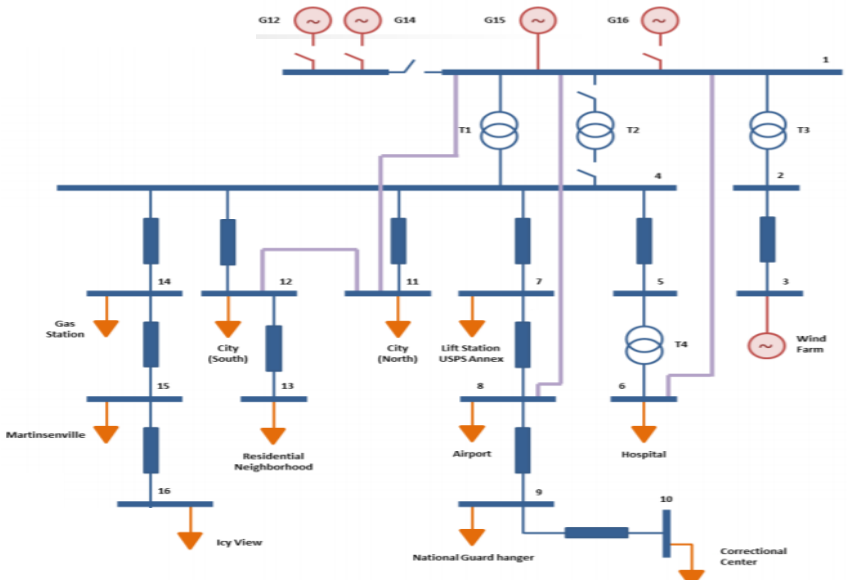
Introduction to RU-LESS Tool User Input Interface

Rutgers University

RU LESS

What does RU-LESS model solve?

- The arbitrary multi-locational micro-grid (MG) consists of:
  - Multiple demand nodes
  - Existing on-site generation/storage technologies



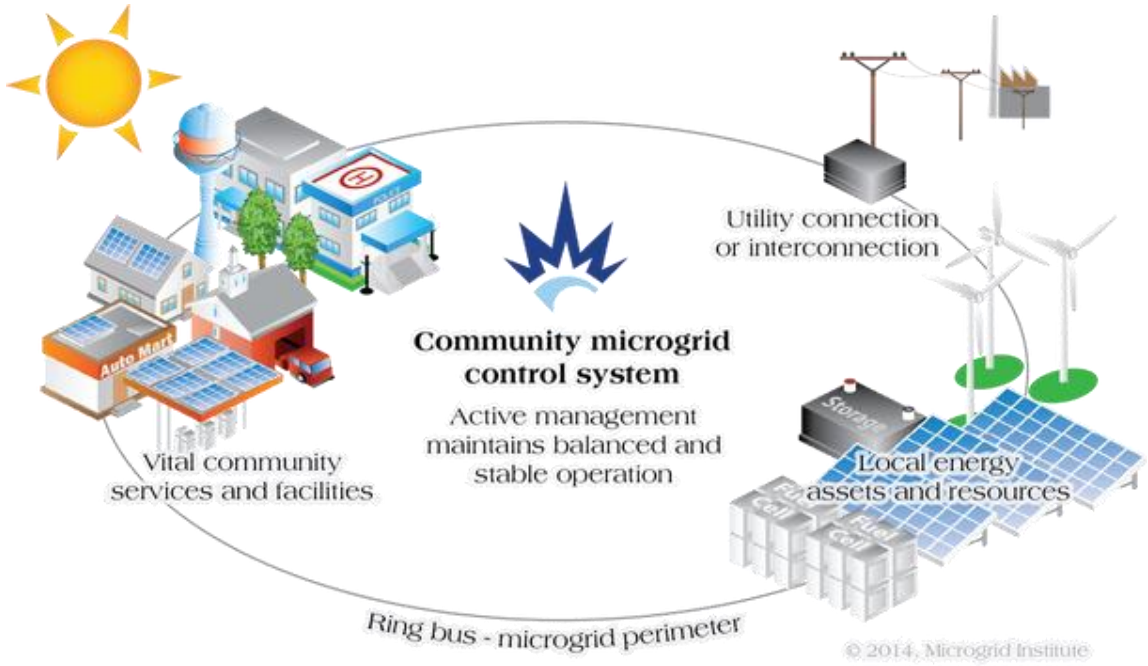
- We are interested to solve following problems:
  - What is the value of MG for distribution network?
  - What is the impact of MG on rate-payers financial?
  - What is the impact of MG on the grid?

What does RU-LESS optimization model offer?

- Impact of MG on the facility annual energy cost, located at different nodes.
- Impact of MG on the real / reactive power loss.
- Impact of MG on the voltage fluctuation at different nodes.
- Impact of MG on the peak electricity demand at different nodes.
    - This will result in capacity upgrade deferral.
- Impact of MG on the resiliency capability.

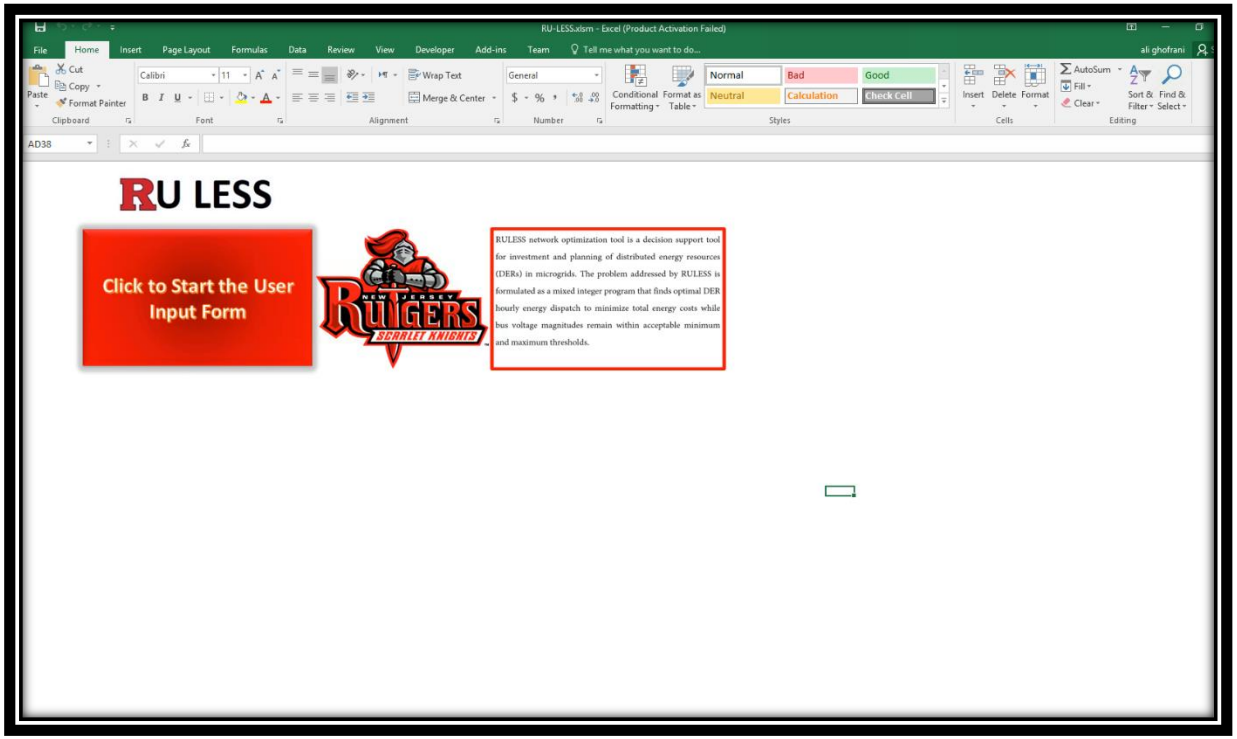
Data requirement in RU-LESS

- Pre-post configuration
  - The current or prior configuration of the system
  - The post configuration design and portfolio



RU-LESS Data Input Interface

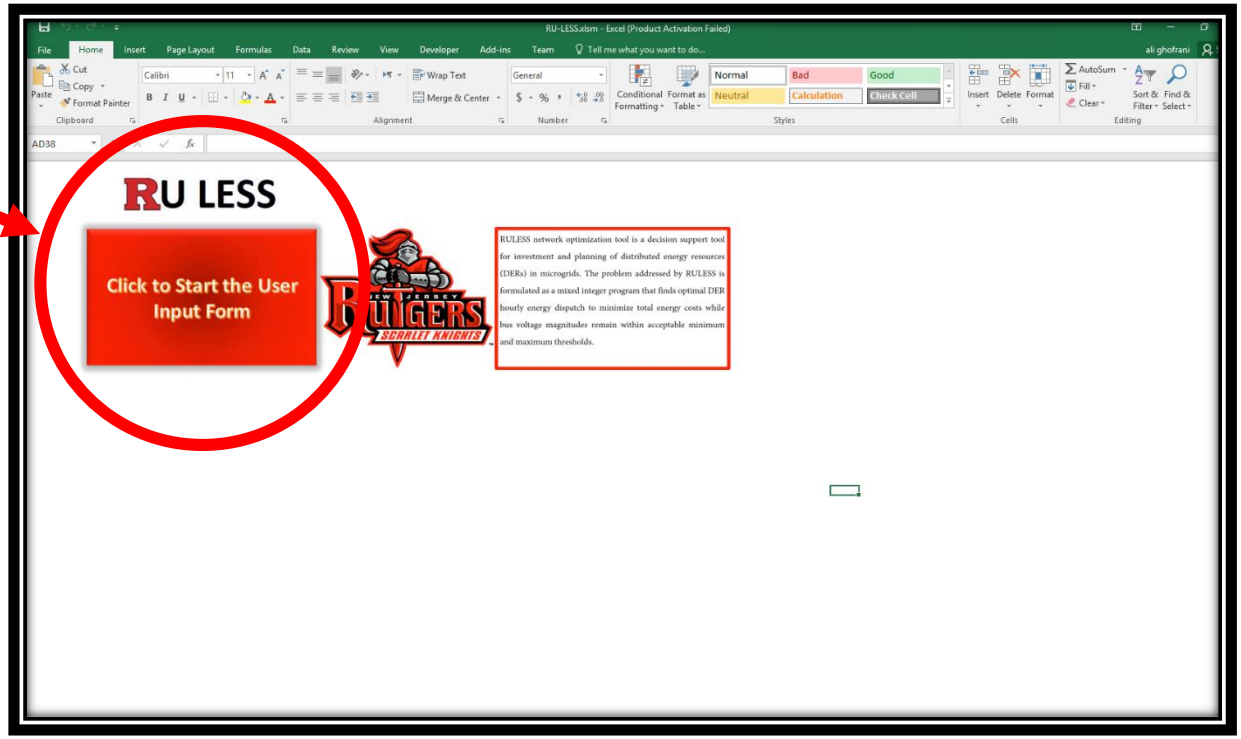
- Rutgers has developed a user-friendly graphical interface to collect the desired data for evaluation of the proposed TCMG configurations.
- There is no need to install any .exe file
- Two Excel files need to be opened by the user
  - Pre-Design
  - Post Design Case



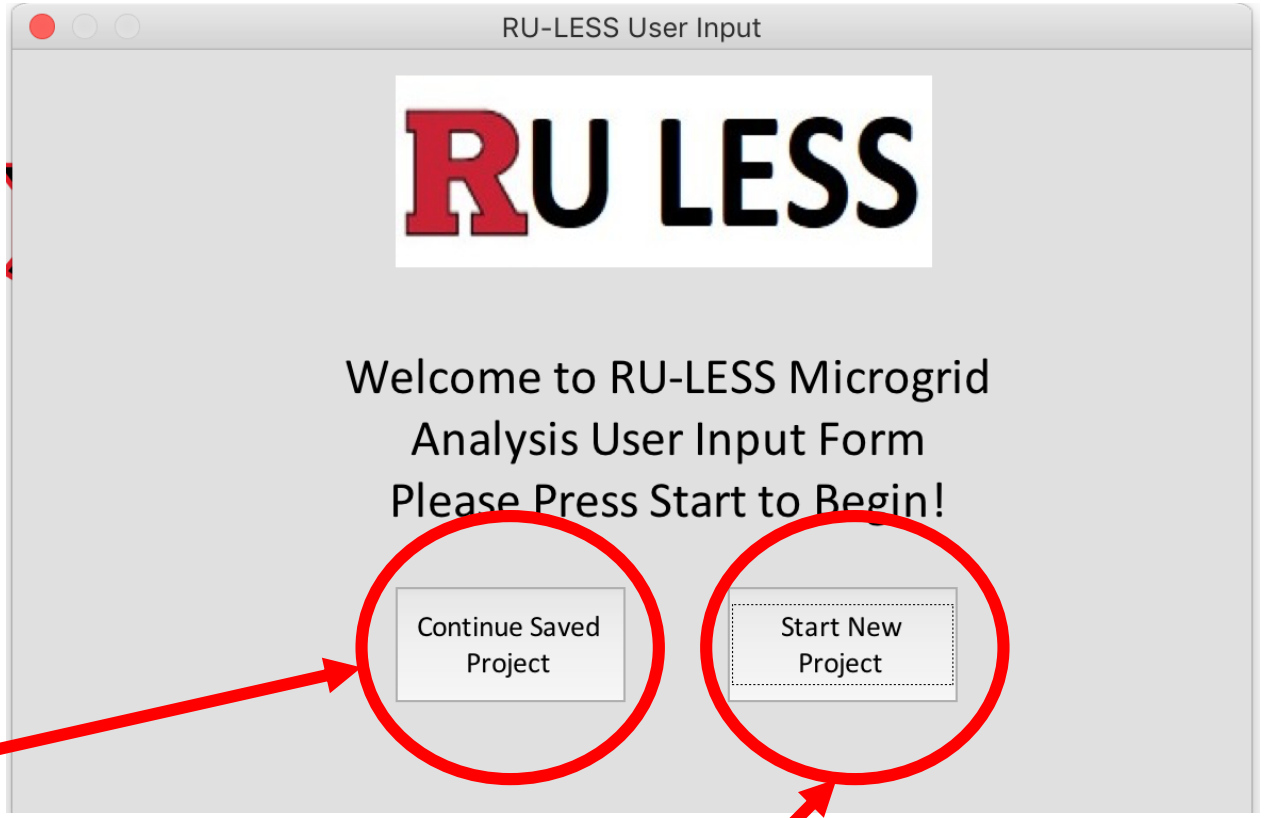
1- Initiation

- Simply open the Excel file and click on the red button to start the user forms

Click to start!



2- Start new project or continue saved projects

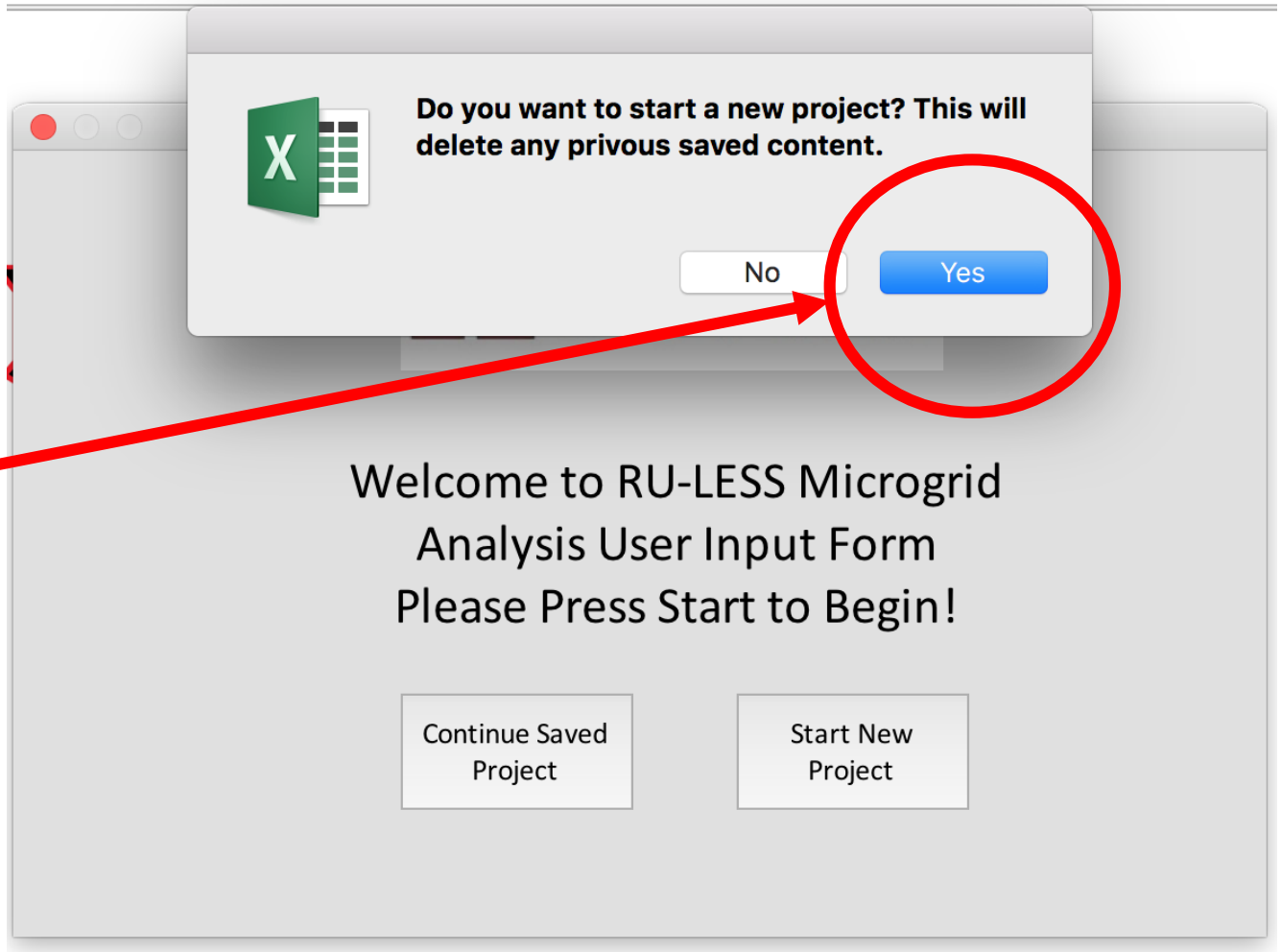


Click to continue saved projects

Click to start a new project

3- Start a new project

Deletes the previous projects and starts a new one



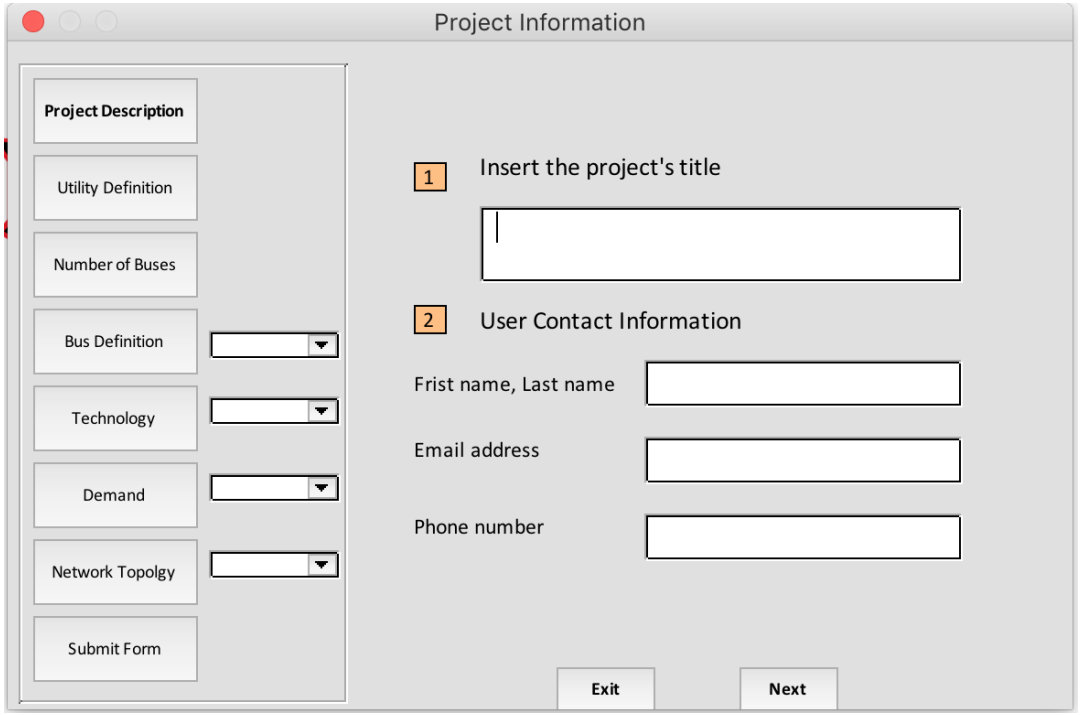
4- What information is needed?

- Project Description
- Utility information
- Number of buses
- Bus definition
- Technology description
- Demand definition
- Network topology
- Comments on data and submitting

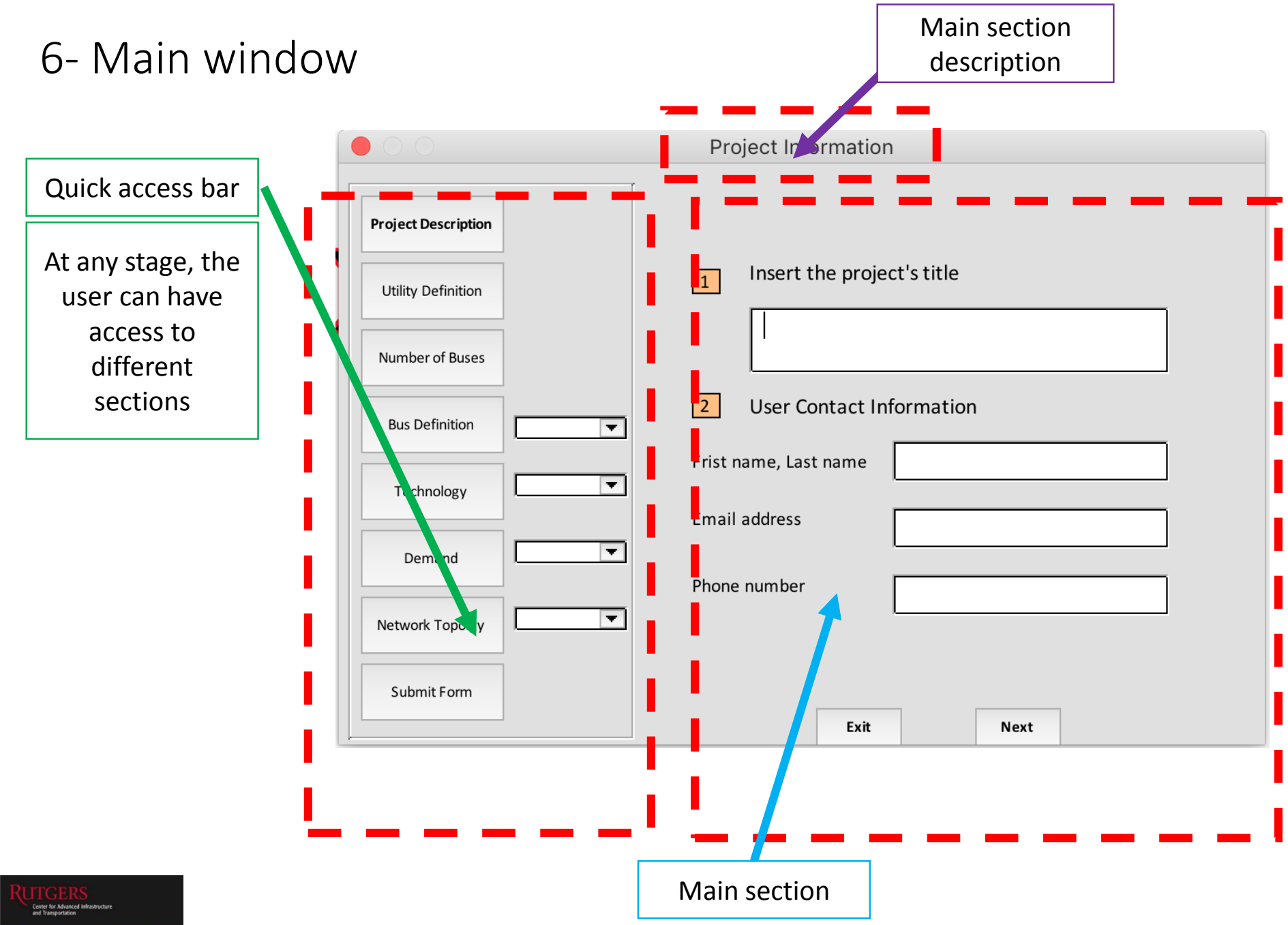
5- Inputsheet structure

At any stage of the process, the interface is composed of three main sections:

- Quick access bar: At any stage the user can have access to the preferred section
- Main section: The information is added in this section
- Section description: Presents details on the main section

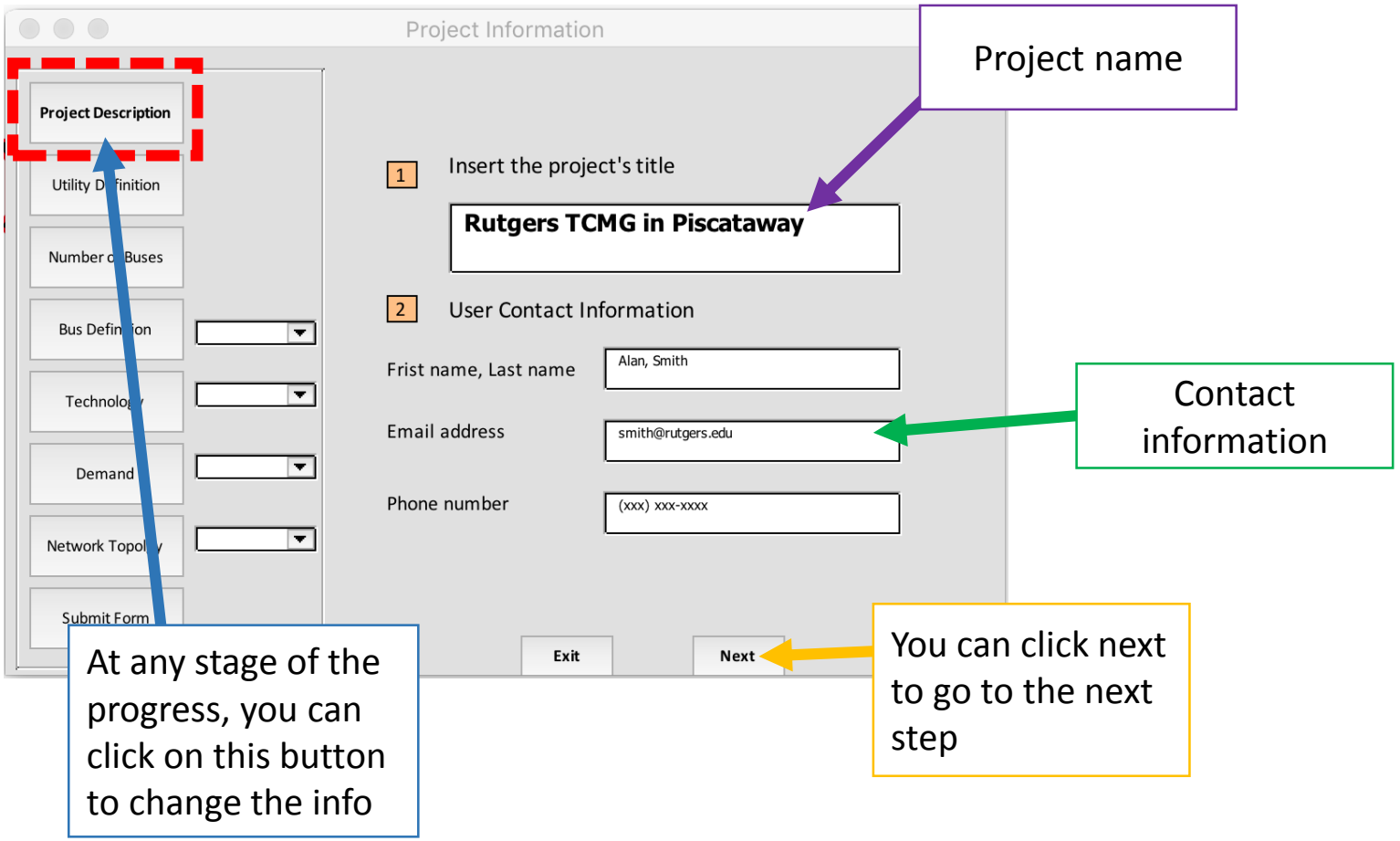


6- Main window



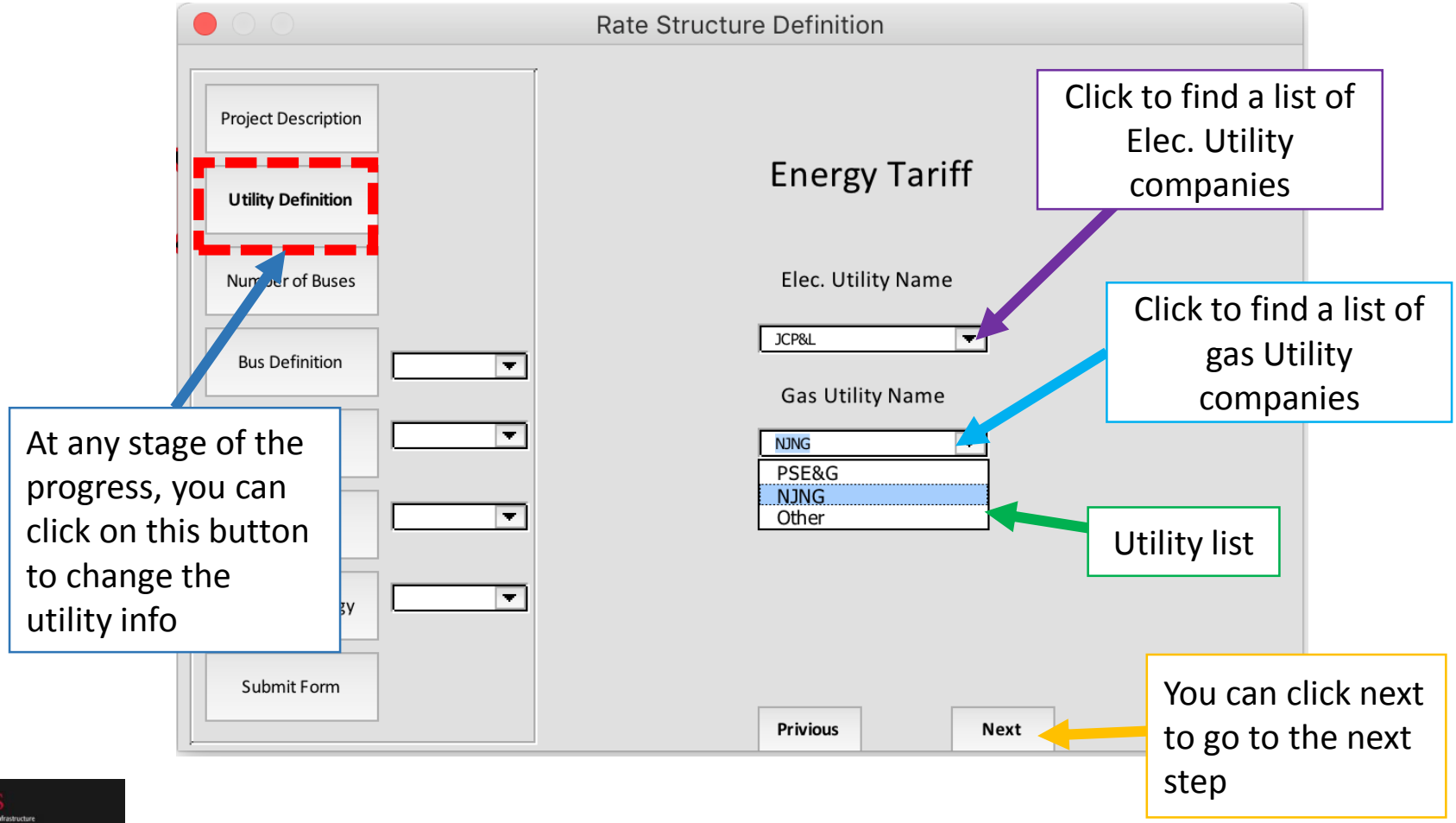
7- Project description

We need to first identify the project and acquire a point of contact for possible further discussion on the TCMG project



8- Utility

We need to know the rate structures that are used for this project. Please specify what Gas/Elec. utility company is involved in this project.

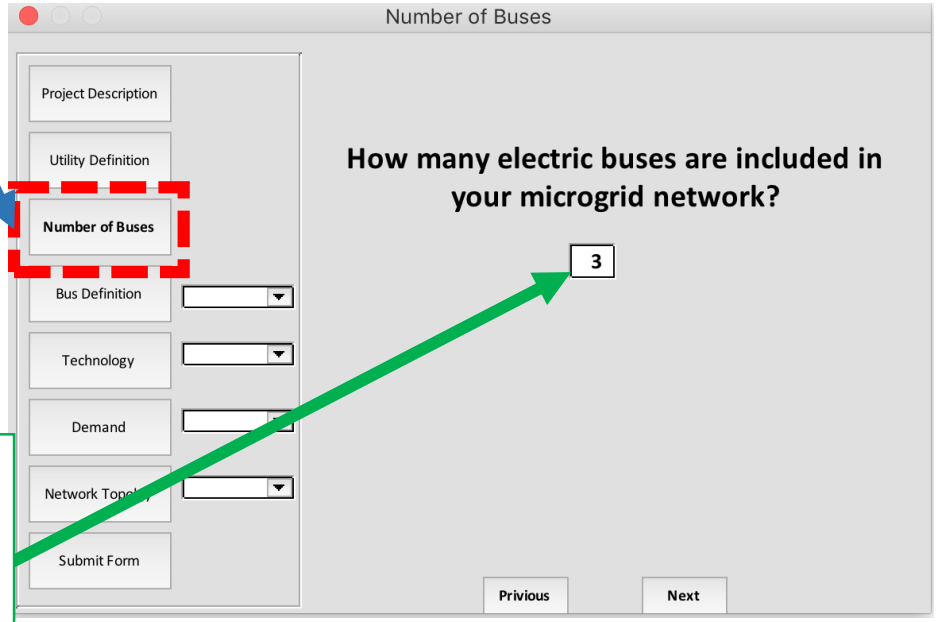


9- Number of buses

- ✓ Definition of bus: A bus (also called node) in a MG configuration is a location within the MG that contains:
  - Thermal or electric load (e.g. buildings)
  - Power generation technology
  - Cold/thermal/electric storage
  - Chiller and boiler
  - Common coupling point to the main power grid
- ✓ One can consider multiple elements described above to define a bus (We also call a bus “Node” as well)
  - These elements should be in a reasonable close vicinity
  - For instance, an office building and a district chiller, solar panels, and battery storage next to the building

We suggest the user first decide about the number of buses and make a list of the buses with the elements that are included

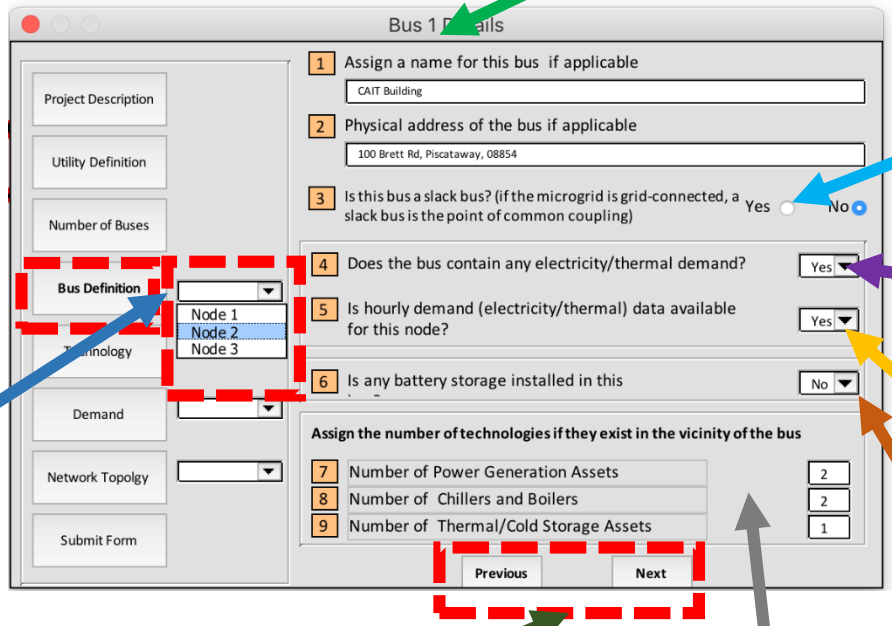
Quick access to this page. (changing the number of buses in the middle of the project is not suggested!)



Specify the number of buses

10- Bus/Node description

The Bus that is being described



Specify if the bus is a slack bus

Specify if the bus contains demand

Specify if the demand data is available

Specify if the bus contains battery

First select the desired bus (Node) from the dropdown button and click on **Bus Definition** button to jump to the page to describe that bus

Go to next or previous bus

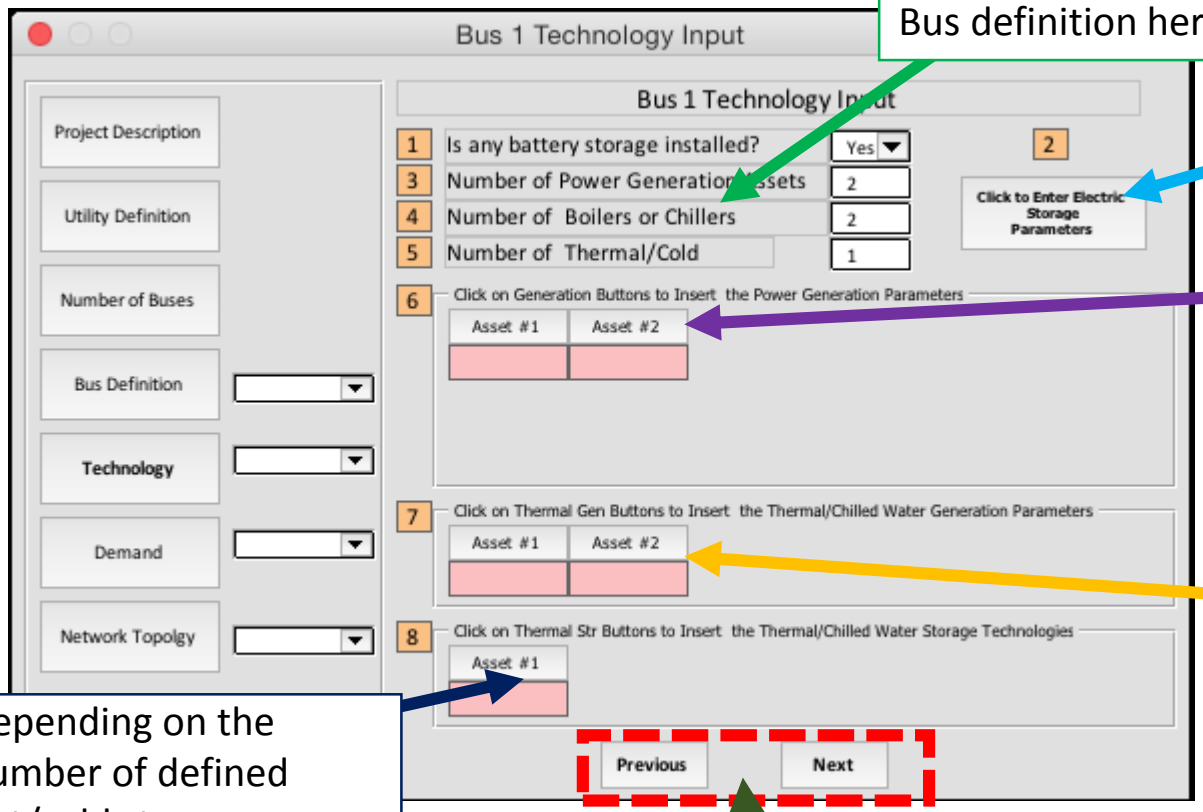
Specify number of different technologies

If the number of nodes is not assigned yet, you are not able to use the quick access buttons

Power generation technologies includes any type of generation such as renewable, CHP, etc.

Maximum number for assets in each node is:
1- Power generation: 12
2- Chiller/Boiler: 6
3- Thermal/Cold Storage: 6
If the number of assets exceeds the max, please use aggregate capacity and average the parameters.

11- Technology description



You can always change the values previously specified in Bus definition here

Battery Parameters

Depending on the number of defined technologies, press on the button to specify the parameters of that power gen technology

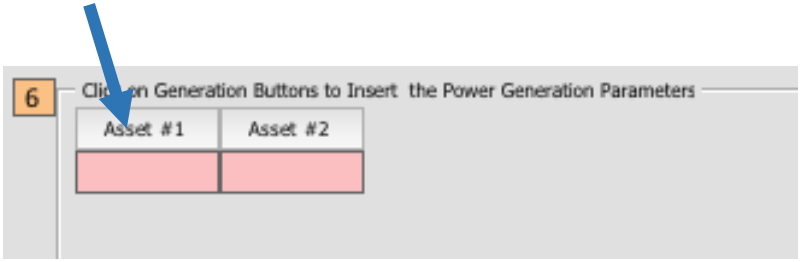
Depending on the number of defined chillers/boilers, press on the button to specify the parameters of that technology

Depending on the number of defined hot/cold storage, press on the button to specify the parameters of that technology

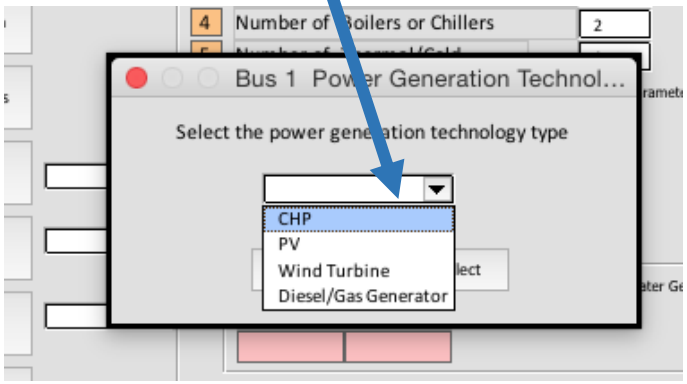
Go to next or previous bus

12- Technology parameters

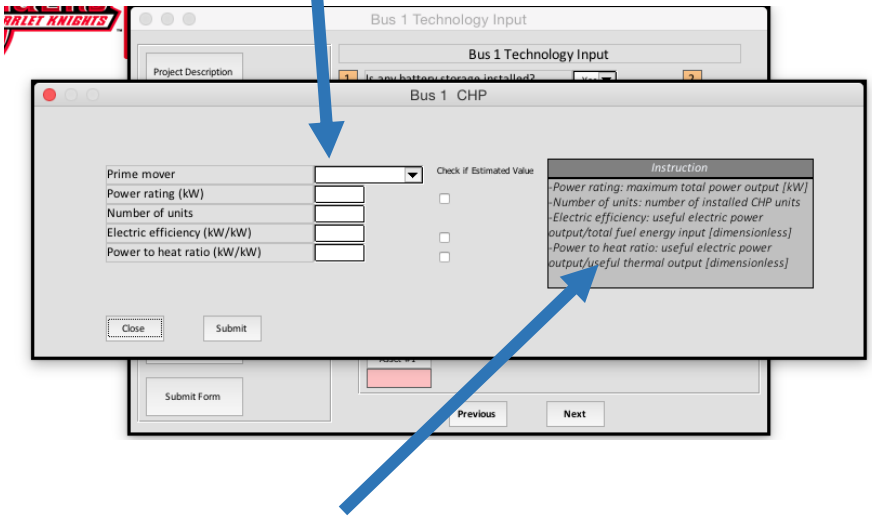
a- Select an asset



b-You can select the technology from the window

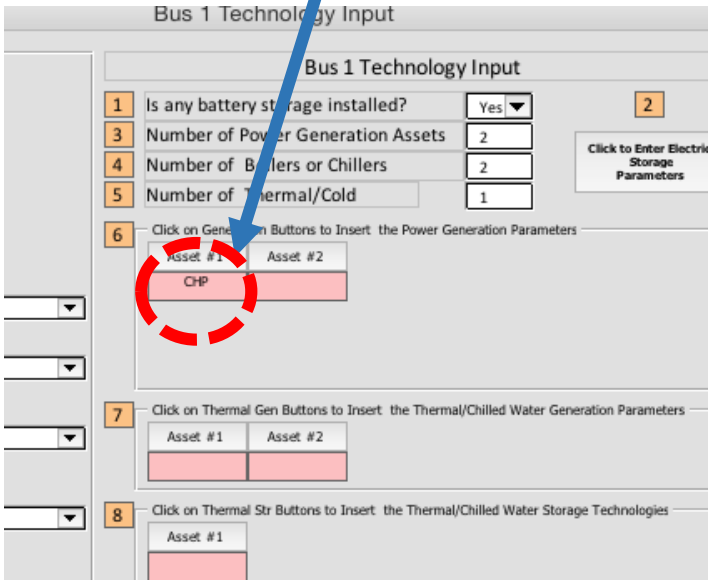


c-After selecting the technology, a list of parameters will be available to be filled out.



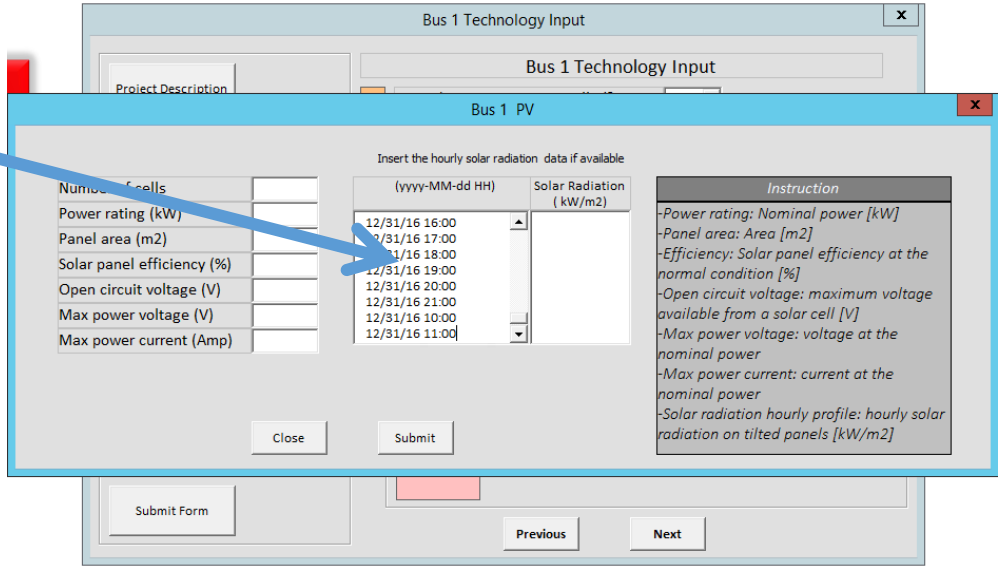
Instruction for the parameters

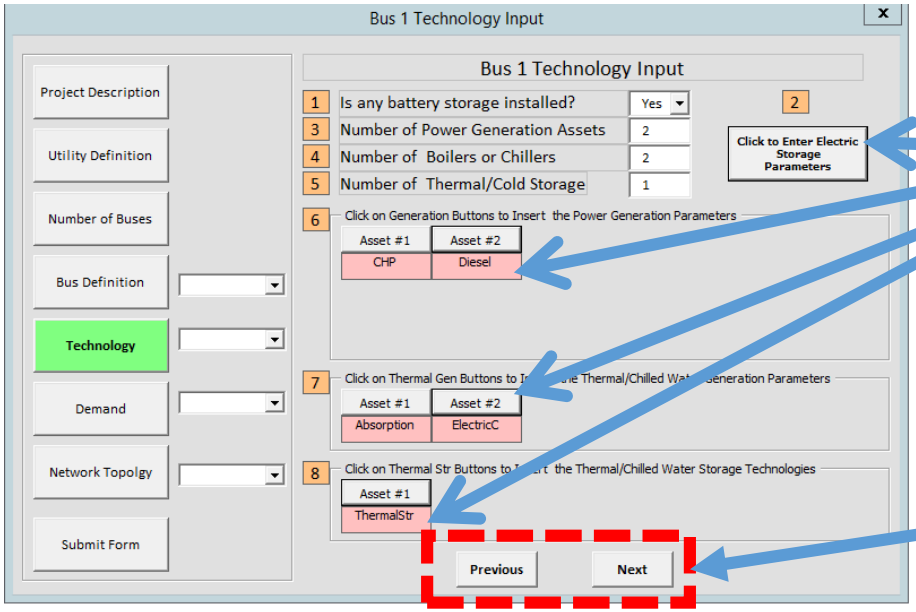
d-After filling out the parameters, the selected technology will show up under the asset number.



13- Technology parameters

For the sections that dataset is requested, simply copy and paste the desired column in the provided space.

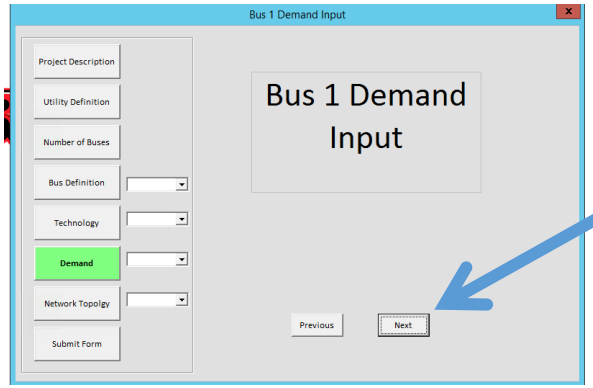




After completing the parameters for each technology, the assets are shown under the related section.

Go to next or previous step

14- Demand data

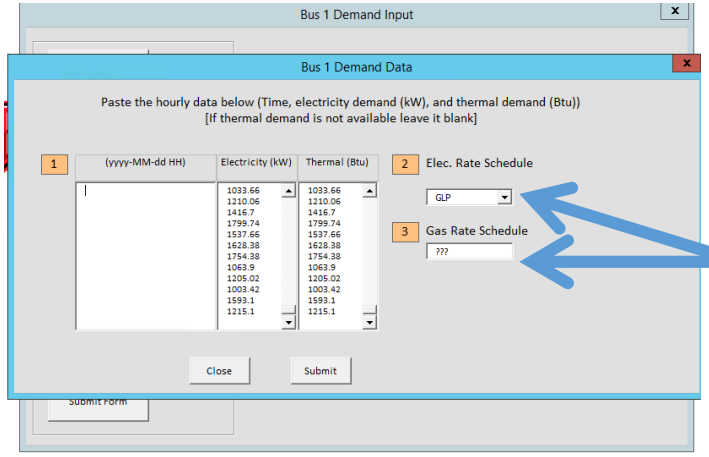


A- Click on next button to insert the demand

B- There are three cases:

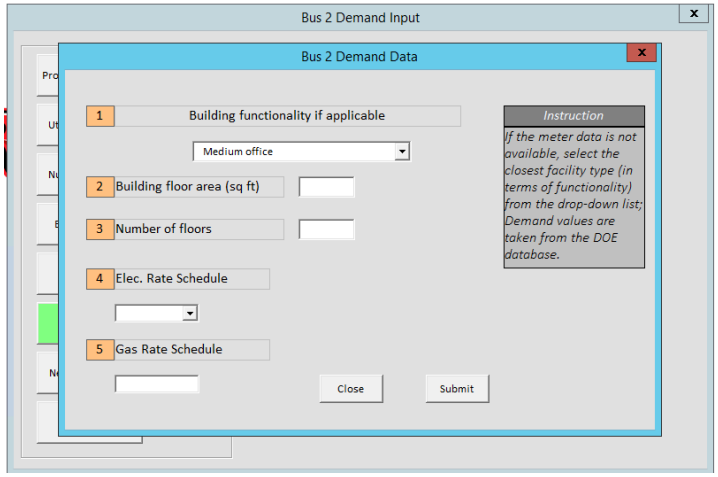
- The bus/node contains demand and demand data is available
- The bus/node contains demand and demand data is <u>not</u> available
- The bus/node does not contain demand

- The bus/node contains demand and demand data is available



Specify the rate schedules for elec. And gas

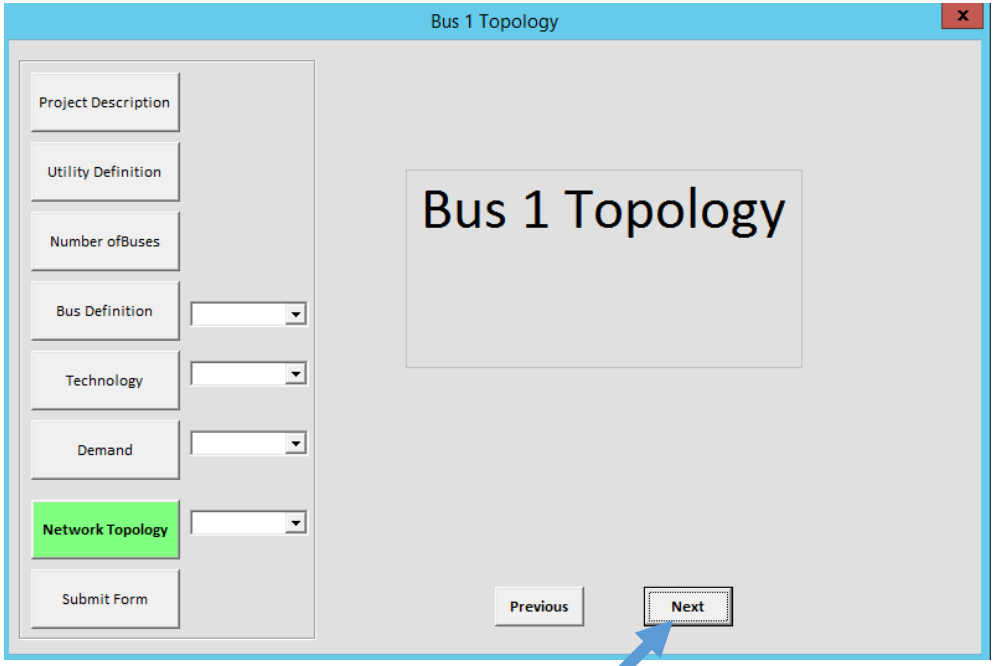
- The bus/node contains demand and demand data is <u>not</u> available



15- Network Topology

A- It should be specified how the current bus/node is connected to other buses/nodes.

- Cable connection between the nodes
- Piping connection between the nodes
  - Hot/medium/ low temp piping
  - Chilled water



Click next to access to the network connection for the bus

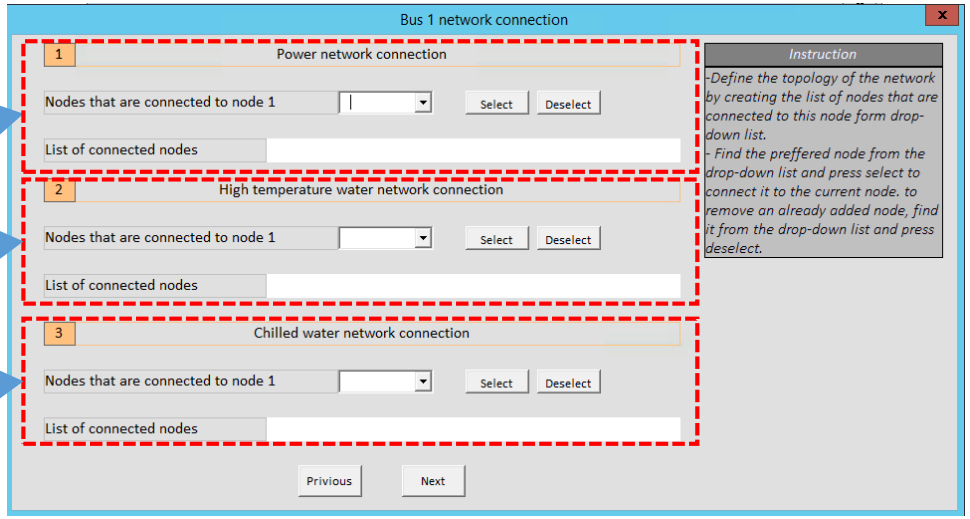
16- Network Topology connection

Three fields should be considered.

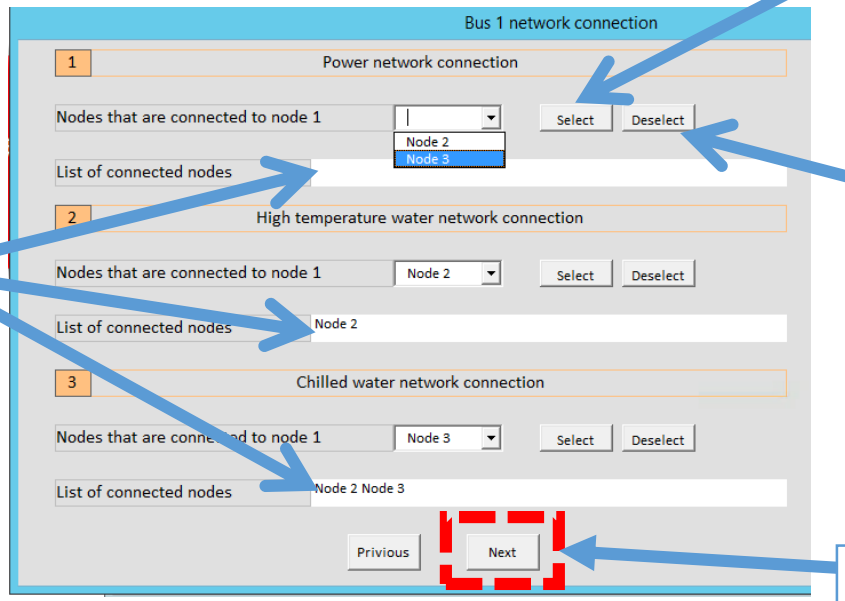
1- Power network

2- Hot/medium/low temp piping network

3- Chilled water piping network



Connected nodes to the current node will appear in these fields

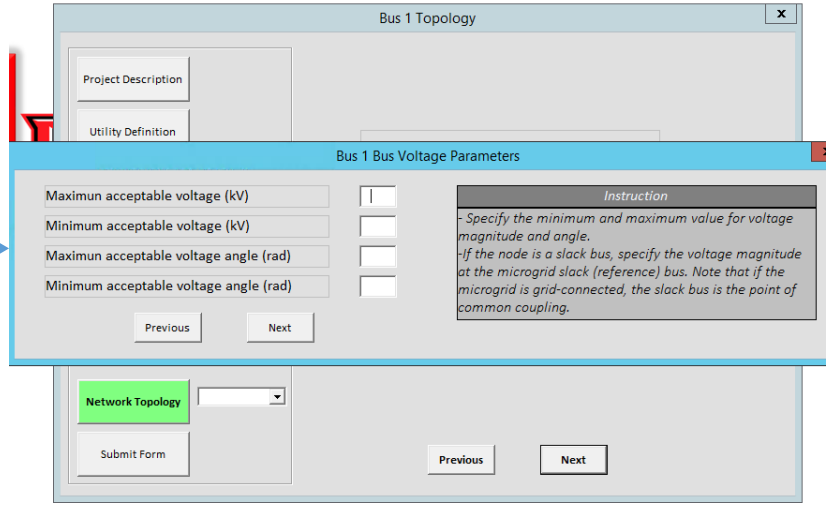


Select a bus/node from the list to connect it to the current bus/node. If you want to remove an already connected node select it from the list and press **Deselect**.

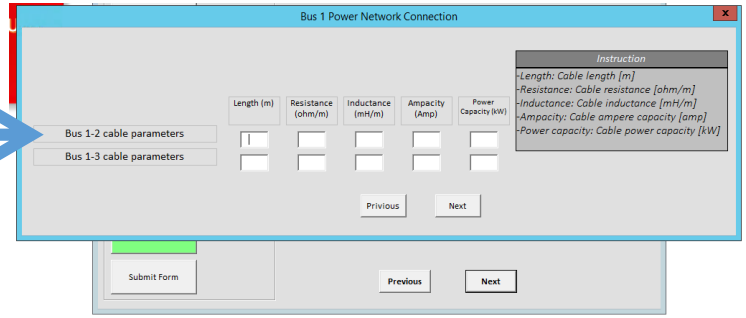
Go to next step

17- Power network constraints

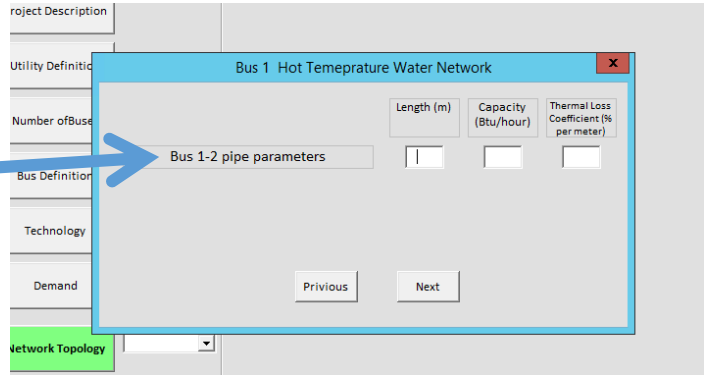
One has to specify maximum/minimum acceptable voltage and angles for the specific bus.



Details of the cables connecting nodes should be specified

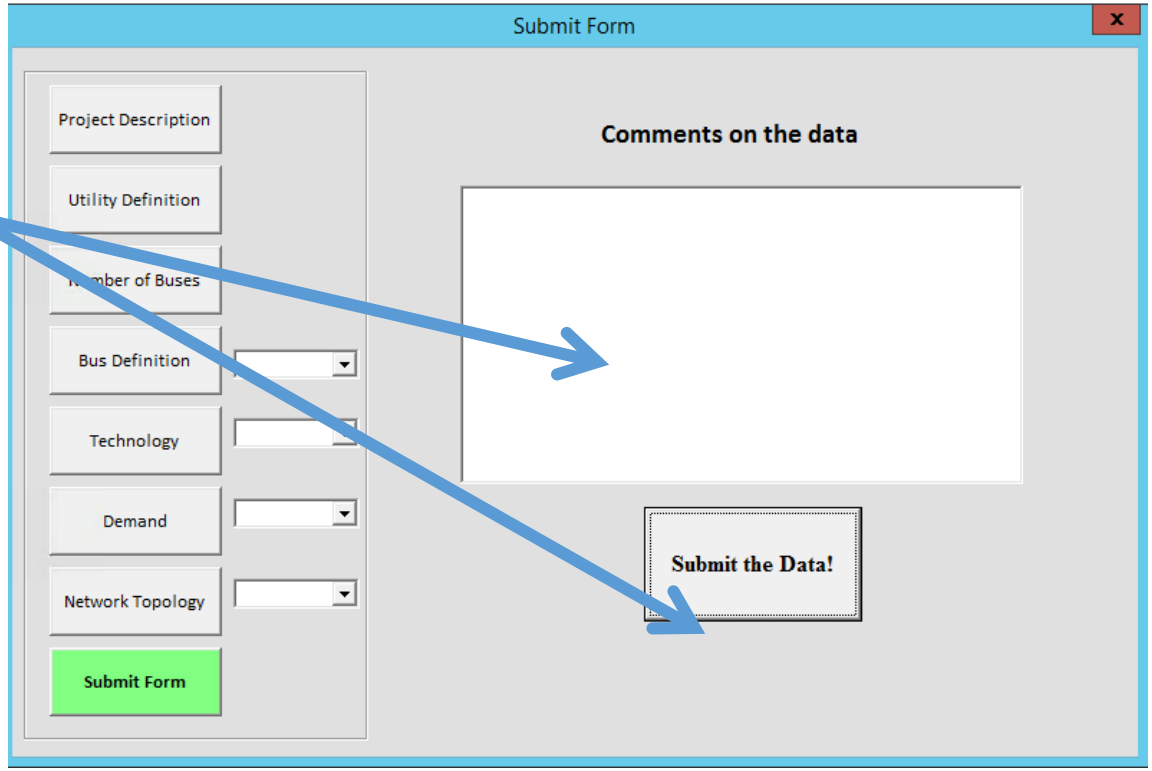


And also the piping system



18- Submit the data

After completion of the all steps, the user can submit the data and add any specific comment regarding the provided information



You can always save the files and continue the projects.

A pdf file (Form.pdf) will be generated for the review of the user. Also, the data will be available in .xls (FinalData.xls) in the same folder.

Before submitting the data, please make sure that the generated pdf and excel files are all closed!

19- Sending the data to LESS

RU-LESS requires the users to submit 3 files for pre-design and 3 files for post-design configurations. Please send the files to A.Ghofrani@rutgers.edu

File checklist:

1- RULESS-PRE.xlsm
2- RULESS-POST.xlsm
3- Form-PRE.pdf
4- Form-POST.pdf
5- FinalData-PRE.xls
6- FinalData-POST.xls