

In-house Training Workshop on “Household Demand Analysis”

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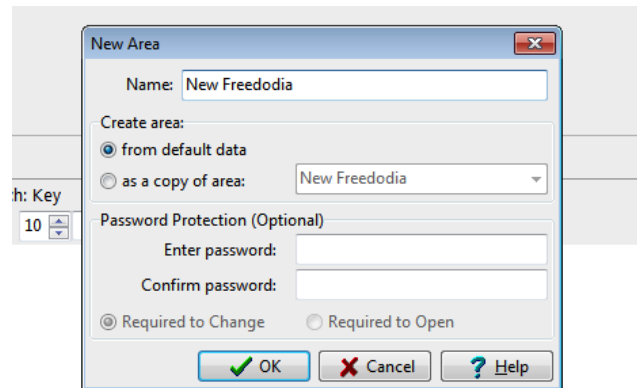
May 29th , 2016

Steps for demand

- 1 • Create new area
- 2 • Set basic parameter
- 3 • Create current account
- 4 • Create demand in current account: Urban and rural
- 5 • Create Reference scenario

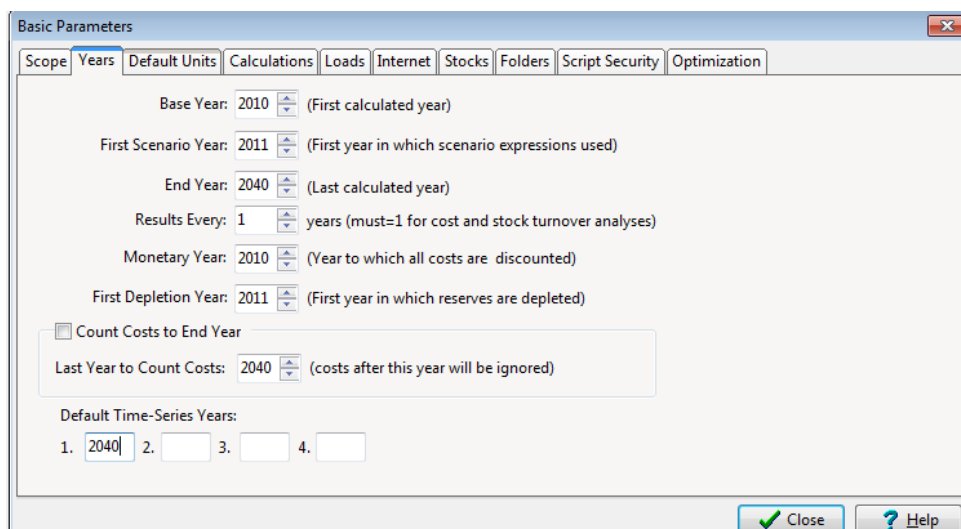
Create new area

➤ Go to “New” to make new data set called “New Freedonia”



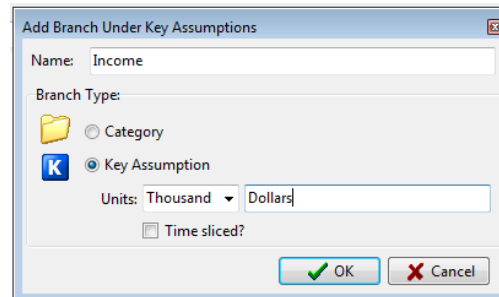
Set basic parameters

➤ Set the base year and end year



Create current account

- Go to “Key Assumptions”
- Create key assumptions
 - Income
 - Population
 - Household Size
 - Households
 - GDP
 - Income Growth_Rate
 - Pop Growth_Rate
 - End Year Urbanization



Create current account (cont')

- In the year 2010
 - Income 3 Thousand Dollars
 - Population Households[Million Households] * Household Size[People]
 - Household Size 5 people
 - Households 8 Million Households
 - GDP Population{Million People} * Income[Thousand Dollars]
 - Income Growth_Rate 3.5%
 - Pop Growth_Rate 2.5%
 - End Year Urbanization 45%

Branch: All Branches Variable: Activity Level Scenario: Current Accounts

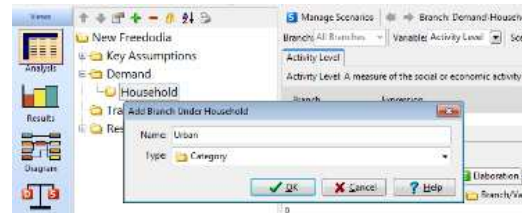
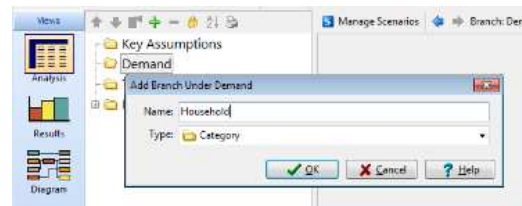
Key Assumptions

Key Assumptions: Macroeconomic, demographic or other variables not entered elsewhere. [Default="0"]

Branch	Expression	Scale	Units
Income	3	Thousand	Dollars
Population	Households[Million Households] * Household Size[People]	Million	People
Household Size	5		People
Households	8	Million	Households
GDP	Population[Million People] * Income[Thousand Dollars] ?calculated BY definition	Billion	US\$
Income Growth_Rate	3.5		%
Pop Growth_Rate	2.5		%
End Year Urbanization	45		%

Create demand folder

- Create category branch named “Household” under “Demand” folder by using “+” command
- Then, create folders named “Urban” and “Rural” under “Household” folder



Current account: Households

- Freedonia’s 40 million people are living in about 8 million households. 30% of these are in urban areas.

Branch	Expression	Scale	Units	Per
Household	8	Million	Household	
Urban	30	Percent	Share	of Households
Rural	Remainder(100)	Percent	Share	of Households

Current account: Urban and rural household demand

Urban

- All of Freedonia's urban residents are connected to the electric grid, and use electricity for lighting and other devices.
- 95% have refrigerators, which consume 500 KWh per year on average.
- The average urban household annually consumes 400 KWh for lighting.
- Other devices such as VCRs, televisions, and fans annually consume 800 KWh per urban household.
- 30% of Freedonia's urban dwellers use electric stoves for cooking: the remainder use natural gas stoves. All households have only one type of cooking device.
- The annual energy intensity of electric stoves is 400 KWh per household, for natural gas stoves it is 60 cubic meters per household.

Rural

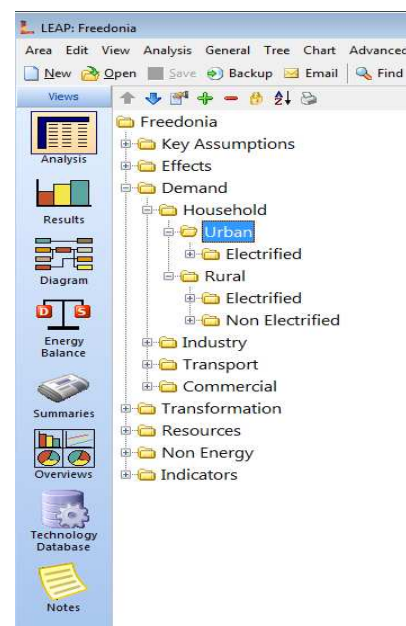
- Only 25% of rural households have access to grid-connected electricity.
- 20% of the electrified rural households own a refrigerator, which consumes 500 KWh per year on average.
- All electrified rural households use electricity for lighting, which consumes 335 KWh per household.
- 20% of these households also use kerosene lamps for additional lighting, using about 10 liters per year.
- Other electric devices (TV, radio, fans, etc.), account for 111 KWh per household per year.
- Non-electrified households rely exclusively on kerosene lamps for lighting, averaging 69 liters consumption per household per year

Cooking in Rural Freedonia

	<u>% Share of Rural HH</u>	<u>Energy Intensity per Household</u>
Charcoal Stove	30%	166 Kg
LPG Stove	15%	59 Kg
Wood	55%	525 Kg

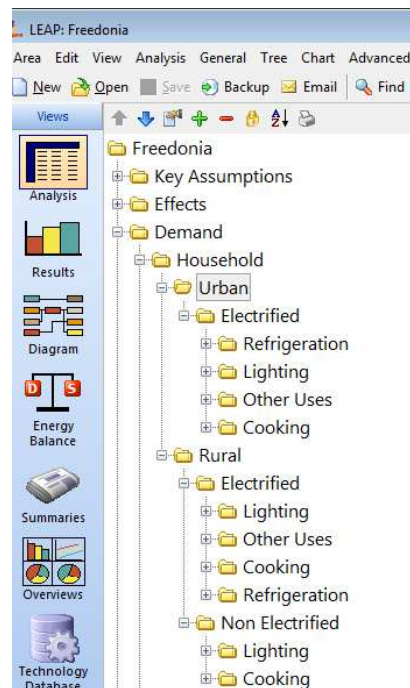
Current Account: Urban and rural household demand

- Create folder "Electrified" under Urban folder
- Then, create another two folders named "Electrified" and "Non Electrified" under Rural folder



Current Account: Urban and rural household demand

- Urban: create folder under “Electrified folder” named
 - Refrigerator
 - Lighting
 - Other Uses
 - Cooking
- Rural:
 - Electrified: do the same thing as Urban
 - Non electrified, there are only Lighting and Cooking folder



Current Account: Urban household

➤ Activity Level

➤ All of Freedonia’s urban residents are connected to the electric grid, and use electricity for lighting and other devices.

Branch	Expression	Scale	Units	Per
Household	8	Million	Household	
Urban	30	Percent	Share	of Households
▶ Electrified	100	Percent	Saturation	of Households

- 95% have refrigerator
- 100% have lighting, other uses and cooking

Branch	Expression	Scale	Units	Per
Household	8	Million	Household	
Urban	30	Percent	Share	of Households
Electrified	100	Percent	Saturation	of Households
▶ Refrigeration	95	Percent	Saturation	of Households
Lighting	100	Percent	Saturation	of Households
Other Uses	100	Percent	Saturation	of Households
Cooking	100	Percent	Saturation	of Households

Current Account: Urban household

➤ Activity level

➤ Create technology icon for each folder

➤ Refrigerator and Lighting

➤ Existing

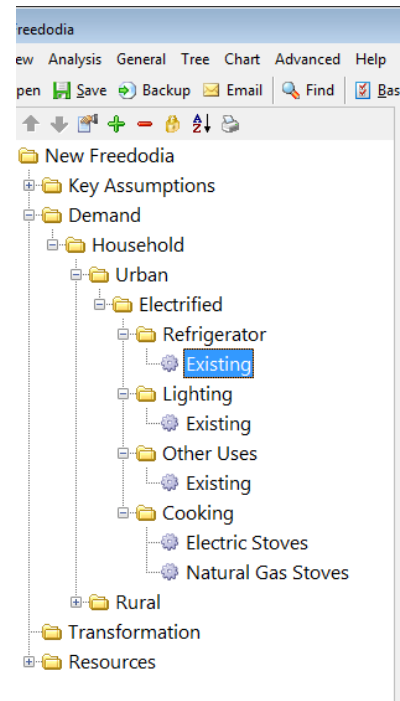
➤ Cooking

➤ Electric Stoves 30% share

➤ Natural Gas Stoves Remainder(100)

➤ Other uses

➤ All



Current Account: Urban household

➤ Activity Level: Electrified

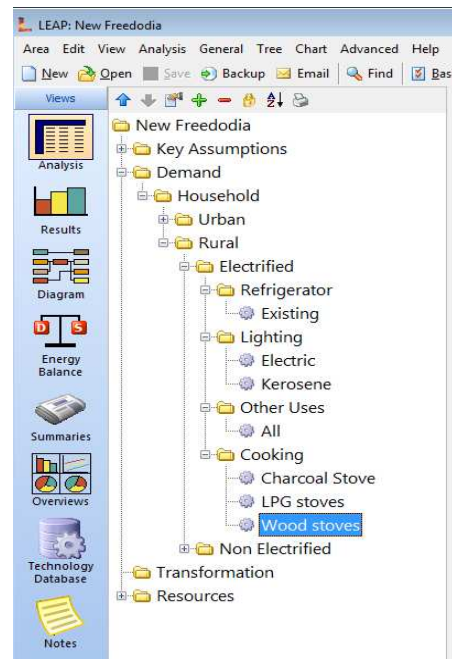
Name	Activity Level	Final Energy Intensity
Refrigerator Existing	95% Saturation	500 kWh
Lighting Electric	100% Saturation	400 kWh
Cooking Electric Stove NG Stoves	30% Share Remainder(100) Share	400 kWh 60 Cubic Meter
Other Uses All	100 % Saturation	800 kWh

Branch	Fuel	Expression	Scale	Units	Per
Electric Stoves	Electricity	400		Kilowatt-Hour	per Household
Natural Gas Stoves	Natural Gas	60		Cubic Meter	per Household

Current Account: Rural household

➤ Create technology icon for each folder

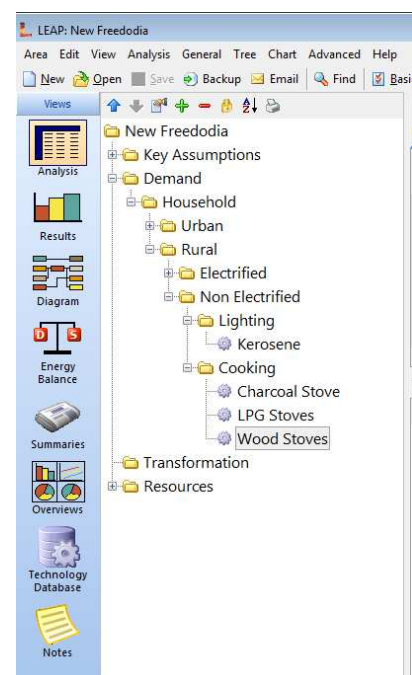
- Electrified
 - Refrigerator
 - Existing
 - Lighting
 - Electric
 - Kerosene
- Cooking
 - Charcoal Stove
 - LPG Stoves
 - Wood Stoves
- Other uses
 - All



Current Account: Rural household

➤ Create technology icon for each folder

- Non Electrified
 - Lighting
 - Kerosene
 - Cooking
 - Charcoal Stove
 - LPG Stoves
 - Wood Stoves



Current Account: Rural household

➤ Activity level

- Electrified 25% share
- Non Electrified Remainder(100)

Branch	Expression	Scale	Units	Per
Household	8	Million	Household	
Rural	Remainder(100)	Percent	Share	of Households
▶ Electrified	25	Percent	Share	of Households
Non Electrified	Remainder(100)	Percent	Share	of Households

Current Account: Rural household

➤ Activity Level: Electrified

Name	Activity Level	Final Energy Intensity
Refrigerator Existing	20% Saturation	500 kWh
Lighting Electric Kerosene	100% Saturation 20% Saturation	335 kWh 10 Liter
Cooking Charcoal Stove LPG Stoves Wood Stoves	30% Share 15% Share Remainder(100)	166 kg 59 kg 525 kg
Other Uses All	100 % Saturation	111 kWh

Current Account: Rural household

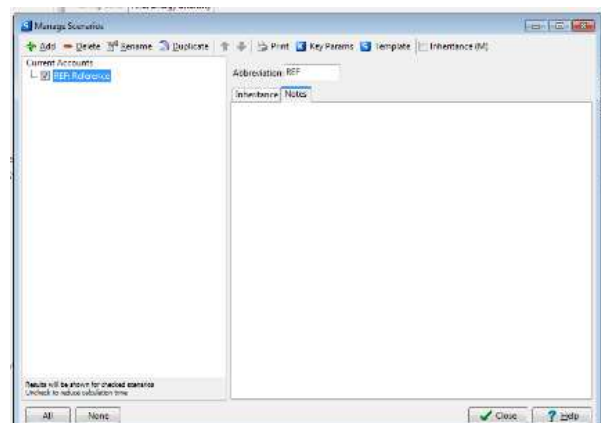
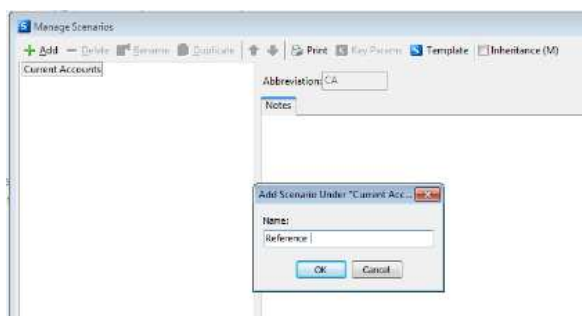
➤ Activity Level: Non Electrified

Name	Activity Level	Final Energy Intensity
Lighting Kerosene	100% Saturation 100% Share	69 Liter
Cooking Charcoal Stove LPG Stoves Wood Stoves	100% Saturation 30% Share 15% Share Remainder(100) Share	166 kg 59 kg 525 kg

Reference Scenario

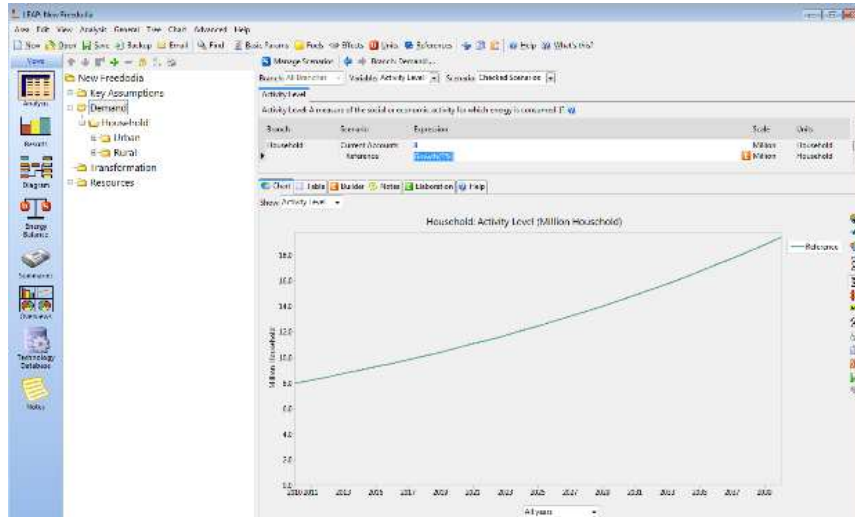
➤ Create reference scenario

- Click “Manage Scenarios” button
- Add Scenario named “Reference” and the abbreviation “REF”



Reference Scenario

- The number of households is expected to grow from 8 million in the year 2010 at 3% per year.



Check key assumptions

- Current Account and Reference Scenario

- Key Assumptions
 - Income
 - Population
 - Household Size
 - Households
 - GDP
 - Income Growth Rate
 - Pop Growth Rate
 - End Year Urbanization
- Effects
- Demand
- Transformation
- Resources
- Non Energy
- Indicators

Branch	Scenario	Expression	Scale	Units
Income	Current Accounts	3	Thousand	Dollars
	Reference	$Growth(Income\ Growth_Rate[\%]/100)$	Thousand	Dollars
Population	Current Accounts	$Households[Million\ Households] * Household\ Size[People]$	Million	People
	Reference	$Households[Million\ Households] * Household\ Size[People]$	Million	People
Household Size	Current Accounts	5		People
	Reference	5		People
Households	Current Accounts	8	Million	Households
	Reference	$Growth(Pop\ Growth_Rate[\%]/100)$	Million	Households
GDP	Current Accounts	$Population[Million\ People] * Income[Thousand\ Dollars]$	Billion	US\$
	Reference	$Population[Million\ People] * Income[Thousand\ Dollars]$	Billion	US\$
Income Growth Rate	Current Accounts	3.5		%
	Reference	3.5		%
Pop Growth Rate	Current Accounts	2.5		%
	Reference	2.5		%
End Year Urbanization	Current Accounts	45		%
	Reference	45		%

Reference Scenario: Urban household

- By 2040, 45% of Freedonia's households will be in urban areas.
- Type "Interp(2040, 45)" → Interp(end year value, value)

Branch	Scenario	Expression	Scale	Units	Per
Urban	Current Accounts	30	Percent	Share	of Households
	Reference	Interp(2040,45)	Percent	Share	of Households
Rural	Current Accounts	Remainder(100)	Percent	Share	of Households
	Reference	Remainder(100)	Percent	Share	of Households

Reference Scenario: Urban household

- Increased preference for electric stoves results in a 55% market share by 2040.
- Type "Interp(2040, 55)"

Branch	Scenario	Expression
Electric Stoves	Current Accounts	30
	Reference	Interp(2040, 55)
Natural Gas Stoves	Current Accounts	Remainder(100)
	Reference	Remainder(100)

- The energy intensity of electric and gas stoves is expected to decrease by half a percent every year due to the penetration of more energy-efficient technologies.

➤ Type "Growth(-0.5%)

Branch	Scenario	Fuel	Expression
Electric Stoves	Current Accounts	Electricity	400
	Reference	Electricity	Growth(-0.5%)
Natural Gas Stoves	Current Accounts	Natural Gas	60
	Reference	Natural Gas	Growth(-0.5%)

Reference Scenario: Urban household

- The energy intensity of electric and gas stoves is expected to decrease by half a percent every year due to the penetration of more energy-efficient technologies.
- Type "Growth(-0.5%)

Branch	Scenario	Fuel	Expression
▶ Electric Stoves	Current Accounts	Electricity	400
	Reference	Electricity	Growth(-0.5%)
Natural Gas Stoves	Current Accounts	Natural Gas	60
	Reference	Natural Gas	Growth(-0.5%)

Reference Scenario: Urban household

- As incomes rise and people purchase larger appliances, annual refrigeration intensity increases to 600 kWh per household by 2040.
- Similarly, annual lighting intensity increases to 500 kWh per household by 2040
- The use of other electricity-using equipment grows rapidly, at a rate of 2.5% per year.

Branch	Scenario	Fuel	Expression
▶ Existing	Current Accounts	Electricity	500
	Reference	Electricity	Interp(2040, 600)

Branch	Scenario	Fuel	Expression
▶ Existing	Current Accounts	Electricity	400
	Reference	Electricity	Interp(2040, 500)

Branch	Scenario	Fuel	Expression
▶ Existing	Current Accounts	Electricity	800
	Reference	Electricity	Growth(2.5%)

Reference Scenario: Rural household

➤ An ongoing rural electrification program is expected to increase the percentage of rural households with electricity service to 28% in 2020 and 50% in 2040.

➤ Type “Interp(2020, 28, 2040, 50)”

Branch	Scenario	Expression
Electrified	Current Accounts	25
	Reference	Interp(2020,28, 2040,50)
Non Electrified	Current Accounts	Remainder(100)
	Reference	Remainder(100)

Reference Scenario: Rural household

➤ As incomes increase, the energy intensity of electric lighting is expected to increase by 1% per year.

➤ The number of grid-connected rural homes using a refrigerator is expected to increase to 40% in 2020, and 66% in 2040.

➤ Due to rural development activities the share of various cooking devices in all households (both electrified and non-electrified) changes

➤ by 2040, LPG stoves are used by 55% of households, and

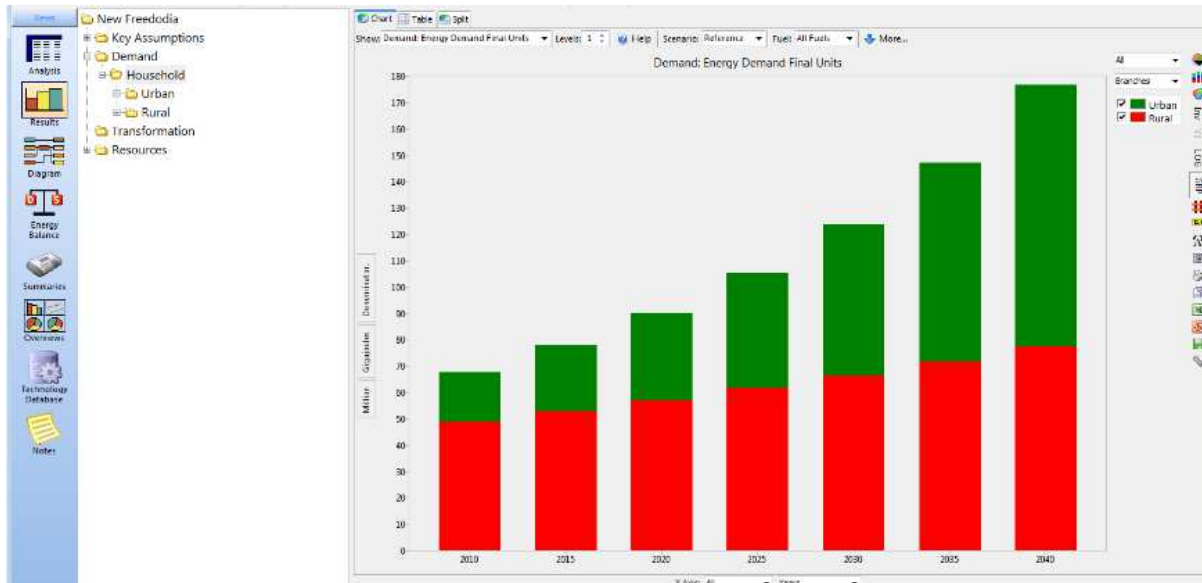
➤ charcoal stoves by 25%. The remaining rural households use wood stoves.

Branch	Scenario	Fuel	Expression
Electric	Current Accounts	Electricity	235
	Reference	Electricity	Growth(1%)
Kerosene	Current Accounts	Kerosene	10
	Reference	Kerosene	10

Branch	Scenario	Expression
Lighting	Current Accounts	100
	Reference	100
Other Uses	Current Accounts	100
	Reference	100
Cooking	Current Accounts	100
	Reference	100
Refrigeration	Current Accounts	20
	Reference	Interp(2020, 40, 2040, 66)

Branch	Scenario	Expression
Charcoal Stove	Current Accounts	30
	Reference	Interp(2040, 25)
LPG Stove	Current Accounts	15
	Reference	Interp(2040, 55)
Wood Stove	Current Accounts	Remainder(100)
	Reference	Remainder(100)

View the results



Thank you

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