations in sectoral productivities due to decarbonization measures will be implemented in GTAP as technological changes

WP1 projects potential scenarios on the demand side of the EUCalc model



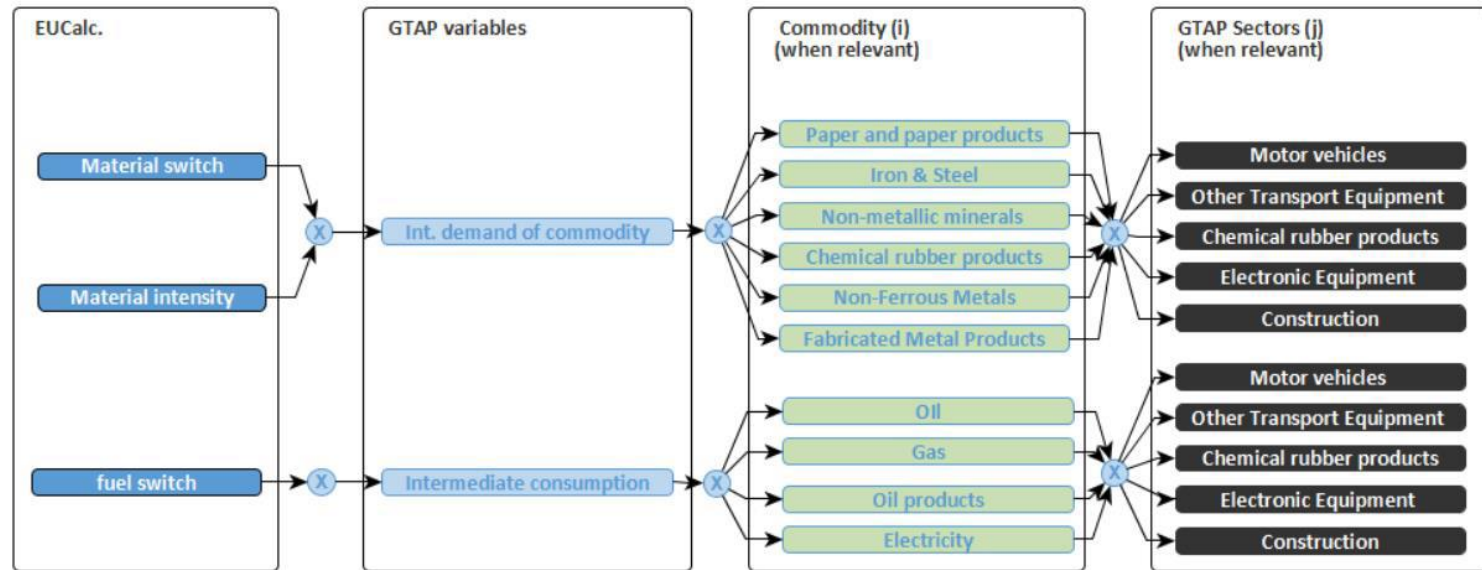


Calculation tree in the "manufacturing" module

The lever allows the EUCalc user to change the “percentage of material in a product that is expected to be substituted by 2050 by a less carbon-intensive material”

Name/Unit	1	2	3	4
Substitution of steel by chemicals (carbon fibers) in cars [%]	5	10	15	20
Substitution of steel by chemicals (carbon fibers) in trucks [%]	2	5	10	15
Substitution of steel by aluminium in cars [%]	10	25	40	60
Substitution of steel by aluminium in trucks [%]	5	15	30	50
Substitution of steel by timber in buildings [%]	2	5	10	20
Substitution of concrete by timber in buildings [%]	10	20	40	60
Substitution of chemicals by paper (cellulose) in renovated surface [%]	2	5	10	20
Substitution of chemicals by natural fibers in renovated surface [%]	10	20	30	40

Together with the other sectoral outputs, levers are “translated” in GTAP variables to be exogenously shocked



Two main questions arising on:

- Sensible vs “solvable” sectoral disaggregation
- User-driven vs price-driven changes in quantities

- The changes to the economic system due to “material switch” can be implemented in GTAP via changes in intermediate consumption
 - In GTAP, such changes can be driven by:
 - **Tax instrument**
 - Tax on the use of intermediate consumption
 - Tax on sectoral emission intensities
 - **or Cost-neutral quantity changes** (“twist” parameter approach)
 - Issues with different sectoral classifications:
 - e.g. substitution of *steel* by chemicals (*carbon fibers*) in cars [%]
 - *Steel* is part of the *iron & steel* sector in GTAP
 - *Carbon fibers* are part of the *chemical & rubber products* in GTAP
 - Some “scaling” of the size of the switches has to be conducted
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- User-defined scenarios are ***virtually unlimited*** due to the presence of the many levers across sectors
 - Formulating model scenarios in itself not a trivial task
 - and we cannot simulate all of them in the CGE model!!!
 - Calculations within the EUCalc core modules will be done in “real-time”
 - Simulations in CGE models: numerical solutions cannot be obtained in “real-time”
 - Successful model solutions cannot be guaranteed a priori
 - Therefore, pre-computing of the most important and relevant representative scenarios is needed
 - Results from these scenarios to be included in the EUCalc Pathway Explorer
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- We could potentially simulate three sets of scenarios to create an “envelope” for a wider set of scenarios:
 - Identical ambition levels in all sectors and countries;
 - Different ambitions across sectors, with sectoral ambition levels being kept the same across EU MSs
 - Individual deviations by MSs from EU-wide ambition, i.e. each EU MS is assumed to deviate its level settings (uniform across sectors) from the ‘core’ scenarios
 - Are the above scenarios the most important, representative, and relevant scenarios? Are there other important ones to consider?
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- Results from GTAP
 - changes in bilateral import and export flows for each/every country (region) pairs and each/every product, % from the baseline
 - Very large matrix, difficult to present/display
 - Deriving key indicators from the raw results?!
 - Overall trade balance/self sufficiency ratio
 - Trade balance/self sufficiency ratio by products or for key products only
 - Overall trade dependency/exposure indices
 - Distinguish between intra- and extra-EU trade flows
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