Incorporating behavior change through modal-shifts in the MARKAL-Georgia transport sector

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Enhancing capacity for Low Emission Development Strategies (EC-LEDS) Clean Energy Program

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- Context
- Description transport sector in MARKAL-Georgia
- Introducing mode-shifting technologies
- Results and Conclusions

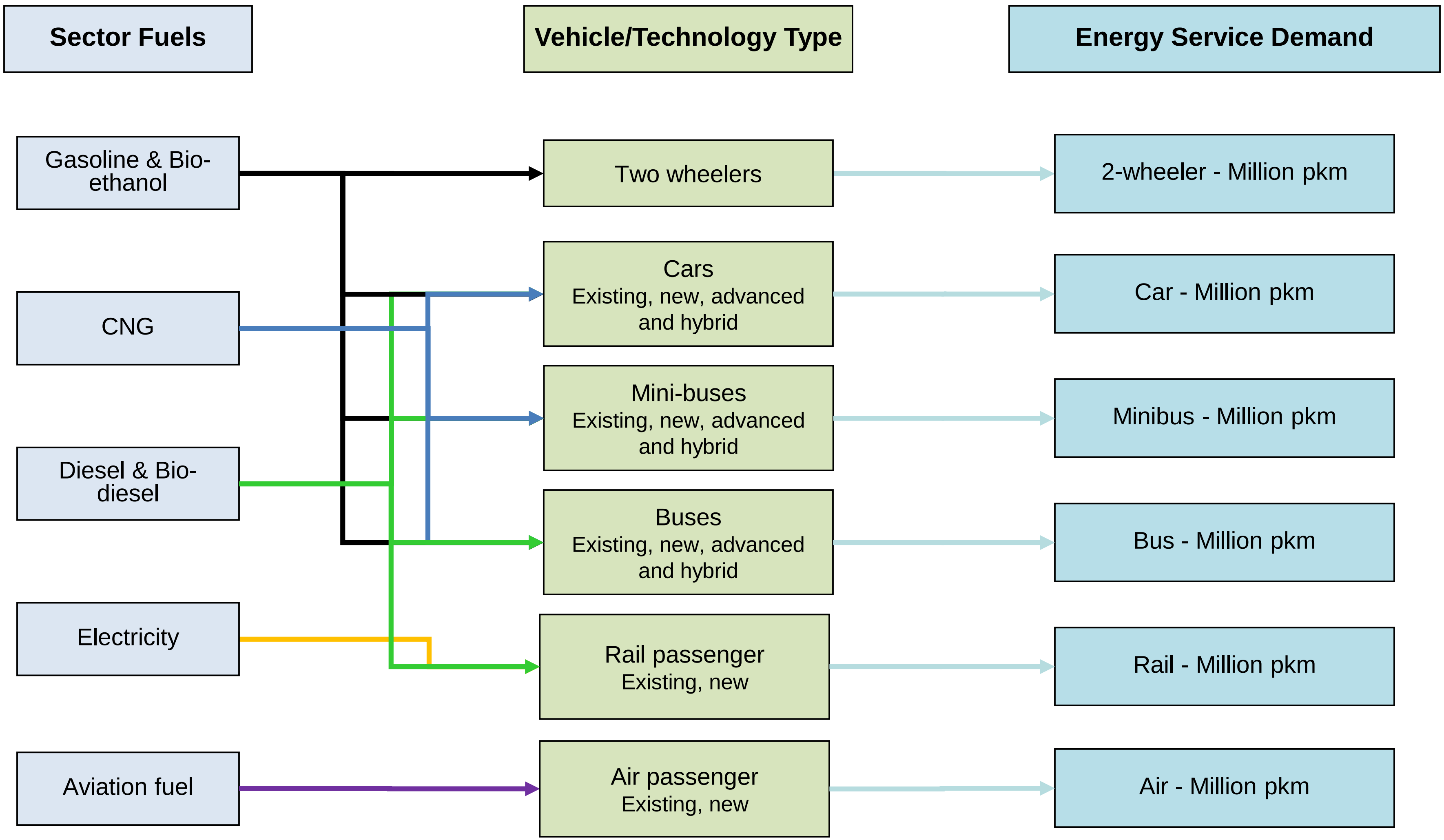
Context

- Several major initiatives connected with GHG mitigation are going on in Georgia:
  – Determination of Intended Nationally Determined Contribution (INDC)
  – Preparation of Low Emission Development Strategy (LEDS)
  – Sustainable Energy Action Plans (SEAPs) of major cities under EU's Covenant of Mayors(CoM) initiative

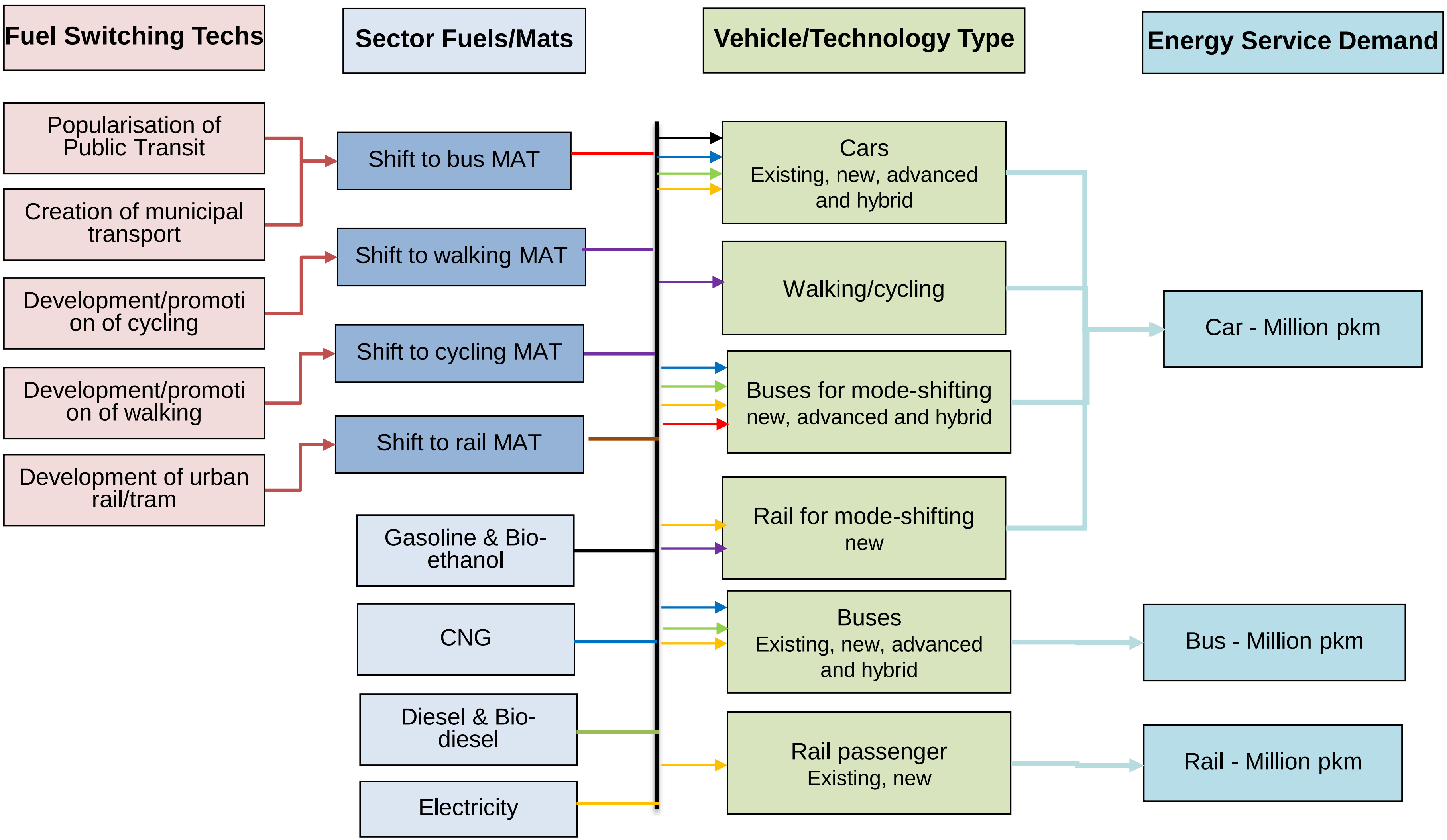
MARKAL-Georgia

- Developed by Georgian experts with support from USAID under the RESMD and EC-LEDS Programs
- Analytic Department of Ministry of Energy is taking the ownership of the model.
- Is being used to support development of INDC, LEDS and SEAPs
- Encompasses an entire energy system of Georgia
- Includes a comprehensive set of technologies in all sectors, enabling the assessments of mitigation measures coming from energy efficiency, renewable energy or fuel switching
- Lacks the capacity to model so called “soft measures” such as behavior-change programs that affect the demand, i.e. in transport sector.

Transportation Sector Structure – Passengers



Introducing mode-shifting



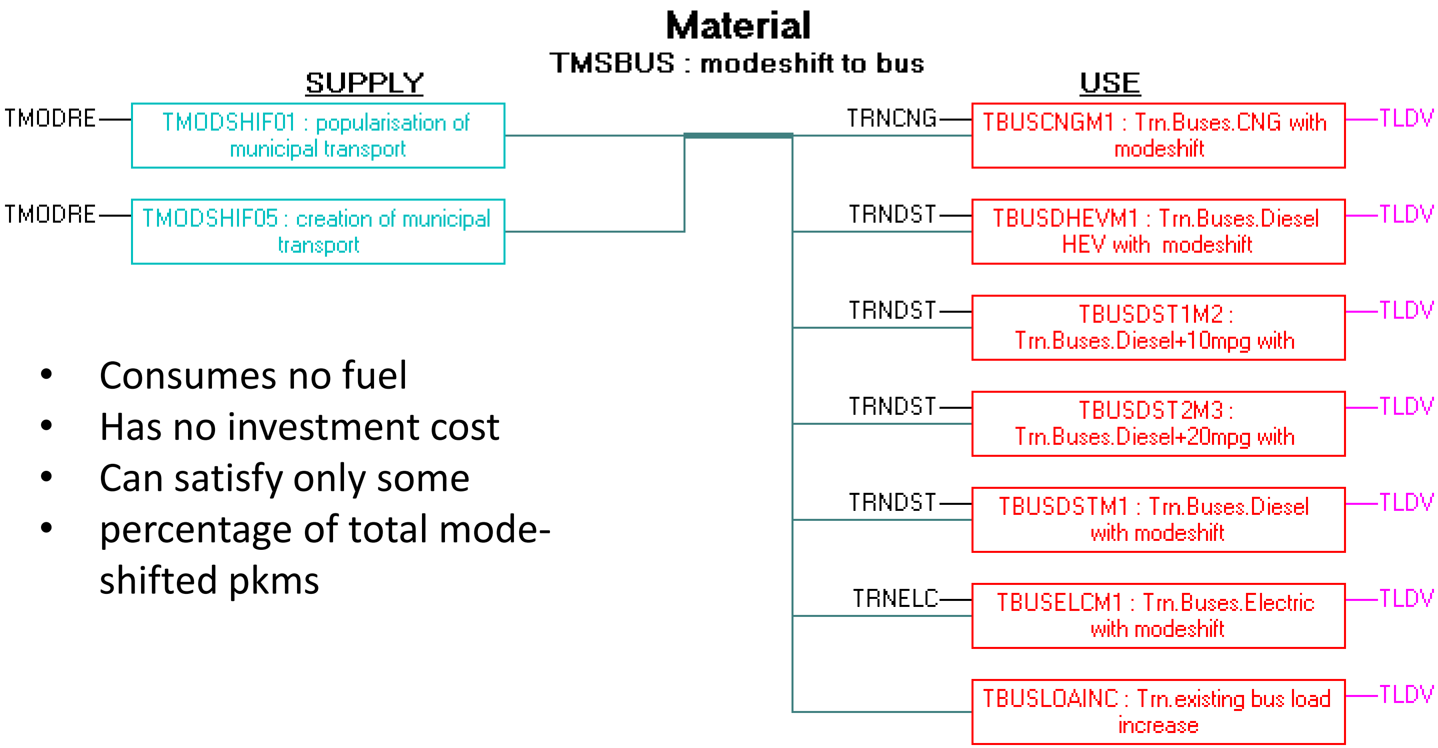
Modeling mode-shifting in MARKAL/TIMES

- Materials:
  - are required for buses, rail, walking or cycling end-use technologies that can satisfy the demand for LDV travel.
  - material flows are tracked in units of million passenger-km (pkm), making their use and cost calculations straightforward.
    - **Example:** 5 cities in Georgia plan to develop cycling infrastructure and promote cycling. They assume they will need 11.5 million USD to set initial infrastructure and then around 3.8 million USD (7.5USD per capita) to maintain 5% modal share of cycling*. Based on population numbers of these cities and their urban travel, the pkms that they can shift to cycling make 0.4% of total pkms in Georgia, i.e. 42 million pkms. Therefore investment cost is 11.8/42=0.27USD/pkm and fixed cost is 3.8/42=0.09 USD/pkm.
- Technologies:
  - represent particular mode-shift measures that can be some behavioral-change initiatives such as information campaigns or other types of undertakings that influence modal shift in transport.
  - The investment (and/or fixed & variable) costs equal to the cost of measures (including infrastructure for something like bike paths or costs of behavior-change advertisement program).
  - They produces dummy mode-shifting material, which is bounded by the limit of pkms that particular measures can achieve.
  - Demand devices then take the material flow and either provide pkm (in the case of walking/biking) or result in new "buses" purchased that then provide LDV services.

* Cost and share estimations are based on International Energy Agency (2009), Transport, Energy and CO2 – Moving Towards Sustainability, OECD Publishing, Paris.

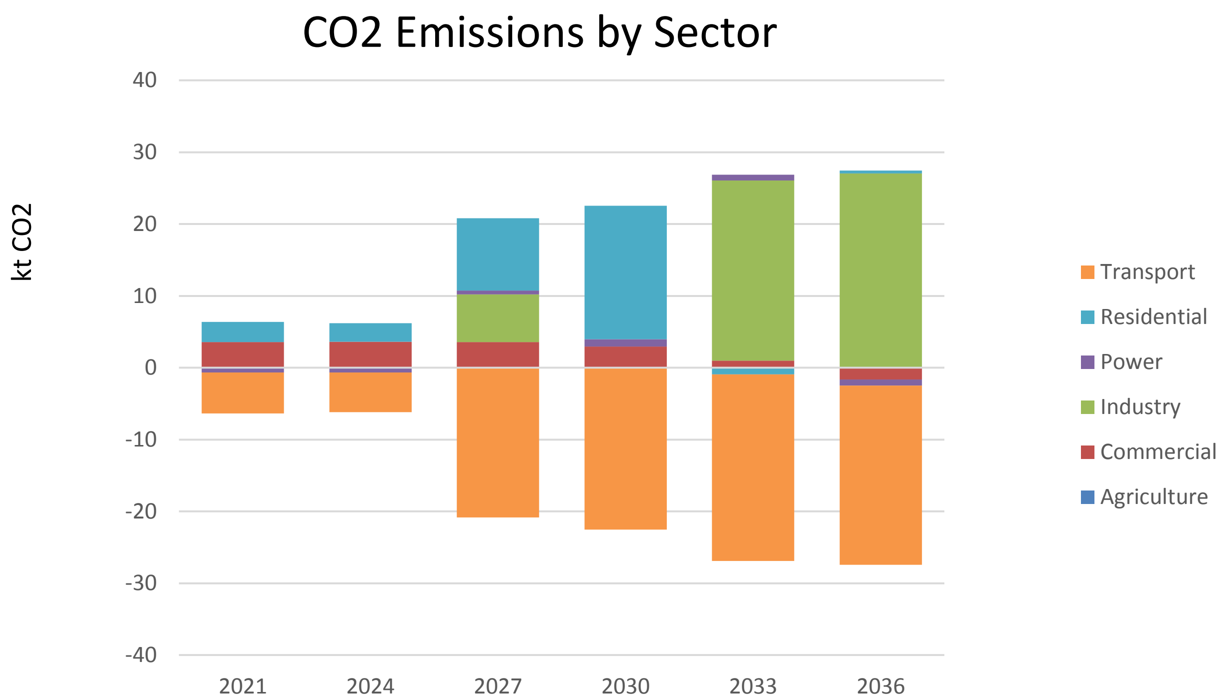
Increasing of bus load factor

Information campaigns (and measures such as increased parking fees for cars) can result in higher level of use of existing buses.



- Consumes no fuel
- Has no investment cost
- Can satisfy only some
- percentage of total mode-shifted pkms

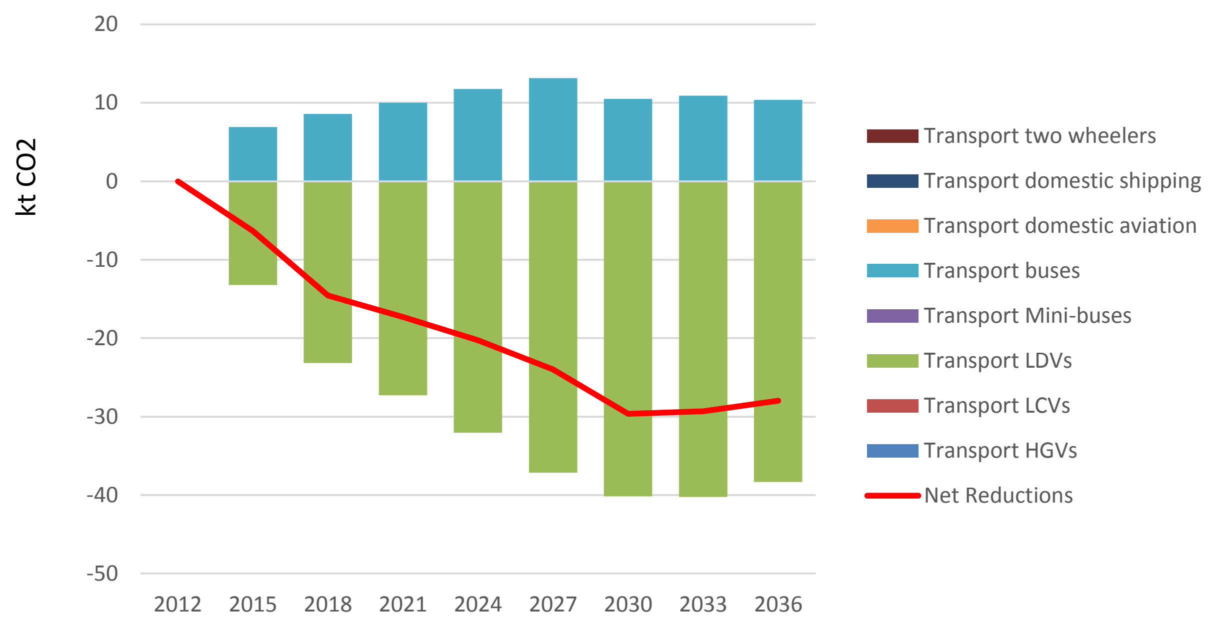
Results – comparison of 30% CO_2 reduction runs with and without modal-shift



- With modal shift more emissions are reduced in transport sector, reducing the pressure on other sectors and resulting in lower system cost.

Results – comparison of 30% CO2 reduction runs with and without modal-shift

Transport Emissions by End-use



- The model invests in mode-shifting activities for cycling, walking and public transport, thus reducing emission from LDV. At the same time because more busses are needed there is an increase in their emissions, though with an overall decrease of emissions in transport sector.

Conclusions

- This approach enables mode-shifting measures to be included in least-cost optimization.
- It can be easily tailored for other sectors to model other non-technology demand-changing activity.
- It can serve as an alternative to the hurdle rate approach to modeling energy efficiency, by separately modeling the measures and policies for 'forcing' more energy efficient technologies into the mix, to more adequately depict the hidden costs associated with such measures in the model.

THANK YOU