Microsimulation as a tool for integrated SDG-based development planning

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The world reached the main target of MDG 1 for 2015 Extreme poverty was more than halved

Yet many people in the world are *severely income deprived* 

12. 70% of the world population were living under US\$ 1.90/day in 2012\*

# almost 1 billion human beings



\* The World Bank, World Development Indicators, 2015 (2011 PPP)

Income is important, but poverty has other dimensions Besides income deprivation, the poor: face hunger and food insecurity lack access to clean water and sanitation lack access to affordable and clean energy There are SDGs related to all these issues





"Land, energy and water are our most precious resources, but the manner and extent to which they are exploited contributes to climate change. Meanwhile, the systems that provide these resources are themselves highly vulnerable to changes in climate" (Howells et al.)

Were it not for their severe budget constraints, and lack of access, the poor would increase their demand for energy, water and food (land)

# How much?

An SDG-based development strategy must address this question



#### Household sector - electricity consumption - Mauritius



Fitting curves to the time series of the outcome variable does not allow us to relate future variation of the outcome with the variables on which it depends, such as household income and consumption patterns



The microsimulation approach allows to estimate the household sector demand for energy, water and land, by simulating changes on social and economic variables linked with consumption variables at the household level, by the data from surveys and censuses What can be done, however, depends on the quality and variety of data available: besides good household surveys, statistics from registry, population projections, price surveys...



The microsimulation approach IPC is developing a tool to do microsimulations aiming at its integration with other tools to support SDG-based development planning Initially, the tool will cover only energy and water

#### Component 1

Population projection

Size and distribution of the population

Component 2

Resource access model

Size and distribution of access to resource

#### Component 3

Microsimulation dataset

*Per capita* consumption of those with access



## The microsimulation approach Household electricity consumption - Mauritius





The microsimulation approach As proof of concept some simple simulations were done for Mauritius for the case of electricity consumption

In the simulations there is only one driver of consumption, household per capita income - the income elasticity of electricity consumption was calculated for every household

Then, we simulate changes in the income distribution that yield new levels of poverty and inequality and using the elasticities we calculate future demand for electricity



The microsimulation approach In the simulations, we used information on past changes in the income distribution but the parameters could be theoretical or obtained from other tools Simulation 1 - income distribution changes as it did from 2013 to 2014 Simulation 2 - income distribution changes as it did from 2009 to 2012

Simulation 3 - income distribution changes as it did in any pair of years from 2007 to 2014, randomly chosen - this is done 10,000 times, yielding interval estimates



### Average - household per capita income - Mauritius



Year

## Inequality - household per capita income - Mauritius



Year

#### Poverty - less than US\$ 3.10/day - Mauritius





#### Average - household per capita income - Mauritius



### Inequality - household per capita income - Mauritius



#### Poverty - less than US\$ 3.10/day - Mauritius



### Household sector - electricity consumption - Mauritius



#### Average household per capita income - Mauritius



Year

#### Gini - household per capita income - Mauritius



Year

#### Poverty - less than US\$ 3.10/day - Mauritius



#### Average domestic electricity consumption - Mauritius



There are many other scenarios to be considered Some very interesting ones are SDG-related Suppose that to eradicate extreme poverty and provide clean and affordable energy for all, a country sets up:

a cash transfer targeted at low income families;
electricity subsidies and no connection charge;
a very progressive electricity tariff;
a plan to expand the grid to one remote area.

All this can be simulated together, giving planners a good idea of what would be the social, economic, and environmental outcomes of different policy options

