GACMO as a supporting tool to estimate ex ante mitigation actions

Training workshop for Anglophone African countries:
Deep dive into tracking NDC mitigation commitments under the Paris Agreement

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What is GACMO

Model GACMO = Greenhouse gas Abatement Cost Model

Bottom-up modelling tool for greenhouse gas emissions based on Excel

IPCC / CDM Methodologies

Developed by Jørgen Fenhann at UNEP CCC

Available for free on the UNEP CCC website GACMO tool - UNEP-CCC (unepccc.org)

GACMO is a simple tool

The tool should be able to make Business As Usual (BAU) projection to:2025/2030/2035/2050

GACMO can make a NDC with a reduction of a percentage reduction of the GHG emission compared to the BAU.

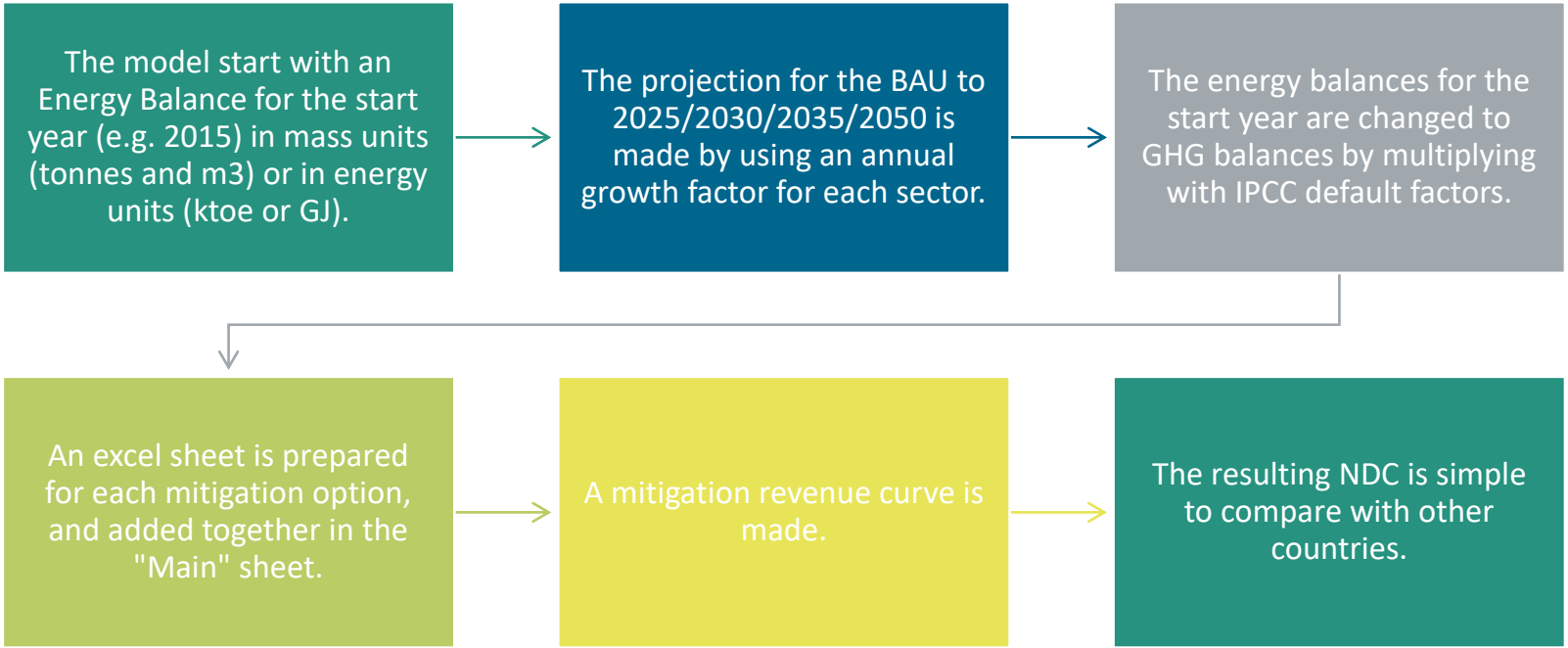
The tool should be able to calculate the GHG reduction and the cost for each mitigation option compared to the technology used in the baseline.

The tool should be able to scale the size of the mitigations option up and down.

The tool should give a clear overview of the total mitigation effort: total GHG reduction, total investment, and total annual cost.

The calculation should be transparent and easy to follow.

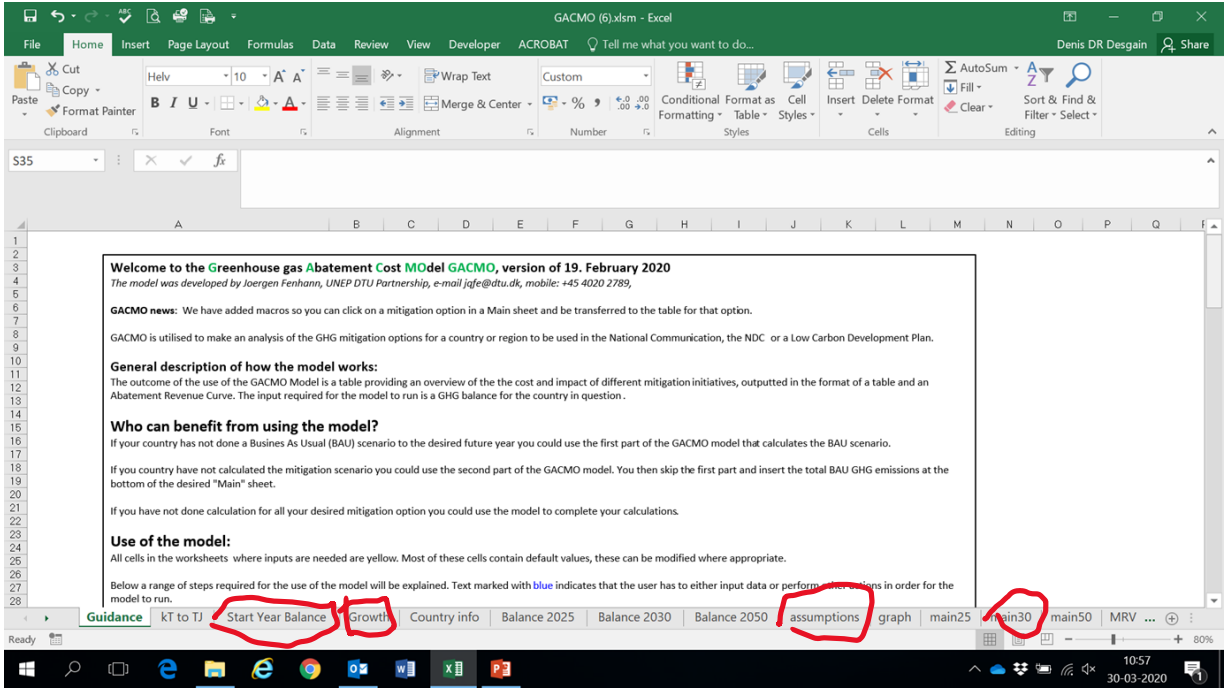
Steps to develop GACMO model



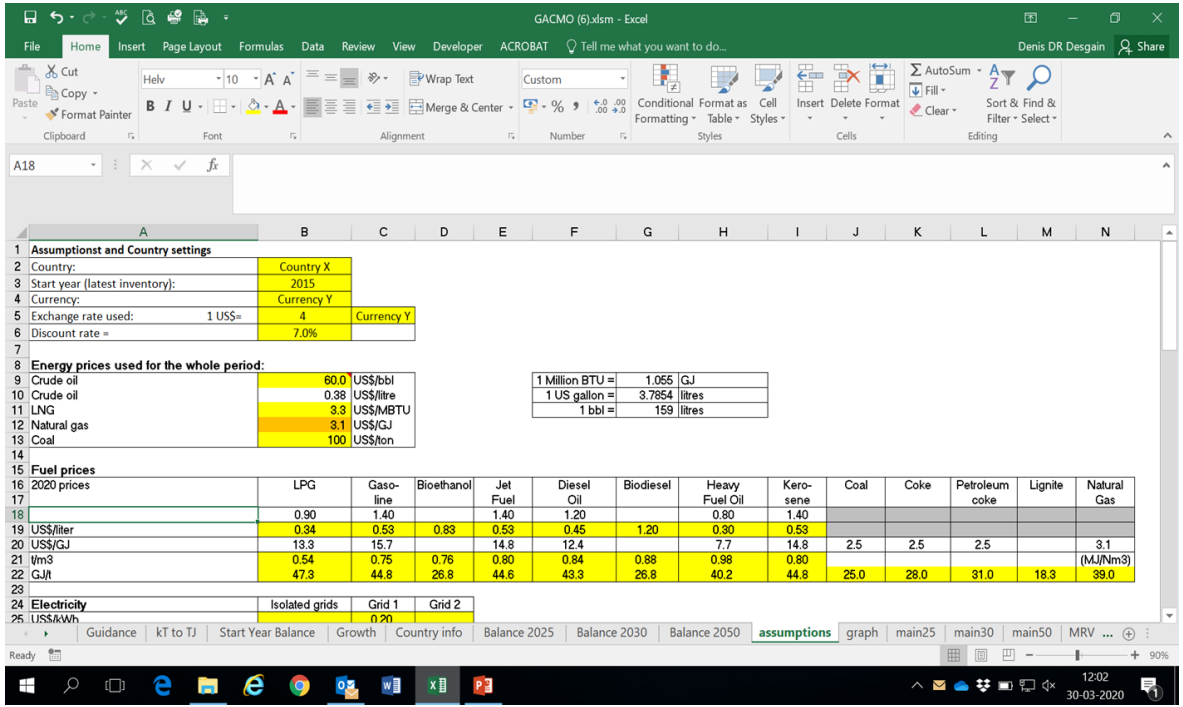
Input data requirements

- GHG emissions inventory by sectors (latest available year).
- Energy Balance (same year as GHG emissions inventory year).
- Emission factors by fuels for fuel combustion sectors (if national emission factors are available).
- Growth rates of energy consumption by sectors (annual % change up to 2025, 2030, 2035 and 2050).
- Mitigation actions by 2025, 2030, 2035, 2050.
- Technical and economical parameters of the technology/mitigation options (new technology and baseline technology).
- Key assumptions (e.g. grid emission factor, energy prices, etc.).

GACMO contains different sheets: Start year balance, growth, assumptions, main, technologies



Assumptions



GACMO (6).xlsm - Excel

	A	B	C
1	**Assumptionst and Country settings**		
2	Country:	Country X	
3	Start year (latest inventory):	2015	
4	Currency:	Currency Y	
5	Exchange rate used: 1 US$=	4	Currency Y
6	Discount rate =	7.0%	
7			
8	**Energy prices used for the whole period:**		
9	Crude oil	60.0	US$/bbl
10	Crude oil	0.38	US$/litre
11	LNG	3.3	US$/MBTU
12	Natural gas	3.1	US$/GJ
13	Coal	100	US$/ton

1 Million BTU =	1.055	GJ
1 US gallon =	3.7854	litres
1 bbl =	159	litres

	A	LPG	Gaso-line	Bioethanol	Jet Fuel	Diesel Oil	Biodiesel	Heavy Fuel Oil	Kero-sene	Coal	Coke	Petroleum coke	Lignite	Natural Gas
15	**Fuel prices**													
16	2020 prices													
17														
18		0.90	1.40		1.40	1.20		0.80	1.40					
19	US$/liter	0.34	0.53	0.83	0.53	0.45	1.20	0.30	0.53					
20	US$/GJ	13.3	15.7		14.8	12.4		7.7	14.8	2.5	2.5	2.5		3.1
21	t/m3	0.54	0.75	0.76	0.80	0.84	0.88	0.98	0.80					(MJ/Nm3)
22	GJ/t	47.3	44.8	26.8	44.6	43.3	26.8	40.2	44.8	25.0	28.0	31.0	18.3	39.0
23														
24	**Electricity**	Isolated grids	Grid 1	Grid 2										
25	US$/kWh		0.20											

Guidance | kT to TJ | Start Year Balance | Growth | Country info | Balance 2025 | Balance 2030 | Balance 2050 | assumptions | graph | main25 | main30 | main50 | MRV ...

Ready

12:02
30-03-2020

Start Year Energy Balance for Country X

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	**Fossil fuel energy balance in TJ**	**Mauritius**		**2021**										
2														
3	TJ units	LPG	Gasoline	Jet Fuel	Diesel	HFO	Kerosene and other	Total oil products	Coal	Lignite	Natural Gas	Coke	Petrocoke	Total energy (fossil)
4	Unit	TJ	TJ	TJ	TJ	TJ	TJ	TJ	TJ	TJ	TJ	TJ	TJ	TJ
5	Total	3,696	7,557	1,362	8,035	10,380	27	31,056.9	19,121	0	0	0	0	50,178
6	Fossil power plants	0	0	0	37	8925	27	8,989.7	18047	0	0	0	0	27,037
7	FINAL CONSUMPTION	3,696	7,557	1,362	7,998	1,455	0	22,067.2	1,074	0	0	0	0	23,141
8	Industry - steel	0	0	0	0	0	0	0.1	0	0	0	0	0	0
9	Industry - chemical	0	0	0	0	0	0	0.0	0	0	0	0	0	0
10	Industry - non metallic mineral	0	0	0	0	0	0	0.0	0	0	0	0	0	0
11	Industry - food processing and beverage	0	0	0	0	0	0	0.0	0	0	0	0	0	0
12	Industry - construction	0	0	0	0	0	0	0.0	0	0	0	0	0	0
13	Industry - mining	0	0	0	0	0	0	0.0	0	0	0	0	0	0
14	Industry - machinery	0	0	0	0	0	0	0.0	0	0	0	0	0	0
15	Industry - non ferrous metals	0	0	0	0	0	0	0.0	0	0	0	0	0	0
16	Industry - paper and pulp	0	0	0	0	0	0	0.0	0	0	0	0	0	0
17	Industry - transport equipment	0	0	0	0	0	0	0.0	0	0	0	0	0	0
18	Industry - textile and leather	0	0	0	0	0	0	0.0	0	0	0	0	0	0
19	Industry - miscellaneous	231	0	0	1261	1311	0	2,802.1	1074	0	0	0	0	3,876
20	Transport - road	118	7557	1362	6659	144	0	15,839.8	0	0	0	0	0	15,840
21	Transport - rail	0	0	0	0	0	0	0.0	0	0	0	0	0	0
22	Transport - domestic air	0	0	0	0	0	0	0.0	0	0	0	0	0	0
23	Transport - navigation	0	0	0	0	0	0	0.0	0	0	0	0	0	0
24	Households	2590	0	0	0	0	0	2,589.9	0	0	0	0	0	2,590
25	Services	757	0	0	0	0	0	756.8	0	0	0	0	0	757
26	Agriculture & Fishery	0	0	0	78	0	0	78.4	0	0	0	0	0	78
27	Non energy - chemical feedstocs	0	0	0	0	0	0	0.0	0	0	0	0	0	0
28														

Growth rates

Start year:	2015							
Growth from the start year	**Annual % increase in the period**				**% increase from start year values**			
Growth and multiplication factors	2015 to 2020	2020 to 2025	2025 to 2030	2030 to 2050	2020	2025	2030	2050
Population growth	0.83%	0.83%	0.83%	0.50%	4%	9%	13%	25%
GDP growth	4.10%	4.10%	4.10%	3.00%	22%	49%	83%	230%
Industry - fuel in steel	6.0%	6.0%	6.0%	2.0%	34%	79%	140%	256%
Industry - fuel in chemical	6.0%	6.0%	6.0%	2.0%	34%	79%	140%	256%
Industry - fuel in non metallic mineral	6.0%	6.0%	6.0%	2.0%	34%	79%	140%	256%
Industry - fuel in food and beverage	6.0%	6.0%	6.0%	2.0%	34%	79%	140%	256%
Industry - fuel in construction	6.0%	6.0%	6.0%	2.0%	34%	79%	140%	256%
Industry - fuel in mining	6.0%	6.0%	6.0%	2.0%	34%	79%	140%	256%
Industry - fuel in machinery	6.0%	6.0%	6.0%	2.0%	34%	79%	140%	256%
Industry - fuel in non ferrous metals	6.0%	6.0%	6.0%	2.0%	34%	79%	140%	256%
Industry - fuel in paper and pulp	6.0%	6.0%	6.0%	2.0%	34%	79%	140%	256%
Industry - fuel in transport equipment	6.0%	6.0%	6.0%	2.0%	34%	79%	140%	256%
Industry - fuel in textile and leather	6.0%	6.0%	6.0%	2.0%	34%	79%	140%	256%
Industry - fuel in miscellaneous	6.0%	6.0%	6.0%	2.0%	34%	79%	140%	256%
Industry - electricity consumption	6.0%	6.0%	6.0%	2.0%	34%	79%	140%	256%
Transport - fuel in road	6.0%	6.0%	6.0%	2.0%	34%	79%	140%	256%
Transport - fuel in rail	6.0%	6.0%	6.0%	2.0%	34%	79%	140%	256%
Transport - fuel in air	6.0%	6.0%	6.0%	2.0%	34%	79%	140%	256%
Transport - fuel in navigation	6.0%	6.0%	6.0%	2.0%	34%	79%	140%	256%
Transport - electricity consumption	6.0%	6.0%	6.0%	2.0%	34%	79%	140%	256%
Households - LPG	6.0%	6.0%	6.0%	2.0%	34%	79%	140%	256%
Households - Kerosene	6.0%	6.0%	6.0%	2.0%	34%	79%	140%	256%
Households - electricity consumption	6.0%	6.0%	6.0%	2.0%	34%	79%	140%	256%
Services - fuel	6.0%	6.0%	6.0%	2.0%	34%	79%	140%	256%
Services - electricity consumption	6.0%	6.0%	6.0%	2.0%	34%	79%	140%	256%
Agriculture - fuel	6.0%	6.0%	6.0%	2.0%	34%	79%	140%	256%
Agriculture - electricity consumption	6.0%	6.0%	6.0%	2.0%	34%	79%	140%	256%
Non energy - fuel in chemical feedstocs	6.0%	6.0%	6.0%	2.0%	34%	79%	140%	256%
Livestock emissions	3.0%	3.0%	3.0%	1.0%	16%	34%	56%	90%
Rice emissions	3.0%	3.0%	3.0%	1.0%	16%	34%	56%	90%
N2O from agricultural soils	3.0%	3.0%	3.0%	1.0%	16%	34%	56%	90%
Biomass burning	3.0%	3.0%	3.0%	1.0%	16%	34%	56%	90%
Forestry emission	0.0%	0.0%	0.0%	0.0%	0%	0%	0%	0%
Solid waste emissions	0.0%	0.0%	0.0%	0.0%	0%	0%	0%	0%
Liquid waste emissions	0.0%	0.0%	0.0%	0.0%	0%	0%	0%	0%
Industrial processes	0.0%	0.0%	0.0%	0.0%	0%	0%	0%	0%

2030 GHG Balance for Country X

Unit : ktCO2-e	Total	LPG	Gasoline	Jet Fuel	Diesel	Fueloil	Kerosene and other	Total oil products	Coal	Lignite	Gas
Total	***33,700.2***	***1,805.0***	***7,030.7***	***137.6***	***10,456.1***	***3,587.0***	***9.0***	***23,025.5***	***0.0***	***0.0***	***10,674.7***
Fossil power plants	*12,428.3*	227.8	0.0	0.0	72.2	3,283.1	0.0	*3,583.2*	0.0	0.0	8,845.2
FINAL CONSUMPTION	*21,271.8*	*1,577.2*	*7,030.7*	*137.6*	*10,383.8*	*303.9*	*9.0*	*19,442.3*	*0.0*	*0.0*	*1,829.5*
Industry - steel	*50.5*	5.2	0.0	0.0	8.3	36.9	0.0	*50.5*	0.0	0.0	0.0
Industry - chemical	*12.1*	0.0	0.0	0.0	5.6	6.5	0.0	*12.1*	0.0	0.0	0.0
Industry - non metallic mineral	*0.0*	0.0	0.0	0.0	0.0	0.0	0.0	*0.0*	0.0	0.0	0.0
Industry - food processing and beverage	*332.3*	137.1	0.0	0.0	17.1	178.2	0.0	*332.3*	0.0	0.0	0.0
Industry - construction	*158.4*	0.0	0.0	0.0	158.4	0.0	0.0	*158.4*	0.0	0.0	0.0
Industry - mining	*2,040.3*	0.0	0.0	0.0	2,040.3	0.0	0.0	*2,040.3*	0.0	0.0	0.0
Industry - machinery	*0.0*	0.0	0.0	0.0	0.0	0.0	0.0	*0.0*	0.0	0.0	0.0
Industry - non ferrous metals	*0.0*	0.0	0.0	0.0	0.0	0.0	0.0	*0.0*	0.0	0.0	0.0
Industry - paper and pulp	*0.6*	0.5	0.0	0.0	0.1	0.0	0.0	*0.6*	0.0	0.0	0.0
Industry - transport equipment	*7.6*	0.0	0.0	0.0	7.6	0.0	0.0	*7.6*	0.0	0.0	0.0
Industry - textile and leather	*53.5*	0.2	0.0	0.0	3.0	50.3	0.0	*53.5*	0.0	0.0	0.0
Industry - miscellaneous	*417.0*	2.0	0.0	0.0	21.2	8.3	0.0	*31.5*	0.0	0.0	385.5
Transport - road	*14,395.0*	267.0	6,795.1	0.0	7,332.9	0.0	0.0	*14,395.0*	0.0	0.0	0.0
Transport - rail	*10.8*	0.0	0.0	0.0	10.8	0.0	0.0	*10.8*	0.0	0.0	0.0
Transport - domestic air	*137.6*	0.0	0.0	137.6	0.0	0.0	0.0	*137.6*	0.0	0.0	0.0
Transport - navigation	*5.0*	0.0	0.0	0.0	5.0	0.0	0.0	*5.0*	0.0	0.0	0.0
Households	*1,026.2*	1,023.4	0.0	0.0	0.0	0.0	2.8	*1,026.2*	0.0	0.0	0.0
Services	*141.8*	141.8	0.0	0.0	0.0	0.0	0.0	*141.8*	0.0	0.0	0.0
Agriculture & Fishery	*486.1*	0.0	154.6	0.0	331.6	0.0	0.0	*486.1*	0.0	0.0	0.0
Energy Industry - Refinery	*35.6*	0.0	0.0	0.0	0.0	23.8	0.0	*23.8*	0.0	0.0	11.8
Energy Industry - Other energy industries	*1,961.4*	0.0	81.0	0.0	442.0	0.0	6.1	*529.2*	0.0	0.0	1,432.3

Mitigation options in GACMO

- There are 119 pre-defined mitigation options available in GACMO
- The user can select and adjust mitigation option applicable for the country

Annex. Mitigation options available in the GACMO tool

Type	Reduction option	Sub-type unit
Agriculture	Rice crop CH4 reduction	Rice crop CH4 red.(1000 ha)
	Zero tillage	1000 ha
	Cover crops	1000 ha
	Nitrification inhibitors (1000 ha)	1000 ha
	Covering slurry stores (1 slurry store)	1 slurry store
	Fat supplementation in ruminants diets (%DM fat added	%DM fat added
	Tobacco curing	100 t tobacco/yr
Biomass energy	Rice husk cogeneration plants	1 MW cogeneration
	Biomass power from biomass residues	1 MW CHP plant
	Bagasse power	100 kt sugar cane/year
CCS	CCS plant	1 MW
Cement	Clinker replacement	1000 tonnes cement/day
Coal bed/mine methane	Coal mine methane	10 Mm3 CMM/year
EE households	Efficient residential airconditioning	1000 Airconditioners
	Efficient lighting with CFLs	1000 Bulps
	Efficient lighting with LEDs	1000 Bulps
	Efficient lighting with LEDs replacing CFL	1000 Bulps
	Efficient wood stoves	1000 stoves
	Efficient charcoal stoves	1000 stoves
	LPG stoves replacing wood stoves	1000 stoves
	Efficient electric stoves	1000 stoves
	Induction based cooking	1000 stoves
	New passive home	1000 new homes
	Efficient refrigerators	1000 refrigerators

Example of the calculations in the GACMO model in the Country X

- **The GACMO model contain sheets like this for the each GHG reduction options**

Solar PVs, large grid, 1 MW - 2020			
Costs in US$	Reduction Option	Reference Option	Increase (Red.-Ref.)
Total investment	1,500,000		
Project life	20		
Lev. investment	176,189		176,189
Annual O&M	15,000		15,000
Annual fuelcost		365,000	-365,000
Total annual cost	191,189	365,000	**-173,811**
Annual emissions (tons)	Tons	Tons	Reduction
Fuel CO2-eq. emission		840	840
Other			
Total CO2-eq. emission	0	840	**840**
US$/ton CO2-eq.			**-207.0**

Notes:
This calculation is made for a country with an avarage daily insolation of 5 hours.

General inputs:		
Discount rate	10%	
Reference electricity price	0.20	US$/kWh
CO2-eq. emission coefficient	0.46	tCO2/MWh

Activity: Solar PV		
Size of solar PV	1.0	MW
Investment in Activity	1500	US$/kW
Daily insolation	5	hours
Annual capacity factor	1825	Full time hours
Efficiency factor	1	
O&M	1.0%	Of investment
Electricity production	1825	MWh
Cost of electricity produced	0.105	US$/kWh
Reference option: No solar PVs		
Electricity production	1825	MWh

The structure of the GHG calculations for the options:

- Looking a the Solar PV option we can see the structure:
  - The first column to the left contains the **data for the mitigation option**.
  - The second column contains the data **for the BAU technology**.

- **The third column calculates the difference between these two.**
  - The upper box calculate the cost increase. The investment cost is levelized using a discount rate and a lifetime.
  - The lower box calculate the GHG reduction.
  - In the bottom the US$/tCO2e result is calculated.

- To the right of the calculations, all inputs are stated in a transparent way.
  - Some input parameters that are similar for all options (like discount rate, energy prices, electricity prices, emission factors) are combined in an "assumption sheet".

In the "Main" sheet where all options are collected, you must decide how large the options is (number of MWs, units etc.)

The data gaps and how to address them:

- The problem with the NDC calculation is **that you need a lot of data**.
- All countries have made an energy balance that can be used as input. We can also get the data from ENERDATA.
- The collection of policies in the countries can be used to decide on the growth factors to use in the projection to 2025/2030/2035/2050. Models like LEAP etc can be used.
- First all, **the existing GHG reduction reports and studies in the country** must be used to get data for the desired mitigation options.
- For option where there is no data, **the information in submitted CDM and PoA projects can be used.**
    - We have collected all this useful information in the pipelines for CDM projects and Programme of Activities (PoAs) at www.cdmpipeline.org.
    - Here information for all kinds of GHG mitigation options is available: Investments, how to calculate emission reductions etc.

GACMO summary table for the 22 GHG mitigation options in the Maldives

Mitigation options	Abatement costs US$/ton$CO_2$	Unit Type	Emission reduction t CO2/unit	Units penetrating in 2020	Investment MUS$	Annualized costs MUS$/year	Emission reduction in 2020	
							Per option kt/year	Cumulative fracion
LED tubes for public sector	-784	1 light tube replaced	0.015	70,000	0.0	-0.8	1.1	0.1%
Better maintenance of motor bikes	-413	All motor bikes	24304	1	0.0	-10.0	24.3	1.3%
Air conditioning at resorts	-398	1 Aircondinioner	0.87	36,467	4.7	-12.7	31.8	2.9%
Cooling new service buildings	-369	1 m2	0.046	270,336	1.8	-4.6	12.4	3.5%
Solar water heater	-323	1 unit	24	102	0.7	-0.8	2.5	3.7%
Efficient air conditioning	-313	1 Airconditioner	1.19	74,186	9.6	-27.7	88.5	8.2%
LED tubes for street light	-292	2200 street lights	1505	1.48	0.1	-0.6	2.2	8.3%
Upgrade of system efficiencies	-260	All eligible Islands	43199	1	61.1	-11.2	43.2	10.5%
PVs outer islands	-252	1 kW	1.22	12,100	42.4	-3.7	14.7	11.2%
Regional waste-to-energy projects	-228	100 ton/day of waste	9535	1	10.4	-2.2	9.5	11.7%
PVs with Net Meters	-189	1 kW	1.13	10,500	42.0	-2.2	11.9	12.3%
Energy efficient refrigerators	-158	1 refrigerator	0.51	82,823	41.2	-6.6	42.0	14.4%
PVs Malé Region (existing plans)	-133	1 kW	1.05	15,000	45.0	-2.1	15.8	15.2%
PVs Malé Region (additional options)	-133	1 kW	1.05	15,000	45.0	-2.1	15.8	16.0%
Efficient water pumping	-117	1 household	0.10	72,470	14.5	-0.9	7.6	16.4%
PVs on resorts	-108	1 kW	1.22	47,815	167.4	-6.3	58.2	19.4%
20 MW wind power & 25 MW LNG	-105	45 MW	26502	1	97.3	-2.8	26.5	20.7%
Thilafushi waste-to-energy project	-68	A 4 MW plant	23061	1	57.8	-1.6	23.1	21.9%
PVs with storage at small islands	-52	1 kW	1.2	29,000	167.1	-1.8	35.3	23.7%
LEDs for domestic lighting	199	All domestic bulps	8467	1	42.4	1.7	8.5	24.1%
Biodiesel 20% blend	336	20% blend	213000	1	0.0	71.6	213.0	34.9%
Bioethanol 15% blend	337	15% blend	14637	1	0.0	4.9	14.6	35.7%
			Totals	Million US$	850.3	-22.6	702.4	35.7%

Total baseline emission in 2020:	1968 ktCO2-eq.

The type of mitigation options used in GACMO are similar to the ones in the CDMPipeline:

GACMO contains a sheet for each type, which then contains several sub-types

Afforestation
Agriculture
Biomass energy
Cement
CO2 usage
Coal bed/mine methane
Energy distribution
EE households
EE industry
EE own generation
EE service
EE supply side
Fossil fuel switch
Forestry
Fugitive
Geothermal
HFCs, PFCs and SF6
Hydro
Landfill gas
Methane avoidance
Mixed renewables
N2O
Solar
Tidal
Transport
Wind

Mitigation options included/excluded in the MAR curve for Chile

Options excluded in MAR Curve		
Reduction option	**US$/tonCO2**	**Emission reduction in 2020 per option kt/year**
New natural gas power plant	2546.69	861.00
Cogeneration in industry	2371.03	620.50
Shifting freight transport from road to rail (1000	1562.82	30.17
Efficient electric motors	296.40	50.16
Efficient residential airconditioning	295.26	32.13
Efficient office lighting with LEDs	255.18	45.74
Zero tillage	198.80	42.86
Electric cars	118.82	165.27
Efficient refrigerators	32.65	102.94
Assisted forest regeneration	4.81	18.33
Reforestation with Silvopasture	0.87	36.67
Biogas at rural farms using non-renewable fue	-2.84	112.74
Nitrification inhibitors (1000 ha)	-67.69	102.70
Fat supplementation in ruminants diets (%DM	-80.50	0.77
Efficient electric grids	-185.27	-6863.98
Solar tower CSP, with storage	-374.07	3567.31
Electric trucks	-615.93	6783.28
Electric 12m buses	-965.37	7641.60

Options included in MAR Curve		
Reduction option	**US$/tonCO2**	**Emission reduction in 2030 per option kt/year**
Efficient lighting with LEDs	345.66	504.25
Hydro power connected to main grid	333.82	8377.52
Solar water heater, residential	319.16	289.72
Solar PVs, large grid	316.19	6298.99
Wind turbines, on-shore	288.73	11900.00
Geothermal power	252.54	8753.50
More efficient gasoline cars	248.36	727.85
Biogas from industrial waste water	191.45	393.39
New bicycle lanes	173.53	2059.75
Mini hydro power connected to main grid	124.47	5298.00
REDD: Avoided deforestation	12.92	4400.00
Composting of Municipal Solid Waste	0.01	1158.30
Biogas from Municipal Solid Waste	-0.26	1949.88
Energy efficiency in industry	-1.17	3759.38
Landfill gas flaring	-1.28	1866.23
Bus Rapid Transit (BRT)	-125.30	493.88
CCS plant	-164.50	4811.00

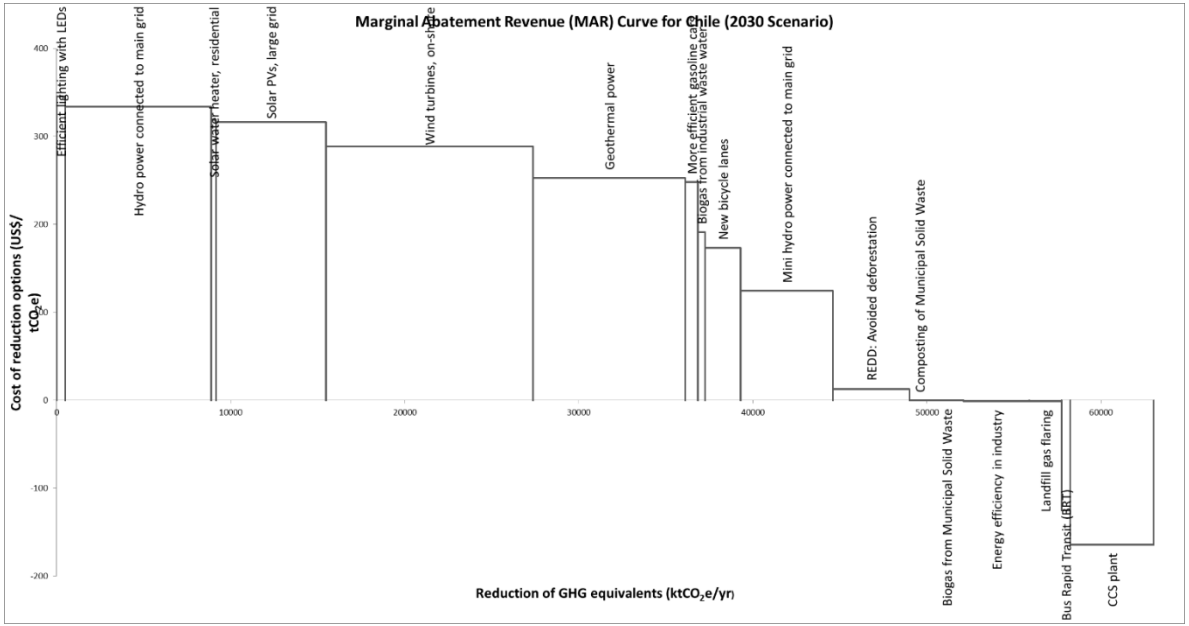
Threshold for smallest value on x-axis (ktCO2e/yr)	200
Threshold for smallest value on y-axis (US$/ktCO2e)	-200
Threshold for largest value on y-axis (US$/ktCO2e)	800

Results of GACMO
Marginal Abatement Revenue (MAR) curve for Chile

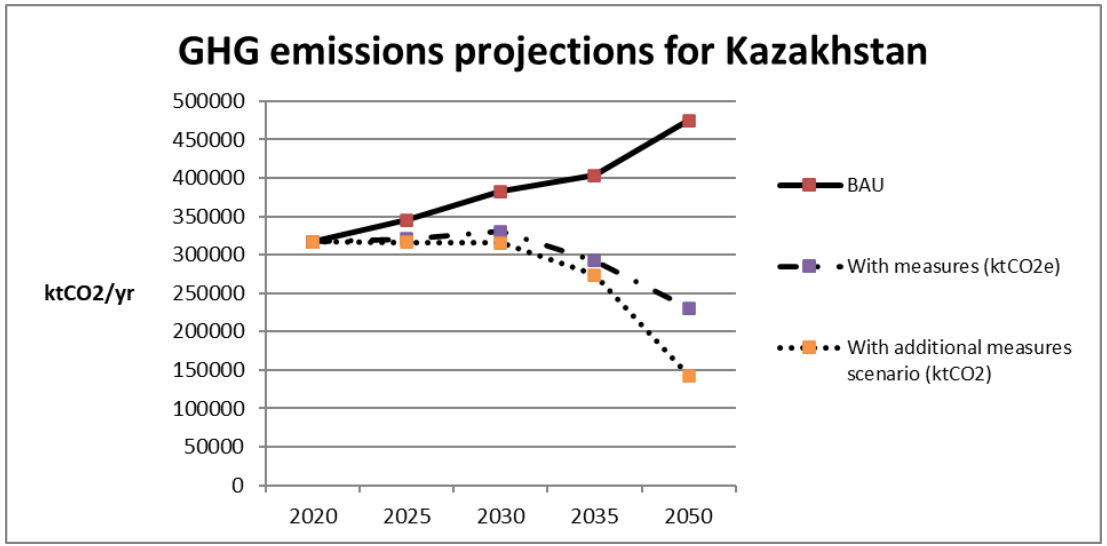
Marginal Abatement Cost Curve (MACC) or Marginal Abatement Revenue Curve (MARC) can be created.

A MACC/MARC presents the costs or savings of the mitigation actions and expected emissions reductions from those mitigation actions.

MACC/MARC can be useful tool to select mitigation actions appropriate for the country based on the emissions reductions and costs/revenues.



Results of GACMO:
GHG emissions projections in BAU and Mitigation scenario



Sectoral split of BAU scenario emissions					
ktCO2e/year	2020	2025	2030	2035	2050
Total	316,859	345,515	382,828	403,232	475,238
Power	105,019	117,325	131,566	141,184	175,026
Industry	93,494	103,701	115,625	123,094	150,378
Transport	22,296	27,297	33,420	34,269	36,946
Households	29,921	30,484	31,058	32,397	36,771
Services	7,652	7,796	7,943	8,285	9,404
Agriculture & Fishery	42,778	47,851	53,525	54,755	58,616
Forestry	8,375	3,178	1,206	1,037	660
Waste	7,323	7,883	8,486	8,211	7,437

Sectoral split of mitigation scenario emissions					
ktCO2e/year	2020	2025	2030	2035	2050
Total	316,859	320,591	330,537	292,387	230,567
Power	105,019	104,000	109,416	79,289	21,053
Industry	93,494	103,701	115,625	115,996	139,661
Transport	22,296	27,066	32,602	29,728	23,083
Households	29,921	30,484	19,456	14,571	-3,848
Services	7,652	7,796	2,018	2,292	7,523
Agriculture & Fishery	42,778	42,374	53,525	54,755	58,616
Forestry	8,375	-2,689	-10,528	-12,310	-22,733
Waste	7,323	7,859	8,422	8,066	7,212

Conclusion

GACMO is a **simple tool, easily adaptable** to a specific national context used to make analysis of mitigation options and their effects in terms of GHG emissions reduction in the context of NDC preparation or update

The GACMO calculations are transparent and easy to follow, in line with the methodologies established by the IPCC and CDM

GACMO allows to establish a Business As Usual (BAU) project 2025/2030/2050

GACMO allows to establish a mitigation scenario projection (percentage of reduction of GHG emissions in comparison with BAU)

GACMO allows you to calculate the reduction of GHG and the cost related to each mitigation option compared to a technology used as a reference

GACMO allows to "play" with the scale of application of any mitigation option to reach a global reduction target

GACMO offers a clear description of the total reduction of GHG emissions, total inversion and total annual cost

Thank you
Any questions?

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