Disclaimer

The results presented in the model should be regarded as an estimation derived from the best available data and information collected during the project. Its primary value lies in facilitating scenario comparisons rather than providing precise future values for certain indicators.

The ITF warrants the outputs of the default scenarios in the model: Baseline, Current Policies and Climate Ambition. These scenarios are validated by the technical team and the Ministry of Road and Transport Development of Mongolia. The model allows to manually create alternative scenarios by adjusting input; however, the ITF does not endorse the outcomes of this exercise and should not be quoted as the source of any manual scenario results.

The use of the model, its default scenarios and any other elements is free.

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Project overview

As part of SIPA, the Sustainable Infrastructure Programme in Asia, a national roadmap study was conducted in Mongolia.

It focused on decarbonising urban passenger transport in Ulaanbaatar, emphasising the role of public transport.

The main deliverables of this study are the Findings & Recommendations slide deck, the Urban Mobility model for Ulaanbaatar, and the current Model Manual.

This manual aims to guide users in utilising the model to support local policy building.

Data collection in cooperation with stakeholders in Mongolia

Consultation with local stakeholders to better grasp the specificities of the urban environment and mobility system in Ulaanbaatar.

Scenario definition with partners in Mongolia: analysis of existing, planned and potential policy measures

Model handover to the Ministry of Road and Transport Development and the City of Ulaanbaatar for supporting local policy building

Access more information and project deliverables
Table of contents

1. Model overview
   A. General information
   B. Scope
   C. Structure

2. Base manipulations before using the model

3. Use case: Standard user
   A. Generating a scenario
   B. Reading the output

4. Use case: More advanced user
   A. Reading detailed output
   B. Editing model data input
   C. Editing model parameters
MODEL OVERVIEW
General information about the model

The model is built in Microsoft Excel (macro-enabled workbooks)

It is based on the ITF Global Urban Passenger Model, from which the structure, formulas and initial calibration were extracted.

The model covers the administrative boundaries of the City of Ulaanbaatar and relies on inputs from local stakeholders and open-source platforms:

- Ministry of Road and Transport Development of Mongolia
- City of Ulaanbaatar (Public Transport Department, Road Development Department, Urban Planning and Research Institute)
- Mongolian University of Science and Technology (MUST)
- UN DESA population data, Intergovernmental Panel on Climate Change (IPCC)
Model purpose

It is a strategic modelling tool allowing to assess the impact of CO₂ mitigation measures:

- **Infrastructure Expansion** (e.g. public transport infrastructure improvement)
- **Public Transport Promotion** (e.g. increased frequencies, lower fares)
- **Shared Transport Promotion** (e.g. car sharing, on-demand taxibus services)
- **Restrictive Measures** (e.g. parking restrictions, speed limitations)
- **Pricing Measures** (e.g. road pricing, parking pricing)
- **Vehicle Technology Development** (e.g. technology stock targets for private and public fleets)
- **Other Measures** (teleworking, land use mixture)

The model develops policy scenarios between 2015 and 2050 and evaluates related transport activity and emissions.
Modelling scope – Level of disaggregation

To enhance the representation of urban mobility for different market segments, the model differentiates:

- 14 modes (current and possible in the future)
- 2 genders and 4 age cohorts
- 6 trip distance bins
- 4 fuel types (gasoline, diesel, electric, LPG/CNG)
- 5-year steps from 2015 to 2050
## Modelling scope – Transport modes

<table>
<thead>
<tr>
<th>Non-motorised</th>
<th>Private vehicles</th>
<th>Public transport</th>
<th>Shared mobility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walk</td>
<td>Car</td>
<td>Bus</td>
<td>Taxi</td>
</tr>
<tr>
<td>Bicycle</td>
<td>Motorcycle</td>
<td>LRT</td>
<td>Ride sharing</td>
</tr>
<tr>
<td>Bike &amp; Scooter sharing</td>
<td></td>
<td>BRT</td>
<td>Car sharing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cable car</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Suburban rail</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>On-demand</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Taxibus</td>
<td></td>
</tr>
</tbody>
</table>
Modelling scope – Population and distance categories

8 population categories × 6 trip distance bins

4 age cohorts
- 0-4
- 5-19
- 20-59
- 60+

2 genders
- Female
- Male

- 0 – 1 km
- 1 – 2.5 km
- 2.5 – 5 km
- 5 – 10 km
- 10 – 20 km
- 20+ km
Model output

Evolution of mode shares

Evolution of trips

Evolution of passenger demand
(Passenger KiloMetres)

Evolution of vehicle demand
(Passenger KiloMetres)

Evolution of CO2 emissions
direct Tank To Wheel
indirect Well To Tank
Modelling framework

Exogenous inputs
- 2015 data
  - Transport supply
- Data projections to 2050
  - Demographic, socio-economic, vehicle emissions
- Scenario
  - Policy measure levels

Endogenous inputs
- Geographic features
- Trip distance
- Transport supply
- Mode characteristics

Models
- Trip generation
- Mode choice

Calibration data
- 2015 Transport demand, ITF global urban transport model 2023

5 years

Transport demand
- Number of Trips, Passenger-kilometres, Vehicle-kilometres

Transport emissions
- CO₂
  - (Tank To Wheel vs Well To Tank)
Principle

Travel demand outputs

- Number of trips
- Average trip distances
- Mode shares

→ Passenger kilometres by mode (PKM)

→ Vehicle kilometres by mode (VKM)

Vehicle load factors

Fuel/technology mix

Emissions outputs

- CO2 and local pollutants by mode

- By fuel type
- By gender

- By distance bin
- By gender
Modelling tool structure

Main sheets to use for a standard user:

- Cover
- Scenario setting
- Scenario output
- Scenario comparison

Other sheets for more advanced users:

- Inputs Socio-eco
- Supply
- Demand
- Model-Calibration
- City evolution
- Fleet
- Trip rates & distances
- Mode Attributes
- Demand detailed
Modelling tool structure

Main sheets for standard users

- **Cover**: overall model information, disclaimer, description, designers & contacts
- **Scenario setting**: definition of scenarios to test by adjusting each available policy measure
- **Scenario output**: main outcomes of the scenario presented as table and figures
- **Scenario comparison**: comparison of the scenario results with the three scenarios developed by the ITF: *Baseline, Current Policies* and *Climate Ambition*
Modelling tool structure

Other sheets for more advanced users:

- **Inputs Socio-eco**: input sheet containing all socio-economic and demographic input data
- **Supply**: input sheet containing all transport supply input data (e.g. fares)
- **Demand**: input sheet containing all transport demand input data (e.g. speed, access/waiting time and occupancy rates)
- **Model Calibration**: lists the formulas used in the model and their related adjustable parameters
- **City evolution**: lists the evolution of the socio-eco-géo-demographic and supply characteristics
- **Fleet**: summarises vehicle fleet assumptions and its evolution for all modes and vehicles
- **Trip rates & distances**: lists the trip generation and trip distance distribution intermediate output
- **Mode attributes**: lists the intermediate mode attributes (e.g. travel time, cost)
- **Demand detailed**: provides all the model output at the most detailed level, for each age, gender and distance category
BASE MANIPULATIONS BEFORE USING THE MODEL
To do when opening the model

1. **Enable Macro Content:**
   
   Upon opening the .xlsm model file, this small bar should appear:
   
   Click on “Enable Content”
   
   N.B. The interface may be slightly different depending on the version of Microsoft Excel

2. **Learn key information:**
   
   Make sure that you are on the first “Cover” sheet:
   
   Read it all, especially the Disclaimer, Introduction and Model scope sections

3. **Disable automated calculation:**
   
   If you don’t already know how to do this manually
   
   Switch to the second “Scenario setting” sheet:
   
   On the top right, click the “Stop Auto Calculation” button:

   Congratulations, you are now good to start!
USE CASE: STANDARD USER
1. Access the “scenario setting” sheet:

2. Choose the scenario that you want to trigger:

There are 4 scenarios to choose from:

- **Manual**: you must define your measure levels and fill the whole sheet, see more details on slide 21
- **Baseline**: Ulaanbaatar city is evolving without any further action and technology development from 2020 on
- **Current Policies**: the policies currently being considered and planned by local authorities are implemented up to 2050
- **Climate Ambition**: more and stronger, yet feasible, measures are implemented to reach climate objectives

Click on the drop-down menu to select your scenario:
Generating a scenario

3. Generating your scenario:

Click on the “Calculate scenario” button:

Congratulations, you generated a scenario!
Generating a scenario

Setting up a manual scenario:

Once the manual scenario is selected:

The different policy measure levels are gathered in 7 sections representing the measure categories: Vehicle technology assumption, Infrastructure Expansion, Public Transport Promotion, Shared Transport Promotion, Restrictive measures, Pricing measures, Other measures

You must fill in all the cells in white; otherwise, they are considered as a null value

N.B. When there is no drop-down menu, indicative values are provided when selecting a case to fill, error messages are provided when the values are inconsistent, with indications about the consistent range
Congratulations, you can now generate your own scenario!
Reading the output

1. Get results for the generated scenario:

Access the “Scenario output” sheet:
Output tables are displayed on the left and figures on the right.

It is possible to get access to mode shares disaggregated by mode instead of mode categories by expanding the rows (crosses on the left).
2. Compare the scenario with the pre-defined scenarios:

Access the “Scenario comparison” sheet:
The sheet is organised like the previous one: tables are displayed on the left and figures on the right.

More disaggregated data can also be accessible by expanding the rows for Trips, Passenger-kilometres, Vehicle-kilometres and CO₂ emissions sections.
Congratulations, you learn how to use the base features of the model!
USE CASE: MORE ADVANCED USER
1. Looking for data on the evolution of city characteristics:

Access the “City evolution” sheet:

This sheet provides all the information on the evolution of socio-economic, demographic, geographic and transport supply characteristics of the city considered in the model.

This sheet should not be edited by the user. Its content is the result of the data input sheets, scenario assumptions and model calibration, it will automatically be updated.
2. Looking for data on the vehicle fleet characteristics:

Access the “Fleet” sheet:
This sheet provides all the information on the evolution of the main vehicle fleet characteristics. It provides the average consumption, emission and occupancy rates for each motorised mode.

It distinguishes Vehicle and Derived fleet. The Derived fleet is computed based on assumptions regarding the emissions as opposed to the regular Vehicle fleet. For instance, the average emissions of a taxi are estimated as a coefficient times the emissions of private cars, a coefficient which is defined in the “Model-Calibration” sheet.

This sheet should not be edited by the user. Its content is the result of the data input sheets, scenario assumptions and model calibration, it will automatically be updated.
3. Looking for data on the trip and distance characteristics:

Access the “Trip rates & distances” sheet:

This sheet provides all the information on the evolution of the trip characteristics. It indicates the average number of trips per day, the total number of trips and their distribution per distance category.

---

This sheet should not be edited by the user. Its content is the result of the data input sheets, scenario assumptions and model calibration, it will automatically be updated.
4. Looking for data on the mode attributes:

Access the “Mode Attributes” sheet:

This sheet provides all the information on the evolution of modal attributes of the different modes (i.e., reliability & connectivity, time, cost, availability) for each distance category.

N.B. By default the rows are grouped, but they can be expanded by clicking on the cross on the left.

This sheet should not be edited by the user. Its content is the result of the data input sheets, scenario assumptions and model calibration, it will automatically be updated.
Reading detailed output

5. Looking for detailed data on the travel demand:

Access the “Demand_detailed” sheet:

This sheet provides all the
detailed demand output. It gives
access to mode shares, trips,
passenger-kilometres, vehicle-
kilometres, CO₂ emissions (Tank
To Wheel vs Well To Tank), for
each category of distance, age,
gender and for each mode. The
“Scenario output” and “Scenario
comparison” sheets are
summaries of this sheet.

This sheet should not be edited by the user. Its content is the result of the data input sheets,
scenario assumptions and model calibration, it will automatically be updated.
Congratulations, you now know how to get more disaggregated data!
1. Adjusting socio-economic & demographic data:

Access the “Inputs Socio-eco” sheet:

<table>
<thead>
<tr>
<th>Socio-economic inputs</th>
<th>Values in this sheet can be modified by the user</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Estimations of demographic and Geographic characteristics of the Ulaanbaatar Urban area</strong></td>
<td></td>
</tr>
</tbody>
</table>

### Population by zone

<table>
<thead>
<tr>
<th>Year</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
<th>2035</th>
<th>2040</th>
<th>2045</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ерөнхий БЦ - West zone</td>
<td>236,298</td>
<td>262,187</td>
<td>275,944</td>
<td>284,204</td>
<td>291,617</td>
<td>302,002</td>
<td>309,580</td>
<td>316,108</td>
</tr>
<tr>
<td>2. Заражлан хуу нах mia BС - South West zone</td>
<td>52,435</td>
<td>78,480</td>
<td>106,880</td>
<td>113,239</td>
<td>125,864</td>
<td>138,498</td>
<td>248,700</td>
<td>295,819</td>
</tr>
<tr>
<td>3. Баян хуу нынас - North West zone</td>
<td>234,855</td>
<td>274,285</td>
<td>300,161</td>
<td>312,361</td>
<td>341,382</td>
<td>365,397</td>
<td>392,583</td>
<td>420,135</td>
</tr>
<tr>
<td>4. Зүүгүү БЦ - East zone</td>
<td>174,482</td>
<td>212,330</td>
<td>241,296</td>
<td>266,745</td>
<td>291,538</td>
<td>319,978</td>
<td>358,233</td>
<td>399,468</td>
</tr>
<tr>
<td>5. Төвлөгүү БЦ - Central zone</td>
<td>296,702</td>
<td>313,737</td>
<td>316,327</td>
<td>313,070</td>
<td>308,006</td>
<td>305,702</td>
<td>297,391</td>
<td>288,157</td>
</tr>
<tr>
<td>6. Баян хуу нынас - Northern zone</td>
<td>166,909</td>
<td>184,928</td>
<td>193,442</td>
<td>198,622</td>
<td>202,908</td>
<td>209,227</td>
<td>213,268</td>
<td>216,522</td>
</tr>
<tr>
<td>7. Шинээл айыл - New zone</td>
<td>21,537</td>
<td>32,065</td>
<td>46,450</td>
<td>59,949</td>
<td>73,529</td>
<td>88,314</td>
<td>122,665</td>
<td>170,226</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>1,163,215</td>
<td>1,355,521</td>
<td>1,488,113</td>
<td>1,571,135</td>
<td>1,688,703</td>
<td>1,775,189</td>
<td>1,843,780</td>
<td>2,137,496</td>
</tr>
</tbody>
</table>

### Population of the habitation by zone

<table>
<thead>
<tr>
<th>Year</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
<th>2035</th>
<th>2040</th>
<th>2045</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ерөнхий БЦ - West zone</td>
<td>12,209</td>
<td>19,823</td>
<td>32,186</td>
<td>44,560</td>
<td>56,913</td>
<td>69,276</td>
<td>81,639</td>
<td>94,003</td>
</tr>
<tr>
<td>2. Заражлан хуу нах mia BС - South West zone</td>
<td>1,001</td>
<td>85</td>
<td>7,602</td>
<td>15,118</td>
<td>22,634</td>
<td>30,150</td>
<td>37,666</td>
<td>45,182</td>
</tr>
<tr>
<td>3. Баян хуу нынас - North West zone</td>
<td>21,475</td>
<td>28,182</td>
<td>36,983</td>
<td>45,785</td>
<td>54,586</td>
<td>63,387</td>
<td>72,188</td>
<td>80,990</td>
</tr>
<tr>
<td>4. Зүүгүү БЦ - East zone</td>
<td>65,245</td>
<td>65,881</td>
<td>66,523</td>
<td>67,165</td>
<td>67,807</td>
<td>68,449</td>
<td>69,091</td>
<td>69,733</td>
</tr>
<tr>
<td>5. Төвлөгүү БЦ - Central zone</td>
<td>152,530</td>
<td>149,523</td>
<td>146,585</td>
<td>143,648</td>
<td>140,710</td>
<td>137,772</td>
<td>137,772</td>
<td>137,772</td>
</tr>
<tr>
<td>6. Баян хуу нынас - Northern zone</td>
<td>28,742</td>
<td>33,134</td>
<td>36,174</td>
<td>43,224</td>
<td>48,274</td>
<td>53,324</td>
<td>58,374</td>
<td>63,424</td>
</tr>
<tr>
<td>7. Шинээл айыл - New zone</td>
<td>23</td>
<td>481</td>
<td>10,127</td>
<td>19,773</td>
<td>29,418</td>
<td>39,064</td>
<td>48,710</td>
<td>58,356</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>260,215</td>
<td>297,100</td>
<td>336,181</td>
<td>379,261</td>
<td>420,342</td>
<td>461,422</td>
<td>505,448</td>
<td>549,459</td>
</tr>
</tbody>
</table>

### Shares of the population by age and gender

<table>
<thead>
<tr>
<th>Age range</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
<th>2035</th>
<th>2040</th>
<th>2045</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women between 0 and 4</td>
<td>4.5%</td>
<td>4.5%</td>
<td>4.5%</td>
<td>4.5%</td>
<td>4.5%</td>
<td>4.5%</td>
<td>4.5%</td>
<td>4.5%</td>
</tr>
<tr>
<td>Women between 5 and 19</td>
<td>11.4%</td>
<td>11.4%</td>
<td>11.4%</td>
<td>11.4%</td>
<td>11.4%</td>
<td>11.4%</td>
<td>11.4%</td>
<td>11.4%</td>
</tr>
<tr>
<td>Women between 20 and 39</td>
<td>32.2%</td>
<td>32.2%</td>
<td>32.2%</td>
<td>32.2%</td>
<td>32.2%</td>
<td>32.2%</td>
<td>32.2%</td>
<td>32.2%</td>
</tr>
<tr>
<td>Women over 60</td>
<td>3.3%</td>
<td>3.3%</td>
<td>3.3%</td>
<td>3.3%</td>
<td>3.3%</td>
<td>3.3%</td>
<td>3.3%</td>
<td>3.3%</td>
</tr>
<tr>
<td>Men between 0 and 4</td>
<td>4.6%</td>
<td>4.6%</td>
<td>4.6%</td>
<td>4.6%</td>
<td>4.6%</td>
<td>4.6%</td>
<td>4.6%</td>
<td>4.6%</td>
</tr>
<tr>
<td>Men between 5 and 19</td>
<td>11.1%</td>
<td>11.1%</td>
<td>11.1%</td>
<td>11.1%</td>
<td>11.1%</td>
<td>11.1%</td>
<td>11.1%</td>
<td>11.1%</td>
</tr>
<tr>
<td>Men between 20 and 39</td>
<td>30.2%</td>
<td>30.2%</td>
<td>30.2%</td>
<td>30.2%</td>
<td>30.2%</td>
<td>30.2%</td>
<td>30.2%</td>
<td>30.2%</td>
</tr>
<tr>
<td>Men over 60</td>
<td>2.6%</td>
<td>2.6%</td>
<td>2.6%</td>
<td>2.6%</td>
<td>2.6%</td>
<td>2.6%</td>
<td>2.6%</td>
<td>2.6%</td>
</tr>
</tbody>
</table>

### USD per capita

<table>
<thead>
<tr>
<th>Year</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
<th>2035</th>
<th>2040</th>
<th>2045</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>6,529</td>
<td>6,267</td>
<td>7,902</td>
<td>9,547</td>
<td>11,584</td>
<td>13,782</td>
<td>16,113</td>
<td>18,596</td>
<td></td>
</tr>
</tbody>
</table>

You can adjust all the input values for the population, its distribution into age and gender groups, GDP per capita and area size between 2015 and 2050: you just need to replace the values in the table.

N.B. Cells in grey and columns and raw titles cannot be edited.
2. Adjusting transport supply data:

Access the “Supply” sheet:

You can adjust all the input values for the vehicle fleet size, the transport services size and the transport fares in 2015 and 2020: you just need to replace the values in the table.

N.B. Cells in grey and columns and raw titles cannot be edited. Blank cells are not considered, and the model automatically makes a linear regression for getting a value.
3. Adjusting transport demand data:

Access the “Demand” sheet:

<table>
<thead>
<tr>
<th>Transport demand inputs - Values in this sheet can be modified by the user</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average mode speed (km per h)</strong></td>
</tr>
<tr>
<td>Walk</td>
</tr>
<tr>
<td>Bicycle</td>
</tr>
<tr>
<td>Motorcycle</td>
</tr>
<tr>
<td>Car</td>
</tr>
<tr>
<td>Taxi</td>
</tr>
<tr>
<td>PT-Bus</td>
</tr>
<tr>
<td>Ride-sharing</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Access time (min)</strong></th>
<th><strong>2015</strong></th>
<th><strong>2020</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bicycle</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Motorcycle</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Car</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Taxi</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>PT-Bus</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Ride-sharing</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Waiting time (min)</strong></th>
<th><strong>2015</strong></th>
<th><strong>2020</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Taxi</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>PT-Bus</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Ride-sharing</td>
<td>8</td>
<td>8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Occupancy rate</strong></th>
<th><strong>2015</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Motorcycle</td>
<td>1.10</td>
</tr>
<tr>
<td>Car</td>
<td>1.80</td>
</tr>
<tr>
<td>Taxi</td>
<td>1.85</td>
</tr>
<tr>
<td>Bus</td>
<td>12.00</td>
</tr>
<tr>
<td>Ride-sharing</td>
<td>2.50</td>
</tr>
</tbody>
</table>

You can adjust all the input values for the average mode speed, the access time (time to access the mode, e.g. time to get to a bus stop), and the waiting time (e.g. time waiting for a bus at the bus stop) between 2015 and 2050: you just need to replace the values in the table. Occupancy rate are only provided for 2015.

N.B. Cells in grey and columns and raw titles cannot be edited.
Congratulations, you now know how to edit the model input data!
Editing model parameters

1. Access the “Model-Calibration” sheet:

2. Read the description of the formulas & regressions:

   Make sure that you understand the role of each parameter in the function before trying to adjust them.

3. Edit the parameter values:

   Increase or decrease the parameter(s) to reach the expected adjusted effect. It is advised to make minor iteration from the original value.

4. Validate:

   Check that the parameter change had the desired effect and update it again if not.

**Calibration - Values in this sheet can be modified by the user**

**Modal Costs**

**PT Fare, Gasoline and Taxi Models**

Future gasoline price is determined by the existing price, as well as the average fuel consumption per kilometer per vehicle, which is influenced by the evolution of population and GDP per capita and average car load factor.

\[
\text{cost}_{\text{gas}} = \text{cost}_{\text{old}} \times (1 + \text{Elasticity} \times \left( \frac{\text{GDPcap}_{\text{new}}}{\text{GDPcap}_{\text{old}}} - 1 \right))
\]

\[
\text{PT cost}_{\text{new}} = \text{PT cost}_{\text{old}} \times (1 + \text{Elasticity} \times \left( \frac{\text{GDPcap}_{\text{new}}}{\text{GDPcap}_{\text{old}}} - 1 \right)) \times (1 + \text{PT}_F\text{ARRcoeff} \times \text{PT}_F\text{ARR})
\]

<table>
<thead>
<tr>
<th>Elastitics to GDP per capita increase</th>
<th>Elasticity</th>
<th>PT FARRcoeff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parking cost</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Gas cost</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Electricity cost</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Taxi - fixed cost</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Taxi - distance cost</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Taxi - time cost</td>
<td>1.00</td>
<td></td>
</tr>
</tbody>
</table>
Congratulations, you can now edit the modelling assumptions!
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