# 1\_br\_complete

Period: 07/01/2012 to 07/31/2012 (mm/dd/yyyy)

Input file names:

hydFile="../data/hydro/hydro\_data\_br\_1.csv",

hydFeather="../data/hydro/br\_shype\_hydro.feather",

windFeather="../data/wind/wind\_br.feather",

solarFeather="../data/solar/solar\_GAMS\_br.feather",

loadFeather="../data/load/load\_Br\_2014.feather",

transmissionCSV="../data/transmission/linesCapacities\_br\_1.csv", investCSV="../data/investOptions/investOpts\_br\_thermal.sources\_1.csv",

intermittentCSV="../data/investOptions/br\_intermittent\_opts\_1.csv"

This first run has presented an infeasibility in the minimum flow constraint on the region SE4. The original minimum flow should be 10503.26. I’ve put a slack variable and it’s presented values of 8500 approximately. So I’ve change the minimum flow of SE4 to 1500 and it worked.

# 2\_br\_complete

Changing investment costs of wind and solar to 10% of original values 🡪 the same results. Wind and solar don’t enter.

Coming back to original values of costs.

I’ve tried to change the WindPower column at wind\_br.feather file, but the result was the same: zero PV and wind.

Tomorrow: extremely high costs of thermal technologies in order to check if renewables will enter 🡪 same results

There was a mistake in GAMS formulation. Now we have some good results.

Now I’m producing results and comparing with ONS website.

# Yearly\_full\_run

Let’s verify if the model is running for an entire year. For that let’s make a run for 2012. This year was chosen because it is a kind of stable year in terms of inflows. The difference between 2\_BR\_COMPLETE and 2012\_RUN is that the variable costs are in millions of R$ of 2017 just like the investment costs. This change can affect the investment in intermittent renewables.

The input data was based in Newave deck of 2017, April.

Concerning the results, a strange one is that the model invests in thermal capacity in NE and N, but there is no thermal generation in this locations.

# validation\_2012

In order to validate our model, let’s make a run using the ONS deck of 2012 and zero investment costs. Let’s choose December of 2012. After that, we are able to access the following indicators:

* graphs that I already have;
* correlation between COPA time series and ONS time series;
* RMSE (Perhaps we will need a package to access it);
* point graphs to verify the differences between the time series.

By adding the thermal plants from Dec 2012 deck, we had the same investment in thermal and renewables of the “yearly\_full\_run”. The generation of thermal plants was non negative during the dry period in subsystem SE and it was zero in the other subsystems. There was investment in thermal capacity and wind new capacity. It was expected because we have zero of investment costs in investment options.

The investigation of investment variables is necessary in the near future, because the model is investing in thermal capacity in some areas, but there is no production in these areas. Probably the model is investing because it is cheap to do it, even it is not necessary to produce. All thermal and intermittent renewable plants has zero investment costs, because they were existent plants already in 2012.

Comparing COPA generation results with ONS generation results we had:

* SE: the biggest difference in hydropower production is observed in the dry period. The hydropower decreases and the thermal power increases in this period. Concerning the thermal power, it increases in the same moment on ONS and on COPA.
* S: complementary behavior between ONS and COPA in hydropower. Thermal generation zero in COPA and something around 50 GWh in ONS during the entire period. Concerning the wind generation, the production is low and it has similar profile between ONS and COPA.
* NE: Similar situation of SE in terms of hydropower. Zero thermal generation on COPA and increasing in ONS thermal generation starting on middle of August.
* N: We have many differences in hydro generation between COPA and ONS. Maybe it is because we have to consider the transfer of energy in region number 5. Thermal generation is almost zero in both models.

The correlations of time series vary between 40% and 50% in majority. Regarding the hydro generation, perhaps it would be nice to improve the approach to transform daily inflows into hourly ones.

## 25.09 – bounds on reservoirs

In our meeting, we have implemented bounds on reservoirs to the first and last hour of 2012 year. First we have created two columns on file “hydro\_data\_br\_2012\_1.csv” containing initial and terminal levels of the reservoirs. This data was achieved from new ONS website.

After that, we went to “functions\_gdx\_transfer.R” and added the parameters names (initReservoir and termReservoir) to this file (lines 141 and 142) in order to apper on GDX file “input\_tr”.

After that, we have added these parameters on GAMS code (changing\_time\_resolution.gms, lines 50 and 51) and we have set the code to load the parameters (line 56).

The next step was to implement bounds of reservoir levels (lines 251 to 265). We have also implemented a constraint regarding transmission to certify that all energy amount that goes to a certain region comes to this region (line 319).

## Sensitivity to check thermal generation

This run is still under the umbrella of VALIDATION\_2012. We will change the constraint of “maximum hydropower production” in GAMS (changing\_time\_resolution of 25.9) to check when the model generates thermal power.