C-PLAN User Guidelines

Document Purpose

The purpose of this document is to provide basic guidance on the C-PLAN code, including the mechanics of running the model in GAMS. It does not provide detailed documentation on the code, the structure of the model, how to use GAMS, or on CGE models in general. Links to some of these forms of documentation are provided in the Further Resouces section at the end of this document.

This document supersedes sections S5 and S6 of the Supplementary Data ars.els-cdn.com/content/image/1-s2.0-S0140988322000779-mmc1.docx from the article *The Climate PoLicy Analysis (C-PLAN) Model, Version 1.0*.

Running the Model

To obtain a copy of the model, you will need to sign a licencing agreement with the New Zealand Climate Change Commission, who will then provide you with either the base package (if you do not have GTAP), or the full package (if you do have GTAP). The full package includes the file cplan.gdx which is an aggregation of the GTAP database essential for running the model.

To run the model, you will need a licence for GAMS with MPSGE and the PATH solver and a licence for version 11 of the GTAP data base.

Files to run the model are in the folder A0_ControlFiles. The naming convention for both control files and results files (in the folder C_ResultsFiles) is %year%_%base%_%case%, where

- %year% is the year of the release of the GHG Inventory and other data used in the calibration
- %base% is the name of the reference scenario
- %case% is the policy scenario to be run

The matching reference scenario must be run before the related policy scenario, as some of the data for the policy scenario is calculated in the reference scenario. Usually (i.e. unless running a sensitivity), the reference scenario will be 2024_CPR2017_CPR.gms.

Reference Scenarios

Reference Scenario Name	Description
2024_CPR2017_CPR	Main reference scenario, most analysis based off this. Uses data published in 2024, with GTAP11 data and a 2017 starting year.
2024_CPR2017SensGDPhi_CPR	Sensitivity with higher GDP and population for Aotearoa New Zealand. The supply constraint on fossil gas is also increased enough to allow the model to solve. All other inputs are the same as 2024_CPR2017_CPR.
2024_CPR2017SensGDPlo_CPR	Sensitivity with lower GDP and population for Aotearoa New Zealand. All other inputs are the same as 2024_CPR2017_CPR
2024_CPR2017SensOilhi_CPR	Sensitivity with higher global oil prices. All other inputs are the same as 2024_CPR2017_CPR
2024_CPR2017SensOillo_CPR	Sensitivity with lower global oil prices. All other inputs are the same as 2024_CPR2017_CPR

2024_CPR2017SensRoWEPhi_CPR	Sensitivity with higher emissions prices in the Rest of the World. All other inputs are the same as 2024_CPR2017_CPR
2024_CPR2017SensRoWEPlo_CPR	Sensitivity with lower emissions prices in the Rest of the World. All other inputs are the same as 2024_CPR2017_CPR

Policy Scenarios

Policy Scenario Name	Description	Associated Reference
2024_CPR2017_DemoEB4	The EB4 demonstration path, as prepared for public consultation in April/May 2024	2024_CPR2017_CPR
2024_CPR2017_HTHS	High technology and high systems change	2024_CPR2017_CPR
2024_CPR2017_HTLS	High technology and low systems change	2024_CPR2017_CPR
2024_CPR2017_LTHS	Low technology and high systems change	2024_CPR2017_CPR
2024_CPR2017_LTLS	Low technology and low systems change	2024_CPR2017_CPR
2024_CPR2017SensGDPhi_ DemoEB4	The EB4 demonstration path with a different baseline, namely higher NZ GDP and population	2024_CPR2017Sens GDPhi_CPR
2024_CPR2017SensGDPlo_ DemoEB4	The EB4 demonstration path with a different baseline, namely lower NZ GDP and population	2024_CPR2017Sens GDPlo_CPR
2024_CPR2017SensOilhi_ DemoEB4	The EB4 demonstration path with a different baseline, namely higher global oil prices	2024_CPR2017Sens Oilhi_CPR
2024_CPR2017SensOillo_ DemoEB4	The EB4 demonstration path with a different baseline, namely lower global oil prices	2024_CPR2017Sens Oillo_CPR
2024_CPR2017SensRoWEPhi_ DemoEB4	The EB4 demonstration path with a different baseline, namely higher emissions prices in the Rest of the World	2024_CPR2017Sens RoWEPhi_CPR
2024_CPR2017SensRoWEPlo_ DemoEB4	The EB4 demonstration path with a different baseline, namely lower emissions prices in the Rest of the World	2024_CPR2017Sens RoWEPlo_CPR

File Structure

The file structure of each control file for C-PLAN is provided here for reference. Names with a % at the beginning and end are stand-ins for names that can change, such as the name of the baseline or the scenario, and are defined in the control files that are used to run each scenario.

1. ..\A1_Model\load.gms

a. ..\A1_Model\order_sets.gms
b. ..\A3_Prep\Parameters\%param%\defndatabase.gms
    i. ..\A3_Prep\Parameters\%param%\%data%.gdx
c. ..\A1_Model\sets.gms
d. ..\A1_Model\parameters.gms
e. ..\A3_Prep\Parameters\Static\load_params.gms
    i. ..\A3_Prep\Parameters\%param%\build_convertdollar.gms
    ii. ..\A3_Prep\Parameters\%param%\build_ele_cost.gms
    iii. ..\A3_Prep\Parameters\%param%\build_sigma_ene.gms
    iv. ..\A3_Prep\Parameters\%param%\build_sigma_fos.gms
    v. ..\A3_Prep\Parameters\%param%\build_sigma_kle.gms
    vi. ..\A3_Prep\Parameters\%param%\build_sigma_tsf.gms
    vii. ..\A3_Prep\Parameters\Static\gtap_data.gms
        1. ..\ A3_Prep\Parameters\%param%\%data%.gdx
        2. ..\ A3_Prep\Parameters\%param%\nonco2_world.gdx
    viii. ..\A3_Prep\Parameters\%param%\build_sigma_va.gms
        1. ..\ A3_Prep\Parameters\%param%\%data%.gdx
    ix. ..\A3_Prep\Parameters\%param%\disagg.gms
    x. ..\A3_Prep\Parameters\%param%\gtap_assign.gms
    xi. ..\A3_Prep\Parameters\%param%\elasticities.gms

2. ..\A3_Prep\Baselines\Static\load_baseline.gms
a. ..\A3_Prep\Baselines\Static\excel_baseline.gms
    i. ..\A3_Prep\Baselines\%year%_%base%\%year%_ENZ_inputs_%base%.xlsx
    ii. ..\A3_Prep\Baselines\%year%_%base%\%year%_annual_inputs_%base%.xlsx
    iii. ..\A3_Prep\Baselines\%year%_%base%\%year%_iter_inputs_%base%.xlsx
    iv. ..\A3_Prep\Baselines\%year%_%base%\%year%_infreq_inputs_%base%.xlsx
    v. ..\A3_Prep\Baselines\%year%_%base%\ENZ_inputs.gdx
    vi. ..\A3_Prep\Baselines\%year%_%base%\annual_inputs.gdx
    vii. ..\A3_Prep\Baselines\%year%_%base%\iter_inputs.gdx
    viii. ..\A3_Prep\Baselines\%year%_%base%\infreq_inputs.gdx
b. ..\A3_Prep\Baselines\Static\basenumbers.gms
    i. ..\A3_Prep\Baselines\%year%_%base%\build_decay.gms
    ii. ..\A3_Prep\Baselines\%year%_%base%\build_f_efix.gms
    iii. ..\A3_Prep\Baselines\%year%_%base%\build_feedin_tariff.gms
    iv. ..\A3_Prep\Baselines\%year%_%base%\build_hht_oil.gms
    v. ..\A3_Prep\Baselines\%year%_%base%\build_sg_shift.gms
    vi. ..\A3_Prep\Baselines\%year%_%base%\build_ele_mult.gms
    vii. ..\A3_Prep\Baselines\%year%_%base%\build_ghgmult.gms
    viii. ..\A3_Prep\Baselines\%year%_%base%\build_oghg.gms
    ix. ..\A3_Prep\Baselines\%year%_%base%\build_startyear.gms
    x. ..\A3_Prep\Parameters\%param%\hht.gms
    xi. ..\A3_Prep\Baselines\%year%_%base%\build_eco2a.gms
    xii. ..\A3_Prep\Baselines\%year%_%base%\build_sg_reduce.gms
    xiii. ..\A3_Prep\Baselines\%year%_%base%\build_tranmult.gms
    xiv. ..\A3_Prep\Baselines\%year%_%base%\build_tsf_mult.gms
c. ..\A3_Prep\Baselines\Static\assign_baseline.gms
    i. ..\A3_Prep\Baselines\Static\new_technologies.gms

1. ..\A3_Prep\Parameters\%param%\new_tech\nt_rtp1.gms
2. ..\A3_Prep\Parameters\%param%\new_tech\nt_hht1.gms
3. ..\A3_Prep\Parameters\%param%\new_tech\nt_bh.gms
4. ..\A3_Prep\Parameters\%param%\new_tech\nt_eh.gms
5. ..\A3_Prep\Parameters\%param%\new_tech\nt_i_s1.gms
6. ..\A3_Prep\Parameters\%param%\new_tech\nt_i_s2.gms
7. ..\A3_Prep\Parameters\%param%\new_tech\nt_rmk1.gms
8. ..\A3_Prep\Parameters\%param%\new_tech\nt_b_s1.gms
9. ..\A3_Prep\Parameters\%param%\new_tech\nt_eoth_ccs.gms
10. ..\A3_Prep\Parameters\%param%\new_tech\nt_ebiogas.gms
11. ..\A3_Prep\Parameters\%param%\new_tech\nt_hyd.gms
12. ..\A3_Prep\Parameters\%param%\new_tech\nt_n2o.gms
13. ..\A3_Prep\Parameters\%param%\new_tech\nt_dac.gms
14. ..\A3_Prep\Parameters\%param%\build_markup_nt.gms

ii. ..\A3_Prep\Baselines\Static\build_elec_scale.gms
iii. ..\A3_Prep\Baselines\Static\build_fe_tax.gms
iv. ..\A3_Prep\Baselines\Static\build_ffprice.gms
v. ..\A3_Prep\Baselines\Static\build_gr_gdp.gms
vi. ..\A3_Prep\Baselines\Static\build_res_cost.gms
vii. ..\A3_Prep\Baselines\Static\build_gdpmult.gms
viii. ..\A3_Prep\Baselines\Static\build_lab_mult.gms
ix. ..\A3_Prep\Baselines\Static\build_lmult.gms
x. ..\A3_Prep\Baselines\Static\build_res_mult.gms
xi. ..\A3_Prep\Baselines\%year%_%base%\build_aeei.gms
xii. ..\A3_Prep\Baselines\%year%_%base%\build_ffmult.gms

3. ..\A3_Prep\Policies\Static\load_policy.gms
   a. ..\A3_Prep\Policies\Static\policies_off.gms
   b. ..\A3_Prep\Policies\Static\excel_policy.gms
      i. ..\A3_Prep\Policies\%year%_%case%\%year%_%case%_inputs.xlsx
      ii. ..\A3_Prep\Policies\%year%_%case%\%case%_inputs.gdx
      iii. If exists (only needed for policy scenarios),
      ..\A3_Prep\Baselines\%year%_%base%\refstore_%year%_%base%.gdx
   c. ..\A3_Prep\Policies\Static\build_land_index.gms
   d. ..\A3_Prep\Policies\%year%_%case%\build_active.gms
   e. ..\ A3_Prep\Policies\%year%_%case%\%year%_policy_%case%.gms
      i. ..\A3_Prep\Policies\Static\Policy_Options\build_nzctax2.gms
      ii. ..\A3_Prep\Policies\Static\Policy_Options\build_nzctax2_out.gms
      iii. ..\A3_Prep\Policies\Static\Policy_Options\build_rowctax2.gms
      iv. ..\A3_Prep\Policies\Static\Policy_Options\build_ets1.gms
      v. ..\A3_Prep\Policies\Static\Policy_Options\build_ets2.gms
      vi. ..\A3_Prep\Policies\Static\build_nzets.gms
      vii. ..\A3_Prep\Policies\Static\Policy_Options\build_addIAS.gms
   f. ..\A3_Prep\Policies\%year%_%case%\build_evffm_nt.gms
   g. ..\A3_Prep\Parameters\%param%\new_tech\build_oghg_nt.gms
   h. ..\A3_Prep\Policies\Static\initial_values.gms
4. ..\A1_Model\build.gms
   a. ..\A1_Model\model.gms
   b. ..\ A1_Model\loop.gms
      i. ..\ A4_Solver\solve_benchmark.gms

c. ..\A3_Prep\Baselines\%year%_%base%\refstore_%year%_%base%.gdx
d. ..\B_ResultsFiles\%year%_%base%_%case%.gdx

Further Resources

New Zealand Climate Change Commission Licensing

To obtain a copy of the C-PLAN code, download the licence agreement www.climatecommission.govt.nz/public/Inaia-tonu-nei-a-low-emissions-future-for-Aotearoa/Modelling-files/License-terms-for-C-PLAN.pdf from the New Zealand Climate Change Commission website www.climatecommission.govt.nz/, read and sign, and return to hello@climatecommission.govt.nz. If you wish to get a copy of the model you can run (i.e. including GTAP data), please also provide proof of a GTAP licence.

GAMS Software & Documentation

GAMS software can be obtained from www.gams.com. The trial version does not allow you to run C-PLAN. You will need to have a copy of the the base GAMS software and the MPSGE and PATH solvers.

Documentation for GAMS is available in the software and online at www.gams.com/latest/docs/.

GTAP Database

A licence for the GTAP database can be obtained from www.gtap.agecon.purdue.edu/databases/pricing.asp

C-PLAN Description

The 2022 paper *The Climate PoLicy Analysis (C-PLAN) Model, Version 1.0* by Niven Winchester and Dominic White www.sciencedirect.com/science/article/pii/S0140988322000779?via%3Dihub#s0195 describes the economic structure of the C-PLAN model. The features of the model as described in this paper remain accurate, but since it was published some new features have also been added and some data sources changed.