

Geospatial Clean Cooking access modelling using OnStove

Hands-on 1

Resources

BAR-HAP tool

<https://www.who.int/tools/benefits-of-action-to-reduce-household-air-pollution-tool>

BAR-HAP manual

[https://www.who.int/publications/m/item/manual-for-benefits-of-action-to-reduce-household-air-pollution-\(bar-hap\)-tool](https://www.who.int/publications/m/item/manual-for-benefits-of-action-to-reduce-household-air-pollution-(bar-hap)-tool)

BAR-HAP related literature

Das, I. et al. The benefits of action to reduce household air pollution (BAR-HAP) model: a new decision support tool. *PLoS ONE* **16**, e0245729 (2021).

Jeuland, M., Tan Soo, J.-S. & Shindell, D. The need for policies to reduce the costs of cleaner cooking in low income settings: implications from systematic analysis of costs and benefits. *Energy Policy* **121**, 275–285 (2018).

Jeuland, M. A. & Pattanayak, S. K. Benefits and costs of improved cookstoves: assessing the implications of variability in health, forest and climate impacts. *PLoS ONE* **7**, e30338 (2012).

Jeuland, M. A. & Pattanayak, S. & Bluffstone R. The economics of Household Air Pollution. *Annu. Rev. Resour. Econ.* 7:81-108 (2015).

CHEST

<https://www.who.int/tools/clean-household-energy-solutions-toolkit>



Learning outcomes

This exercise focuses on BAR-HAP. BAR-HAP or the Benefits of Action to Reduce Household Air Pollution is the first tool comparing the costs and benefits of specific clean cooking interventions. The tool is developed by researchers at Duke University together with the World Health Organization. As we saw in the previous presentation the use of traditional fuels brings with it negative consequences for health and the environment as well as lost productivity for people (mainly women). BAR-HAP internalizes these benefits of a clean cooking transition in its cost-benefit analysis and relates them to the cost of making the transitions. BAR-HAP is a part of the WHO's CHEST (Clean Household Energy Solutions Toolkit). CHEST is a collection of 6 modules aiming at helping countries in designing and implementing health policies. BAR-HAP is part of the second module "Identification of technological and policy interventions". The tool was first published for Nepal in 2019 and then a global version in 2021. The tool is being maintained and updated regularly.

BAR-HAP allows the user to assess different transitions from traditional cooking to cleaner solutions. The traditional stoves included in BAR-HAP are traditional biomass and charcoal as well as kerosene. There are a number of improved cook stoves in the tool, which they define as cleaner solutions and lastly four clean stoves. In total you have 16 transitions to choose from. Each transition is coupled with specific benefits and costs. The analysis can be done on either a national, urban or rural level.

Beyond specifying pure transitions, the user can include specific policy interventions aimed at different stoves. These policy interventions are:

- subsidies (either aimed at the stove or the fuel which they use)
- financing (which assumes to change the willingness to pay for a transition by 40%)
- behavior change communication campaigns (which assumes to change the willingness to pay for a transition by 10%)
- technology and fuel bans

Stove subsidies can be combined with all other subsidies except for technology and fuel bans. This allows the user to determine which policy is the most efficient from a cost-benefit perspective, which policies lead to higher costs than benefits and which policies may be needed to get a desirable transition.



To conduct a cost-benefit analysis a lot of data is needed. BAR-HAP includes default data for all of the information that is needed to model a transition. The default data can be modified by the user if one wishes to do so. We will return to these calculations at a later point when discussing OnStove and here we will just run through the tool for you to gain a greater understanding. A large portion of the tool is password protected to ensure that the wrong edits are not made. The tool is open-source, does not require an internet connection (beyond the initial download) and is purely excel based.

By the end of this exercise, you will learn how to:

- 1) Basic operation of BAR-HAP
- 2) The costs and benefits of different cooking transitions

BAR-HAP demo

1. Download the tool from the official website: <https://www.who.int/tools/benefits-of-action-to-reduce-household-air-pollution-tool>

Benefits of action to reduce household air pollution (BAR-HAP) tool

****Updated version** released March 2022, with important bug fixes and other updates. If you have downloaded a previous version, please delete the download and use this updated version instead**

2. Step 1 will download an excel file. Once opened you will see that the file includes 64 work sheets. Out of these 23 are the “active” worksheets. These 23 sheets are editable by the user without any specific requirements, while the others are password protected to avoid edits by mistake. The password is available in the manual, but we will not use it for this exercise. We will be working with the tabs shaded in green (the “active” ones).

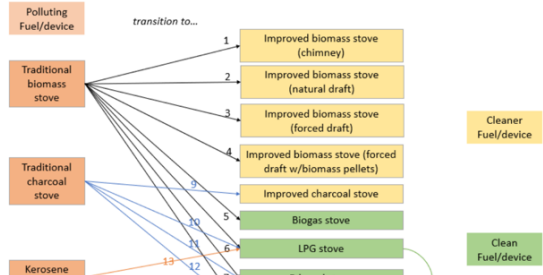
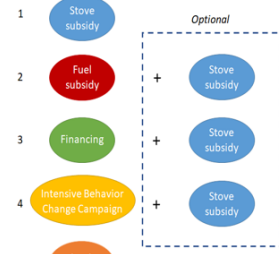
World Health Organization **Benefits of Action to Reduce Household Air Pollution (BAR-HAP) Tool**
Assessment of the Impacts of Clean and Transitional Cooking Interventions

[Get Started!](#)

Cooking Transitions and Policy Interventions
Two major decisions for users of BAR-HAP are selection of a) the stove and fuel transitions to analyze, and b) policy interventions to consider. These two aspects are explained below.

PART 0 Transitions
Sixteen cooking device transition scenarios are currently included in the BAR-HAP tool. The technology/fuel transitions are classified into four major types (Figure 1), from:
(a) Traditional biomass or traditional charcoal to transitional fuels and technologies ("cleaner" fuels/devices);
(b) Traditional biomass or traditional charcoal to clean fuels and technologies;
(c) Kerosene to clean fuels and technologies; and
(d) One clean fuel/technology to another (specifically LPG to electric).

PART 0 Policy Interventions
For each of the sixteen transitions, the user must select from one of the following **five mutually exclusive policy interventions**:
1. Subsidy for stoves only;
2. Subsidy for fuel (where fuel subsidy is only possible for biomass pellets, LPG, electricity and ethanol), alone or in concert with stove subsidy;
3. Stove financing that would allow adopting households to spread payments for new technology over time, alone or in concert with stove subsidy;
4. Behavior change communication (BCC), alone or in concert with stove subsidy; and
5. Technology ban (for any technology that is transitioned away from).

Transitions

Polluting Fuel/device	Transition to...	Cleaner Fuel/device	Clean Fuel/device
Traditional biomass stove	1. Improved biomass stove (chimney)	Improved biomass stove (chimney)	
Traditional biomass stove	2. Improved biomass stove (natural draft)	Improved biomass stove (natural draft)	
Traditional biomass stove	3. Improved biomass stove (forced draft)	Improved biomass stove (forced draft)	
Traditional biomass stove	4. Improved biomass stove (forced draft w/biomass pellets)	Improved biomass stove (forced draft w/biomass pellets)	
Traditional charcoal stove	5. Improved charcoal stove	Improved charcoal stove	
Traditional charcoal stove	6. Biogas stove	Biogas stove	
Traditional charcoal stove	7. LPG stove	LPG stove	
Kerosene	8. Ethanol stove	Ethanol stove	

Policy Interventions

Policy Intervention	Optional
1. Stove subsidy	Stove subsidy
2. Fuel subsidy	Stove subsidy
3. Financing	Stove subsidy
4. Intensive Behavior Change Campaign	Stove subsidy

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- Go to the "Setup-Country" sheet, this is the sheet number four (see image below). In this sheet we will set general information about your country of choice.

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Step 1. Define Your Country and Time Horizon For Analysis

In this section, you first select a country, the duration of the cooking transition program, and the time for scale-up of policy interventions. The scale-up phase and duration refer to the acceleration period at the beginning of the program launch – this phase is optional but allows for gradual implementation over the time duration that is specified. Review which fuels are currently used in the selected country (displayed in Part 1.2). In Part 1.3, select the fuels (e.g. traditional biomass, charcoal, kerosene, and LPG) that you would like to reduce use of. Once you have selected the fuels that you would like to transition the population away from, click the “Advance to Transitions” button to proceed to selecting the transition scenario: the fuels to which you would like the population to transition (as shown in the Intro-User Guide tab).

Please note that the costs are presented in US dollars. It is not possible to calculate costs in another currency in this version of the tool.

Important: If you do not navigate through the buttons in the interface, the tool's code may not run properly.

PART 1 Country Selection and Basic Information

Select Country From Drop Down

Nigeria

World bank income level

Low-Income

WHO sub-region

AFR

Starting Year

2020

Program time horizon (up to 31 years)

15

Is there a scale up phase? (Yes/No)

Yes

Scale up duration (3, 4 or 5 years)

3

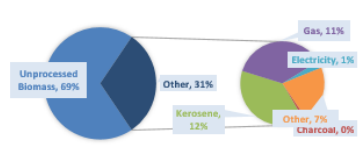
Costs expressed in

US Dollars

Choose scope (rural / urban / full country)

Full country

PART 1 Baseline fuel mix



Data source information

Note: Unprocessed biomass includes firewood, crop waste, and dung

Click for Detailed Country Baseline Fuel

Total Population 2019

200 963 603

Age 15+

107 146 010

Children <15

93 817 593

Exchange rate (US\$, 2020)

306.9

Exchange rate (PPP, 2020)

736.8

GDP per capita (US\$, 2020)

2 229.9

GDP per capita (PPP, 2020)

5 352.7

View Baseline Burden Summary

PART 1 Custom Country Fuel Selection

Traditional Biomass

Traditional Charcoal

Kerosene

LPG

Advance to Transitions

Reset this sheet only

Reset Entire Tool and Restart (Only click here if you want to start all over again, and note, the reset takes some time!)

Tips

Select the fuel or fuels that the target population currently uses, which the program aims to reduce. Based on the baseline fuel(s) selected, the tool will automatically unlock possible fuels to which users can transition in the “Transition & Intervention” screen (“Setup-Transition” tab). Refer to the user guide for information about the transition options.

Intro-Description

Intro-User Guide

Data Sources

Setup-Country

Setup-Transition

Setup-MultiTrans

Setup-Basic Custom

Setup - Advanced

- In the drop down menu which reads “Select Country from Drop Down”, select your country of choice. Notice how the numbers on the sheet change as you select a country. This is because BAR-HAP has a large number of default values for different countries stored within the tool. Most countries have specific data, but if this is not available, regional estimates are used.
- At this point it is important to mention that the tool has different orange clickable buttons in each sheet, make sure to use these as you navigate through the workbook (and not the sheet tabs at the bottom). This is important as orange buttons are the buttons which triggers all necessary calculations.
- Click on “View Baseline Burden Summary” button.

CCG 2021
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Easy **Transition & Intervention** **Multi-Transition** **Custom Parameters**

Step 1. Define Your Country and Time Horizon For Analysis

In this section, you first select a country, the duration of the cooking transition program, and the time for scale-up of policy interventions. The scale-up phase and duration refer to the acceleration period at the beginning of the program launch - this phase is optional but allows for gradual implementation over the time duration that is specified. Review which fuels are currently used in the selected country (displayed in Part 1.2). In Part 1.3, select the fuels (e.g. traditional biomass, charcoal, kerosene, and LPG) that you would like to reduce use of. Once you have selected the fuels that you would like to transition the population away from, click the "Advance to Transitions" button to proceed to selecting the transition scenario: the fuels to which you would like the population to transition (as shown in the Intro-User Guide tab).

Please note that the costs are presented in US dollars. It is not possible to calculate costs in another currency in this version of the tool.

Important: If you do not navigate through the buttons in the interface, the tool's code may not run properly.

PART 1 Country Selection and Basic Information

Select Country From Drop Down: **Nigeria**
 World bank income level: **Low-Income**
 WHO sub-region: **AFR**
 Starting Year: **2020**

Program time horizon (up to 31 years): **15**

Is there a scale up phase? (Yes/No): **Yes**

Scale up duration (3, 4 or 5 years): **3**
(only relevant if there is scale-up!)

Costs expressed in: **US Dollars**

Choose scope (rural / urban / full country): **Full country**

Total Population 2019: 200 963 603
Age 15+: 107 146 010
Children <15: 93 817 593

Exchange rate (US\$, 2020): 306.9
Exchange rate (PPP, 2020): 736.8

GDP per capita (US\$, 2020): 2 229.9
GDP per capita (PPP, 2020): 5 352.7

Number of Provinces: 31
Avg. Pop. Ratio: 6 482 697 / 1.30

Number of Health Districts: 616
Avg. Pop. Ratio: 326 240 / 0.85

View Baseline Burden Summary

PART 1 Custom Country Fuel Selection

Traditional Biomass **Traditional Charcoal** **Kerosene** **LPG**

Advance to Transitions **Reset this sheet only**

Reset Entire Tool and Restart (Only click here if you want to start all over again, and note, the reset takes some time!)

PART 1 Baseline fuel mix

Unprocessed Biomass, 69% **Gas, 11%** **Electricity, 1%** **Other, 31%** **Kerosene, 12%** **Other, 7%** **Charcoal, 6%**

Data source information

Note: Unprocessed biomass includes firewood, crop waste, and dung

Click for Detailed Country Baseline Fuel

Intro-Description **Intro-User Guide** **Data Sources** **Setup-Country** **Setup-Transition** **Setup-MultiTrans** **Setup-Basic Custom** **Setup - Advanced**

7. This will take to a sheet describing the baseline situation of your selected country (before any policies are implemented)
 - a. First are the health burdens:



This section shows the excess hours spent cooking and collecting fuels, compared to the most efficient cooking technology and fuels that do not require collection from the environment, in **Nigeria**. If households had more efficient technology, the affected individuals could use this time for other purposes. The time burden is measured in person-years, meaning that the total excess hours in a year are divided by 365 days and 24 hours to obtain the number of person-years. This time is then valued as a fraction of the wage rate for unskilled labor in the country, to account for the fact that individuals spending this time are often not fully employed in the labor market.

8. Once the current burden has been explored click on any of the orange “Go back” buttons, this will take you back to “Setup-country” sheet

This section shows first (top left) the cases and deaths due to 5 different HAP-attributable illnesses - Chronic obstructive pulmonary disease, acute lower respiratory illness, ischemic heart disease, lung cancer, and stroke - in **Nigeria**. At the top right, the annual disability adjusted life year burdens arising from morbidity (years of life in disability) and mortality (years of life lost) are shown. The bottom three boxes summarize the annual economic costs of the burdens, based on cost of illness (COI) valuation for morbidity, and value of a statistical life (VSL) valuation for mortality.

Go Back

Environmental Burdens



This section shows first (left) the climate-forcing arising from HAP-related emissions from two different sets of pollutants - a basic set including only Kyoto protocol pollutants, and an extended set that also includes carbon monoxide, organic carbon, and black carbon - in **Nigeria**. These emissions costs are valued using the more inclusive pollution measure, at the social cost of carbon equivalent emissions. Second (right), there is a summary of non-renewable biomass loss due to wood harvesting, which is valued at the cost of renewable biomass replacement (tree planting and sustainable forest management). For reference, typical mature trees can weight anywhere from 1,000-20,000 kg, depending on the species.

Time Burdens (Relative to most time efficient cooking solution)



9. Once back at the “Setup-country” sheet, set your time-horizon (15 years), scale up (yes), scale-up duration (3 years), monetary value (USD) and select whether you want to do the analysis on a national, urban or rural scale (national)
 - a. Scale up defines whether the clean cooking transition is gradually scaled up and for how long that goes. We are saying that it is and that it goes on for 3 years.

PART 1 Country Selection and Basic Information

Select Country From Drop Down: **Nigeria**
 World bank income level: Low-Income
 WHO sub-region: AFR
 Starting Year: 2020

Program time horizon (up to 31 years): **15**

Is there a scale up phase? (Yes/No): **Yes**

Scale up duration (3, 4 or 5 years): **3**
(only relevant if there is scale-up)

Costs expressed in: **US Dollars**

Choose scope (rural / urban / full country): **Full country**

Total Population 2019: 200 963 603
 Age 15+: 107 146 010
 Children <15: 93 817 593

Exchange rate (US\$, 2020): 306.9
 Exchange rate (PPP, 2020): 736.8

GDP per capita (US\$, 2020): 2 229.9
 GDP per capita (PPP, 2020): 5 352.7

Number of Provinces: **31**
 Avg. Pop.: 6 482 697
 Ratio: 1.30



Number of Health Districts: **616**
 Avg. Pop.: 328 240
 Ratio: 0.65

[View Baseline Burden Summary](#)

PART 1 Custom Country Fuel Selection

Traditional Biomass
 Traditional Charcoal
 Kerosene
 LPG

[Advance to Transitions](#)

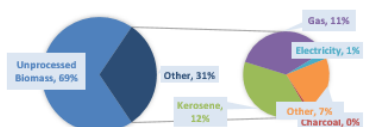
[Reset this sheet only](#)

[Reset Entire Tool and Restart](#) (Only click here if you want to start all over again, and note, the reset takes some time!)

Tips

Select the fuel or fuels that the target population currently uses, which the program aims to reduce. Based on the baseline fuel(s) selected, the tool will automatically unlock possible fuels to which users can transition in the "Transition & Intervention" screen ("Setup-Transition" tab). Refer to the user guide for information about the transition options.

PART 1 Baseline fuel mix



Data source information

Note: Unprocessed biomass includes firewood, crop waste, and dung

[Click for Detailed Country Baseline Fuel](#)

10. Below the section called "Country Selection and Basic Information" is a section called "Baseline fuel mix" this will show you the fuel mix of your selected country. Click on "Detailed Country Baseline Fuel"

PART 1 Country Selection and Basic Information

Select Country From Drop Down: **Nigeria**
 World bank income level: Low-Income
 WHO sub-region: AFR
 Starting Year: 2020

Program time horizon (up to 31 years): **15**

Is there a scale up phase? (Yes/No): **Yes**

Scale up duration (3, 4 or 5 years): **3**
(only relevant if there is scale-up)

Costs expressed in: **US Dollars**

Choose scope (rural / urban / full country): **Full country**

Total Population 2019: 200 963 603
 Age 15+: 107 146 010
 Children <15: 93 817 593

Exchange rate (US\$, 2020): 306.9
 Exchange rate (PPP, 2020): 736.8

GDP per capita (US\$, 2020): 2 229.9
 GDP per capita (PPP, 2020): 5 352.7

Number of Provinces: **31**
 Avg. Pop.: 6 482 697
 Ratio: 1.30



Number of Health Districts: **616**
 Avg. Pop.: 328 240
 Ratio: 0.65

[View Baseline Burden Summary](#)

PART 1 Custom Country Fuel Selection

Traditional Biomass
 Traditional Charcoal
 Kerosene
 LPG

[Advance to Transitions](#)

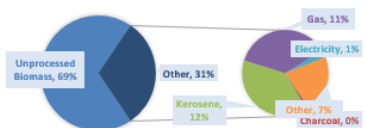
[Reset this sheet only](#)

[Reset Entire Tool and Restart](#) (Only click here if you want to start all over again, and note, the reset takes some time!)

Tips

Select the fuel or fuels that the target population currently uses, which the program aims to reduce. Based on the baseline fuel(s) selected, the tool will automatically unlock possible fuels to which users can transition in the "Transition & Intervention" screen ("Setup-Transition" tab). Refer to the user guide for information about the transition options.

PART 1 Baseline fuel mix



Data source information

Note: Unprocessed biomass includes firewood, crop waste, and dung

[Click for Detailed Country Baseline Fuel](#)

- On this sheet you see how the share of different cooking fuels has changed in your country during the last 20 years. Once this has been explored click on the orange "Go back" button.

11. Next in step 1.3 select the fuels you want to transition away from. For the this example select traditional biomass and traditional charcoal, by clicking on them (this will highlight them, see image below)

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Step 1. Define Your Country and Time Horizon For Analysis

In this section, you first select a country, the duration of the cooking transition program, and the time for scale-up of policy interventions. The scale-up phase and duration refer to the acceleration period at the beginning of the program launch – this phase is optional but allows for gradual implementation over the time duration that is specified. Review which fuels are currently used in the selected country (displayed in Part 1.2). In Part 1.3, select the fuels (e.g. traditional biomass, charcoal, kerosene, and LPG) that you would like to reduce use of. Once you have selected the fuels that you would like to transition the population away from, click the “Advance to Transitions” button to proceed to selecting the transition scenario: the fuels to which you would like the population to transition (as shown in the Intro User Guide tab).

Please note that the costs are presented in US dollars. It is not possible to calculate costs in another currency in this version of the tool.

Important: If you do not navigate through the buttons in the interface, the tool’s code may not run properly.

PART 1 Country Selection and Basic Information

Select Country From Drop Down

Nigeria

World bank income level: Low-Income

WHO sub-region: AFR

Starting Year: 2020

Program time horizon (up to 31 years)

15

Is there a scale up phase? (Yes/No)

Yes

Scale up duration (3, 4 or 5 years)

3

Costs expressed in

US Dollars

Choose scope (rural / urban / full country)

Full country

Total Population 2019

200 963 603

Age 15+

107 146 010

Children <15

93 817 593

Exchange rate (US\$, 21)

306.9

Exchange rate (PPP, 21)

736.8

GDP per capita (US\$, 2)

2 229.9

GDP per capita (PPP, 2)

5 352.7

Number of Provinces

31

Avg. Pop. Ratio: 6 482 697 1.30

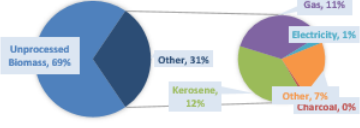
Number of Health Districts

616

Avg. Pop. Ratio: 326 240 0.65

View Baseline Burden Summary

PART 1 Baseline fuel mix



Data source information

Note: Unprocessed biomass includes firewood, crop waste, and dung

Click for Detailed Country Baseline Fuel

PART 1 Custom Country Fuel Selection

Traditional Biomass

Traditional Charcoal

Kerosene

LPG

Advance to Transitions

Reset this sheet only

Reset Entire Tool and Restart (Only click here if you want to start all over again, and note, the reset takes some time!)

Tips

select the fuel or fuels that the get population currently uses, which the program aims to reduce. Based on the baseline fuel(s) selected, the tool will automatically unlock possible fuels to which users can transition in the “Transition & Intervention” screen (“Setup-Transition” tab). Refer to the user guide for information about the transition options.

12. Click on “Advance to transitions”

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Basic Transition & Intervention Multi-Transition Custom Parameters

Step 1. Define Your Country and Time Horizon For Analysis

In this section, you first select a country, the duration of the cooking transition program, and the time for scale-up of policy interventions. The scale-up phase and duration refer to the acceleration period at the beginning of the program launch - this phase is optional but allows for gradual implementation over the time duration that is specified. Review which fuels are currently used in the selected country (displayed in Part 1.2). In Part 1.3, select the fuels (e.g. traditional biomass, charcoal, kerosene, and LPG) that you would like to reduce use of. Once you have selected the fuels that you would like to transition the population away from, click the "Advance to Transitions" button to proceed to selecting the transition scenario: the fuels to which you would like the population to transition (as shown in the Intro User Guide tab).

Please note that the costs are presented in US dollars. It is not possible to calculate costs in another currency in this version of the tool.

Important: If you do not navigate through the buttons in the interface, the tool's code may not run correctly.

PART 1 Country Selection and Basic Information

Select Country From Drop Down: **Nigeria**
 World bank income level: Low-Income
 WHO sub-region: AFR
 Starting Year: 2020

Program time horizon (up to 31 years): **15**

Is there a scale up phase? (Yes): **Yes**

Scale up duration (3, 4 or 5 years): **3**
 (only relevant if there is scale-up)

Costs expressed in: **US Dollars**

Choose scope (rural / urban / full): **Full country**

PART 1.2 Baseline fuel mix

Unprocessed Biomass, 69%
 Gas, 11%
 Electricity, 1%
 Other, 31%
 Kerosene, 12%
 Charcoal, 0%
 Other, 7%

Data source information

Note: Unprocessed biomass includes firewood, crop waste, and dung

Click for Detailed Country Baseline Fuel

Total Population 2019: 200 963 603
 Age 15+: 107 146 010
 Children <15: 93 817 593

Exchange rate (US\$, 21): 306.9
 Exchange rate (PPP, 21): 736.8

GDP per capita (US\$, 2): 2 229.9
 GDP per capita (PPP, 2): 5 352.7

View Baseline Burden Summary

PART 1 Custom Country Fuel Selection

Traditional Biomass Traditional Charcoal Kerosene LPG

Advance to Transitions Reset this sheet only

Reset Entire Tool and Restart (Only click here if you want to start all over again, and note, the reset takes some time!)

Tips

Select the fuel or fuels that the target population currently uses, which the program aims to reduce. Based on the baseline fuel(s) selected, the tool will automatically unlock possible fuels to which users can transition in the "Transition & Intervention" screen ("Setup-Transition" tab). Refer to the user guide for information about the transition options.

- a. Here you decide what transitions you promote and which policy option to use. There are 16 transitions in total:

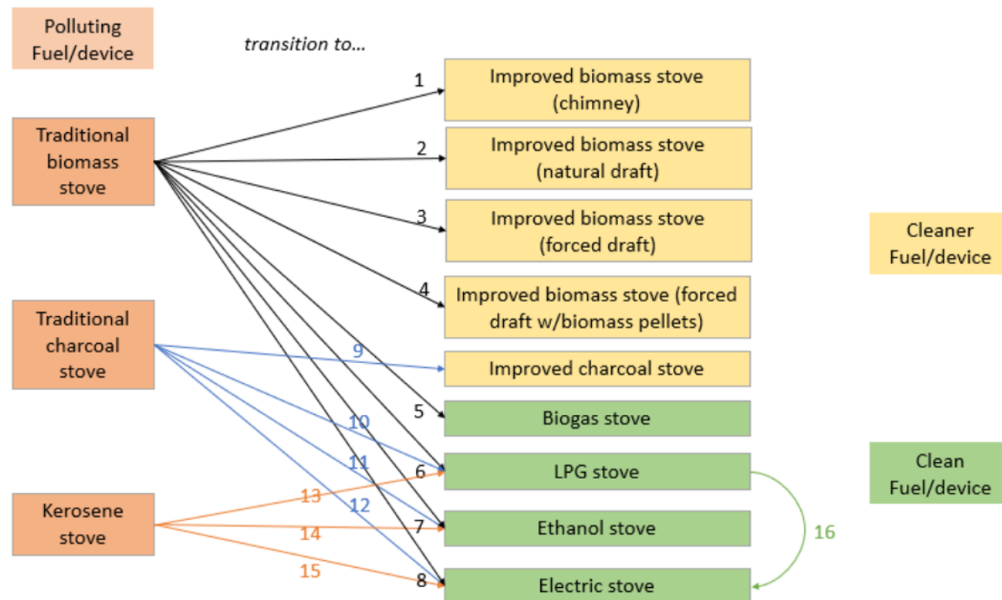


Figure 1. Transitions included in BAR-HAP[1]

- b. For each transition, you will have to select a policy option. If you do not select a policy option the transition is not included. There are five policy options



- i. Stove subsidies
 - ii. Fuel subsidies
 - iii. financing (which assumes to change the willingness to pay for a transition by 40%)
 - iv. behavior change communication campaigns (which assumes to change the willingness to pay for a transition by 10%)
 - v. technology and fuel bans
- c. For this example select only Biogas, LPG and Electricity (we want to focus on fully clean stoves). Select these transitions for both traditional biomass and traditional charcoal. You are free to select whichever policy you want, but makes sure that you select one policy for each transitions. Your transitions are
- i. Traditional biomass -> Biogas
 - ii. Traditional biomass -> LPG
 - iii. Traditional biomass -> Electricity
 - iv. Traditional charcoal -> LPG
 - v. Traditional charcoal -> Electricity

See example below. Notice that once a transition is selected the gray "Select" changes to a red "Selected". We want the six transitions above to be selected as in the image below.

Introduction	User Guide	Essential Parameters	Advanced Parameters	Summary Result
	Basic	Transition & Intervention	Multi-Transition	Custom Parameters



Step 2. Specify your transitions and interventions

In this tab, you must specify the stoves/fuels to which you want to transition by choosing policy interventions that enable those transitions. A specific transition is not active until a policy intervention is selected, and you must scroll down and click the advance button to continue from here. Note: Only select policy interventions for transitions you want. Note that stove subsidy is also active when you select fuel subsidy, finance and behavior change campaign (you specify whether you want this policy later in the Setup-Basic Custom tab, by indicating the stove subsidy level).

Important: If you do not navigate through the buttons in the interface, the tool's codes may not run properly.

PART 2 Transition & Intervention Selection				Tips
Select Transition 1 From Traditional Stove To ICS Chimney Drop Policy Options Down	Select Transition 2 From Traditional Stove To ICS Natural Draft Drop Policy Options Down	Select Transition 3 From Traditional Stove To ICS Forced Draft Drop Policy Options Down	Select Transition 4 From Traditional Stove To ICS Pellet Drop Policy Options Down	Please confirm that appropriate transitions are unlocked for all currently-used fuels selected in the Setup-Country tab. For each transition that you would like to include, select a policy option from the drop down menu under that transition. Leave the policy option blank for any transitions that you do not wish to include. If you select a policy option for multiple transitions, you will need to specify the targeted population for each in the next section.
Selected Transition 5 From Traditional Stove To Biogas Drop Policy Options Down Financing	Selected Transition 6 From Traditional Stove To LPG Drop Policy Options Down Fuel Subsidy	Select Transition 7 From Traditional Stove To Ethanol Drop Policy Options Down	Selected Transition 8 From Traditional Stove To Electric Drop Policy Options Down Fuel Subsidy	
Select Transition 9 From Traditional Charcoal To ICS Charcoal Drop Policy Options Down	Selected Transition 10 From Traditional Charcoal To LPG Drop Policy Options Down Fuel Subsidy	Select Transition 11 From Traditional Charcoal To Ethanol Drop Policy Options Down	Selected Transition 12 From Traditional Charcoal To Electric Drop Policy Options Down Fuel Subsidy	

13. Once your transitions are selected, click on "Advance to Multi-transitions"

PART 2 Transition & Intervention Selection																Tips
Select Transition 1 From Traditional Stove To ICS Chimney Drop Policy Options Down	Select Transition 2 From Traditional Stove To ICS Natural Draft Drop Policy Options Down	Select Transition 3 From Traditional Stove To ICS Forced Draft Drop Policy Options Down	Select Transition 4 From Traditional Stove To ICS Pellet Drop Policy Options Down	Please confirm that appropriate transitions are unlocked for all currently-used fuels selected in the Setup-Country tab. For each transition that you would like to include, select a policy option from the drop down menu under that transition. Leave the policy option blank for any transitions that you do not wish to include. If you select a policy option for multiple transitions, you will need to specify the targeted population for each in the next section.												
Selected Transition 5 From Traditional Stove To Biogas Drop Policy Options Down Subsidy for Stove	Selected Transition 6 From Traditional Stove To LPG Drop Policy Options Down Fuel Subsidy	Select Transition 7 From Traditional Stove To Ethanol Drop Policy Options Down	Selected Transition 8 From Traditional Stove To Electric Drop Policy Options Down Financing													
Selected Transition 9 From Traditional Charcoal To ICS Charcoal Drop Policy Options Down Subsidy for Stove	Selected Transition 10 From Traditional Charcoal To LPG Drop Policy Options Down Fuel Subsidy	Select Transition 11 From Traditional Charcoal To Ethanol Drop Policy Options Down	Selected Transition 12 From Traditional Charcoal To Electric Drop Policy Options Down Financing													
Select Transition 13 From Kerosene To LPG Drop Policy Options Down	Select Transition 14 From Kerosene To Ethanol Drop Policy Options Down	Select Transition 15 From Kerosene To Electric Drop Policy Options Down	Select Transition 16 From LPG To Electric Drop Policy Options Down													
Advance to Multi-Transitions				Reset transitions and policy selections only				Reset Entire Tool and Restart (Please note, if you want to simply remove a policy, choose the blank option from the drop down. Only click here if you want to start all over again!)								

- If you chose more than one stove to transition to (which we just did), you have to enter the percentage of the population transitioning to each new stove.
- You do not want the percentage sum to be larger than 100%, but smaller than 100% is OK if you are modelling a scenario where everyone does not switch.
- For this example, feel free to select the percentages as you wish. See an example below:

 **World Health Organization** **Benefits of Action to Reduce Household Air Pollution (BAR-HAP) Tool**
Assessment of the Impacts of Clean and Transitional Cooking Interventions

Introduction	User Guide	Essential Parameters	Advanced Parameters	Summary Result
Basic		Transition & Intervention	Multi-Transition	Custom Parameters

PART 3 Multi-Transition Selection

The following section displays the percentage of the population using each baseline fuel that is targeted to transition away from that fuel. For example, if your transition scenario targets only biomass users, you want to analyze a transition from traditional biomass technology to both natural draft stoves and LPG stoves. In this case, you must specify what percent of biomass users will switch to natural draft stoves, and what percent to LPG. (Note that the sum under each baseline fuel cannot exceed 100%, but it can be less than 100% if some users will continue to use the baseline fuel/stove).

Steps: 1) For all baseline fuels included, specify the percentage targeted to transition to cleaner stoves/fuels (all baseline fuels not selected on the Setup-Transition tab are greyed out).
2) Check that the total under each baseline fuel is positive but no more than 100% (can be less than 100%).
3) If you want to use the default parameter assumptions, click "Advance to Results". Users who want to change default assumptions (e.g., size of subsidy, stove cost, cooking time) should click "Advance to Custom Parameters".

Important: If you do not navigate through the buttons in the interface, the tool's codes may not run properly.

From	Traditional biomass Users	Proportion
To	Chimney ICS	0%
	Natural draft ICS	0%
	Forced draft ICS	0%
	Pellet ICS	0%
	Biogas	20%
	LPG	70%
	Ethanol	0%
	Electric	10%
Total		100%
Check	This Portfolio Is Ok	

From	Traditional charcoal users	Proportion
To	CharICs	20%
	LPG	30%
	Ethanol	0%
	Electric	50%
Total		100%
Check	This Portfolio Is Ok	

From	Kerosene users	Proportion
To	LPG	0%
	Ethanol	0%
	Electric	0%
Total		0%
Check		

From	LPG Users	Proportion
To	Electric	0%
Total		0%
Check		

Advance to Custom Parameters (to change policy or other assumptions)

Advance to Results (without changing default assumptions)

Reset transitions and policy selections only

Reset Entire Tool and Restart (Caution: This will reset all information entered so far. Only click here if you want to start all over again!)

- Click on "Advance to results". This new sheet will show you all of the results of the transitions that you have modeled.

Introduction	User Guide	Essential Parameters	Advanced Parameters	Summary Result
	Basic	Transition & Intervention	Multi-Transition	Custom Parameters

PART 3 Multi-Transition Selection

The following section displays the percentage of the population using each baseline fuel that is targeted to transition away from that fuel. For example, if your transition scenario targets only biomass users, you want to analyze a transition from traditional biomass technology to both natural draft stoves and LPG stoves. In this case, you must specify what percent of biomass users will switch to natural draft stoves, and what percent to LPG. (Note that the sum under each baseline fuel cannot exceed 100%, but it can be less than 100% if some users will continue to use the baseline fuel/stove).
 Steps: 1) For all baseline fuels included, specify the percentage targeted to transition to cleaner stoves/fuels (all baseline fuels not selected on the Setup-Transition tab are greyed out).
 2) Check that the total under each baseline fuel is positive but no more than 100% (can be less than 100%).
 3) If you want to use the default parameter assumptions, click "Advance to Results". Users who want to change default assumptions (e.g., size of subsidy, stove cost, cooking time) should click "Advance to Custom Parameters".
Important: If you do not navigate through the buttons in the interface, the tool's codes may not run properly.

From	Traditional biomass Users	Proportion
To	Chimney ICS	0%
	Natural draft ICS	0%
	Forced draft ICS	0%
	Pellet ICS	0%
	Biogas	20%
	LPG	70%
	Ethanol	0%
	Electric	10%
Total		100%
Check	This Portfolio Is Ok	

From	Traditional charcoal users	Proportion
To	CharlCS	20%
	LPG	30%
	Ethanol	0%
	Electric	50%
Total		100%
Check	This Portfolio Is Ok	

From	Kerosene users	Proportion
To	LPG	0%
	Ethanol	0%
	Electric	0%
Total		0%
Check		

From	LPG Users	Proportion
To	Electric	0%
Total		0%
Check		

Advance to Custom Parameters (to change policy or other assumptions)

Advance to Results (without changing default assumptions)

Reset transitions and policy selections only

Reset Entire Tool and Restart (Caution: This will reset all information entered so far. Only click here if you want to start all over again!)

- a. Present Value of Social Net Benefits – Shows the net-benefits of the scenario. This is defined as benefit minus costs. One value (the net-present value) includes a social discount rate, while the other one does not. If you have a parenthesis around your value it means that it is negative (the costs outweigh the benefits). If this is the case you might want to change some of your transitions or associated policies.

Introduction	User Guide	Essential Parameters	Advanced Parameters	Summary Result
	Cost	Time Savings	Morbidity Breakdown	Mortality Breakdown
	Climate Savings	Other Benefits		

To view benefit breakdowns across multiple policy interventions, you must click "Generate Transition Comparison Graphs" button first.

Results Summary | **View SDG7 Progress** | **Graphic Visualization of Costs and Benefits of the Intervention**

Present Value of Social Net Benefits

\$3 878 204 346	(Undiscounted; full program duration)
\$2 685 546 697	(Net present value; full program duration)

Click for Categorical Cost-Benefit Breakdown | Click for CBA by transition

Generate Transition Comparison Graphs

Reset Entire Tool and Restart (Caution: This will reset all information entered so far. Only click here if you want to start all over again!)

Tips and explanation: All monetary values, unless labeled

- b. If you click on "View SDG 7 progress" you can see the results of your created scenario in comparison the business as usual case.

[Introduction](#)
[User Guide](#)
[Essential Parameters](#)
[Advanced Parameters](#)
[Summary Result](#)

[Cost](#)
[Time Savings](#)
[Morbidity Breakdown](#)
[Mortality Breakdown](#)
[Climate Savings](#)
[Other Benefits](#)

To view benefit breakdowns across multiple policy interventions, you must click "Generate Transition Comparison Graphs" button first.

[Results Summary](#)
[View SDG7 Progress](#)

Graphic Visualization of Costs and Benefits of the Intervention

\$3 878 204 346

(Undiscounted; full program duration)

\$2 685 546 697

(Net present value; full program duration)

Click for Categorical Cost-Benefit Breakdown

Click for CBA by transition

Generate Transition Comparison Graphs

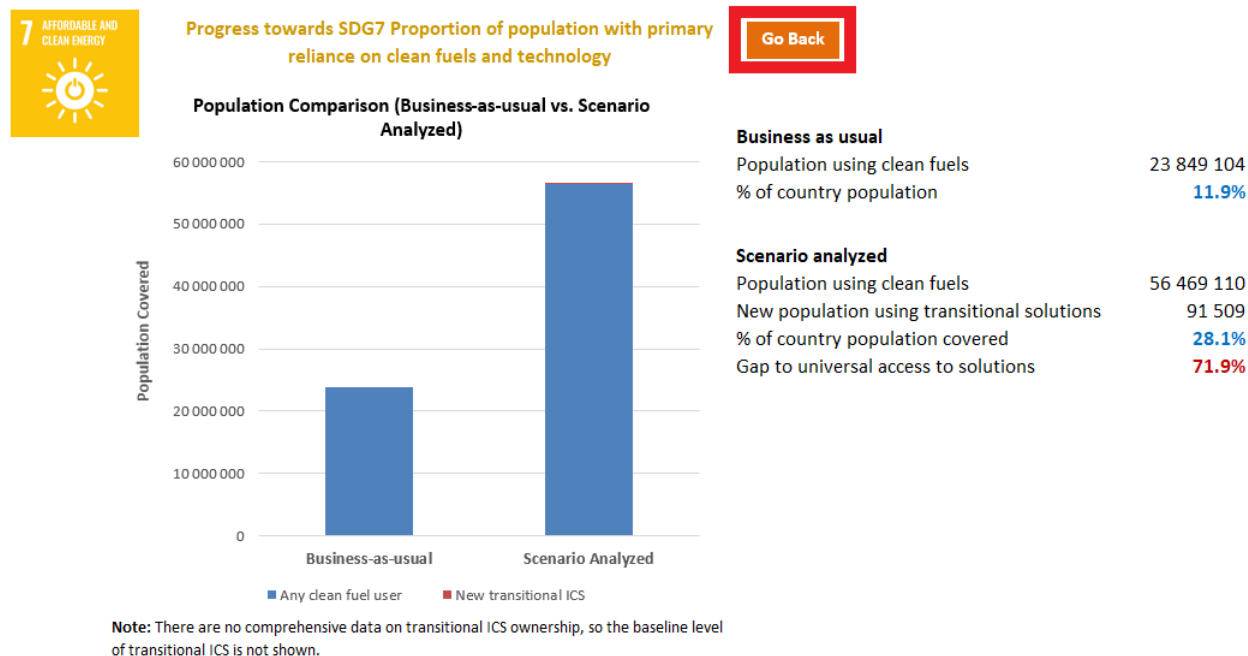
Reset Entire Tool and Restart

(Caution: This will reset all information entered so far. Only click here if you want to start all over again!)

Tips and explanation

All monetary values, unless labeled

- The fact that it does not reach 100% for your scenario could be due to the efficiency of your policy assumption. As an example if you do a technology ban (restrict people from using the stove completely) you will see that the share gets much closer to 100%. (click on "Go Back" when you have checked the results).

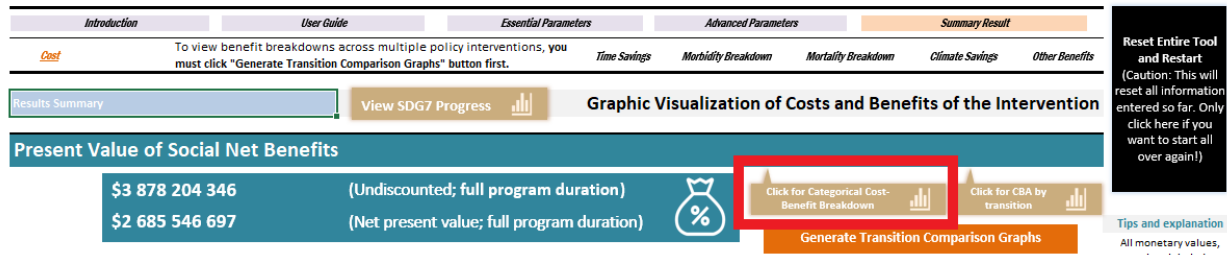


- Click on categorical cost-benefit breakdown to see each cost and benefit on its own



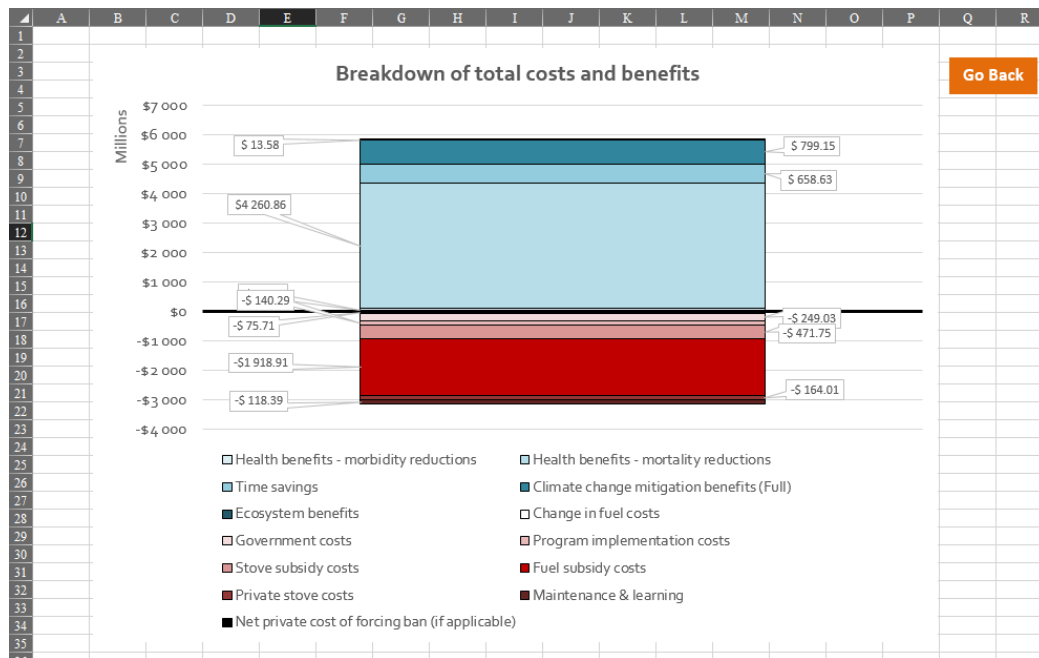
Benefits of Action to Reduce Household Air Pollution (BAR-HAP) Tool

Assessment of the Impacts of Clean and Transitional Cooking Interventions



This panel includes:

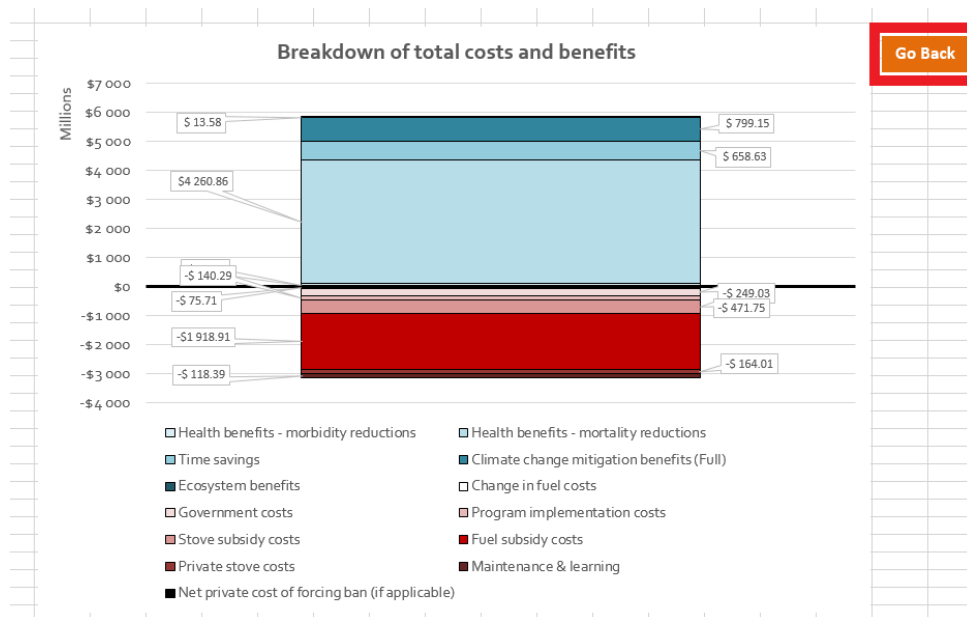
- i. **Change in fuel cost** – How does fuel cost change
- ii. **Climate change mitigation benefits** – reduction of GHG-pollutants
- iii. **Ecosystem benefits** – other environmental benefits beyond greenhouse gas emissions. This could for example be a reduction in unsustainable wood collection.
- iv. **Time savings** – opportunity cost gained
- v. **Mortality reductions** – reduction in deaths
- vi. **Morbidity reductions** –reduction in cases
- vii. **Maintenance and learning cost**
- viii. **Private stove costs** –cost of buying stoves (to the consumer)
- ix. **Stove subsidy cost (to society)** – cost of giving a subsidy on stove
- x. **Fuel subsidy cost (to society)** – cost of giving a subsidy on fuel
- xi. **Program implementation cost** - Cost of implementing your proposed program
- xii. **Government costs** - personnel/staffing, training, advertising, equipment
- xiii. **Net private cost of forcing a ban** - Cost of forcing a ban (if you have selected a ban)



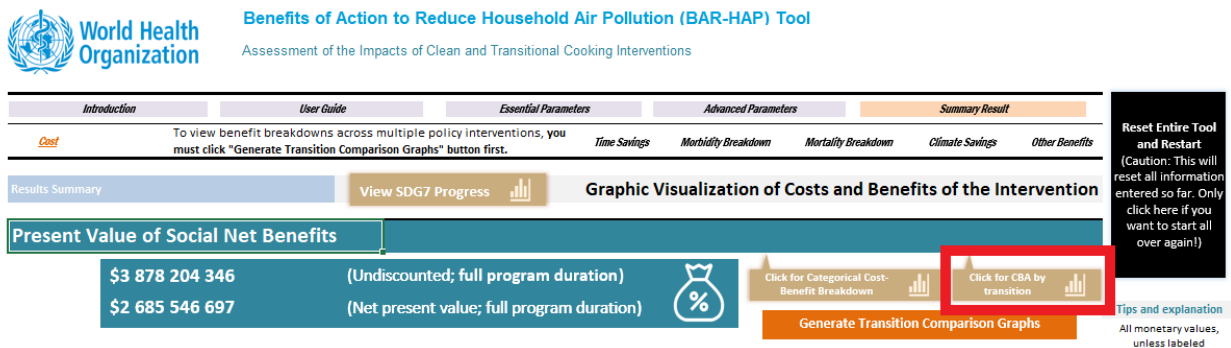
Some questions to look into:

- Are the total benefits in your scenario higher than the total costs?
- Are any of your costs on the positive section? What would this indicate?
- What is the largest category of costs? Do you see any ways of alleviating these?
- What is the largest category of benefits

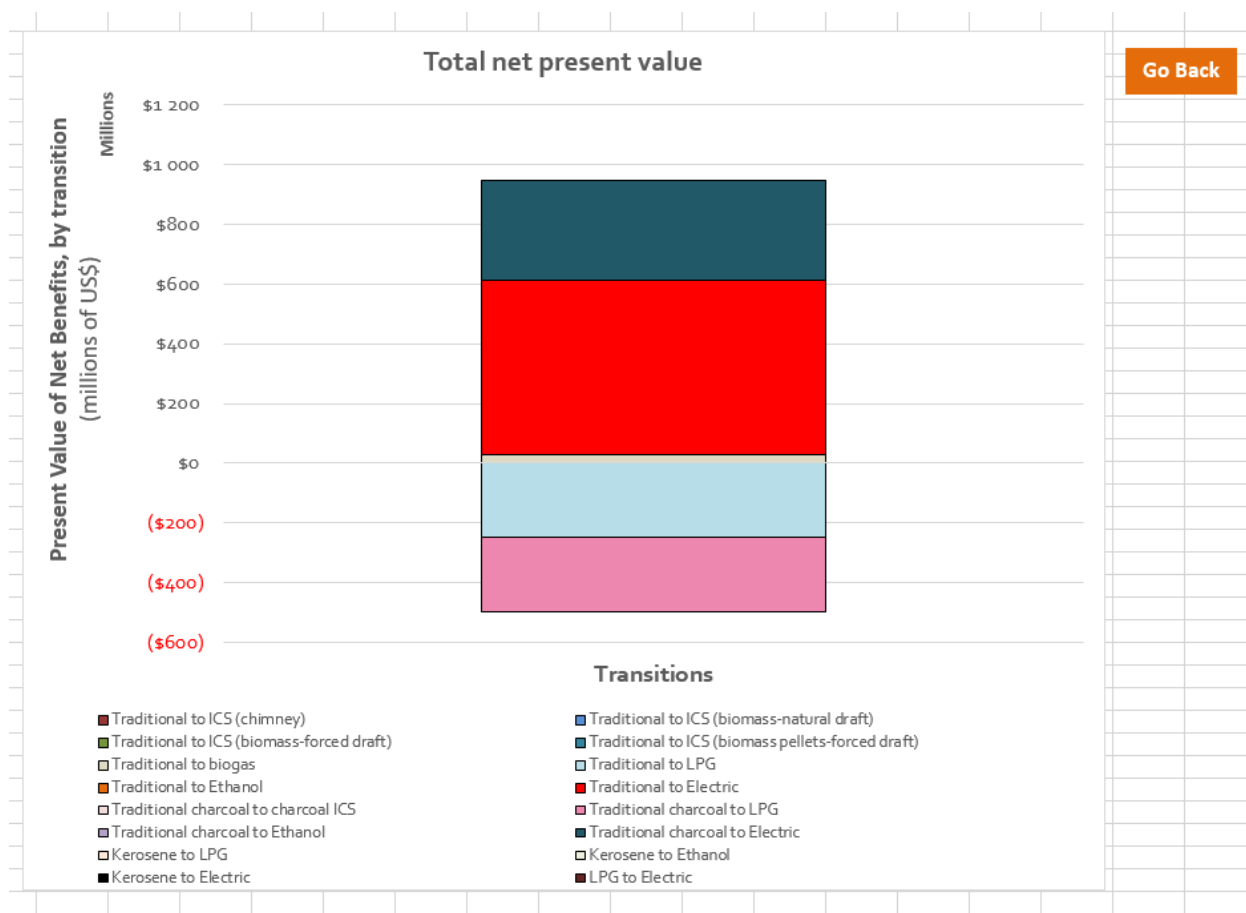
Click on "Go Back" whenever you are ready



d. Next click on "Click on CBA by transition"



- i. Shows you the net-benefits of each transition that you have selected. Are any of the transitions negative? If so, what does that tell you?



Click on “Go Back” when happy

- e. If you scroll down in the sheet that you come back to you will find the costs and the three previously described benefits of your selected transitions. As with the net-benefit values parenthesis indicates negative values. This gives you the ability to compare the results to the current scenario.

Note that there are advanced parameters we have not assessed here. Feel free to do so with the help of the official manual ([https://www.who.int/publications/m/item/manual-for-benefits-of-action-to-reduce-household-air-pollution-\(bar-hap\)-tool](https://www.who.int/publications/m/item/manual-for-benefits-of-action-to-reduce-household-air-pollution-(bar-hap)-tool))

15. This marks the end of this hands-on. The purpose of this exercise has been to introduce to you net-benefit calculations as they relate to clean cooking without the spatial dimension involved. We have here given you a basic run-down on how BAR-HAP works, created some transitions and assessed the results for one case study.



We will move on the rest of the course, but feel free to come back to this exercise and run different scenarios at a later stage.

References

- [1] I. Das, J. J. Lewis, R. Ludolph, M. Bertram, H. Adair-Rohani, en M. Jeuland, "The benefits of action to reduce household air pollution (BAR-HAP) model: A new decision support tool", *PLOS ONE*, vol 16, no 1, bl e0245729, Jan 2021, doi: 10.1371/journal.pone.0245729.



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