

Institute for Global Environmental Strategies

Japan 2050 Low Carbon Navigator Japanese version of the UK 2050 Pathways Calculator



JAPAN 2050 Low Carbon Navigator

23 July 2014

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Institute for Global Environmental Strategies (IGES)*



What is the Japan 2050 Low Carbon Navigator?

- ✦ Japanese version of the UK 2050 Pathways Calculator;
- ✦ Simulation model for energy system and emissions;
- ✦ An interactive simple to communicate tool that allows:
 - ☞ *To answer the fundamental questions of how far we can reduce emissions and meet energy needs;*
 - ☞ *To develop your own combination of change in different technologies and sectors up to 2050;*
 - ☞ *To outline, in minutes, the results of energy and emissions in a transparent and evidence-based way.*



Why have we developed it?



JAPAN 2050
Low Carbon
Navigator

- ✦ Japan is committed to reduce its greenhouse gas emissions by 80% by 2050.
- ✦ After Fukushima accident in 2011, Japan is placed at the crossroads for deciding on its future energy structure.
- ✦ Japan will set post-2020 national mitigation target for the 2015 international agreement.

We believe that the Low Carbon Navigator can be used as a handy tool for engaging domestic policy dialogues and for education purposes.



How was the Low Carbon Navigator developed?

- ⊕ Developed jointly by IGES and NIES during May 2013 – July 2014;
- ⊕ Received various support from Japanese experts, the UK DECC, British Embassy Tokyo and MOEJ.
- ⊕ Built on the UK 2050 Calculator with Japanese ingredients:
 - ☞ *Japan-specific data on scenario setting, technology specifications, and social and economic indicators;*
 - ☞ *Uniqueness in setting five society scenarios for 2050 reflecting future social and economic development;*
 - ☞ *Level setting ranging from no efforts to high level of efforts (from L1 - L4) with an additional L5 for physical /technological limits.*
 - ☞ *Treatment of energy oversupply compared with demand levels.*

Questions can be addressed



- ☞ *How much energy can we supply from different energy technologies?*
- ☞ *How much energy do different sectors use and how can we change this?*
- ☞ *Which sectors are the one we should focus on? Which are less important?*
- ☞ *What could happen to our energy dependency and security?*
- ☞ *Without nuclear, what will be the energy mix for Japan to achieve the 80% emissions target by 2050?*
- ☞ *How much CO2 reduction can be achieved using the most ambitious renewable energy scenarios? At what cost?*
- ☞ *What is the full potential of CO2 reductions in Japan? At what cost? What does the low-carbon pathway look like?*



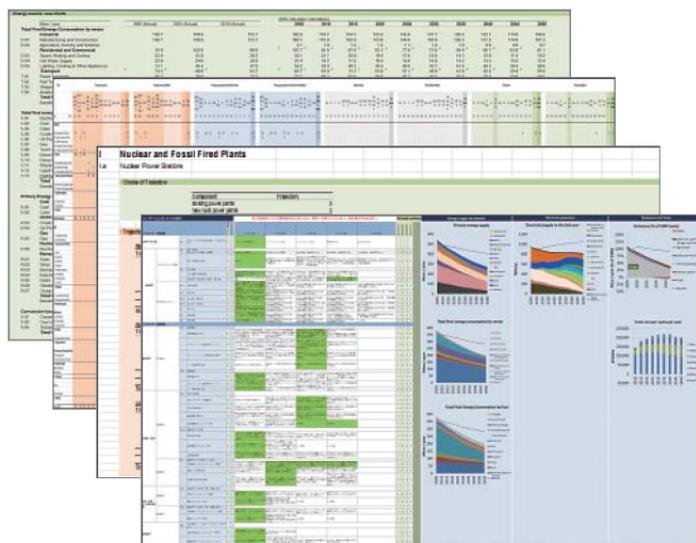
What does the Low Carbon Navigator look like?

✦ Two versions: the Excel version and the Web Tool.

Excel model: <http://www.en-2050-low-carbon-navi.jp/>

<http://www.2050-low-carbon-navi.jp/>

Web Tool: <http://www.2050-low-carbon-navi.jp/web/en/>



Excel Spreadsheet



Web Tool

How does it work?



01 Select trajectories

02 Calculate the outputs of each sector based on trajectory options

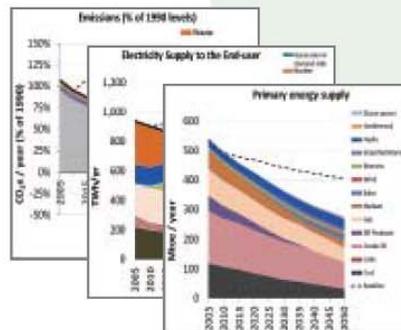


03 Generate the Energy Balance Table for each year

06 Rebuild of trajectories



05 Present the results



04 Compile the Intermediate Output Sheet by summarizing the Energy Balance Tables



How does it work?



01 Select trajectories

02 Calculate the outputs of each sector based on trajectory options

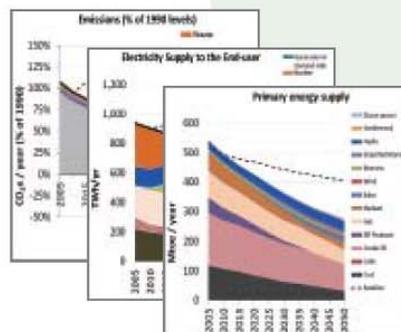


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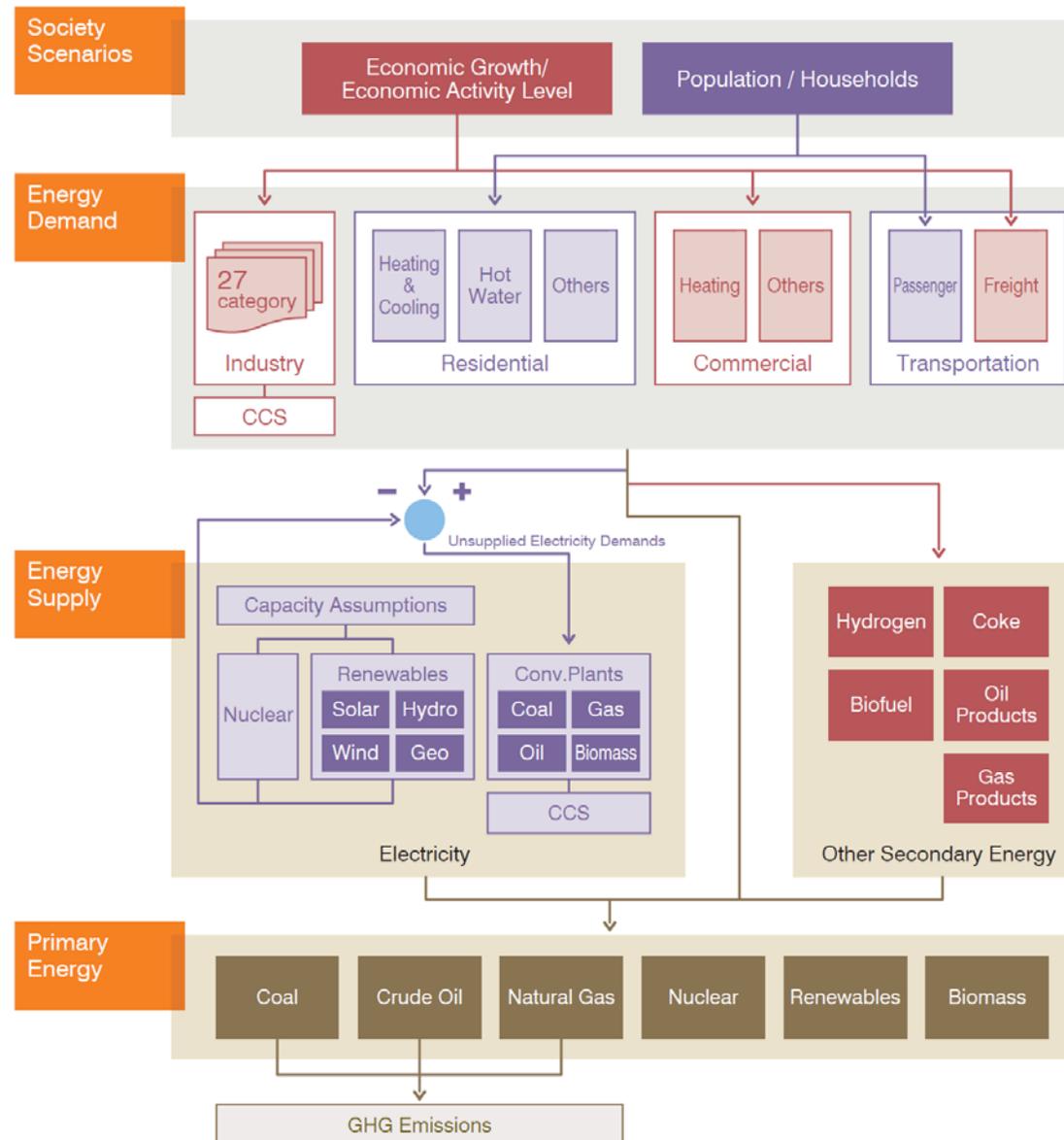
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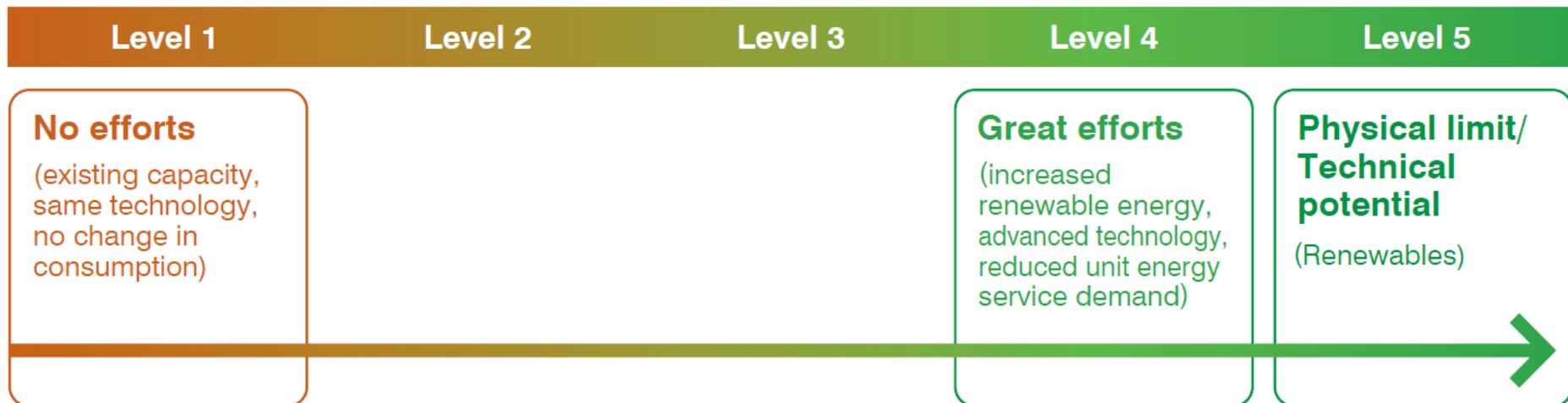
Sectoral coverage





Level setting under the Low Carbon Navigator

The Low Carbon Navigator sets out four or five (renewable energy and nuclear power) trajectories reflecting the whole range of potential future scenarios.





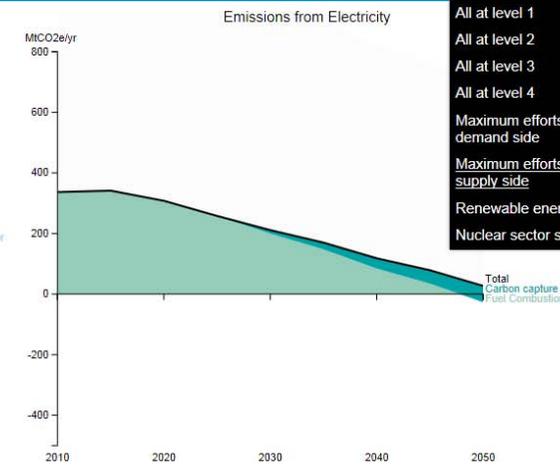
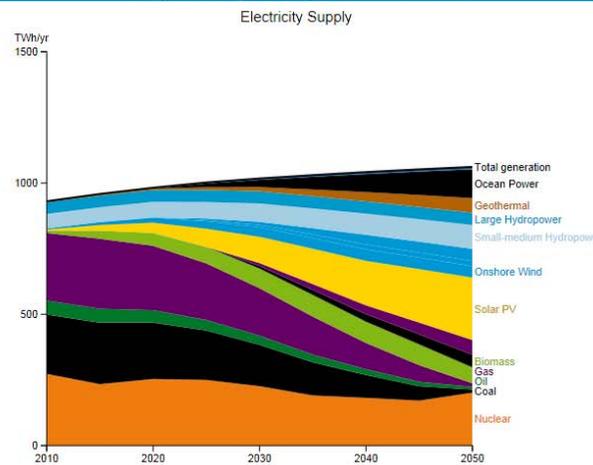
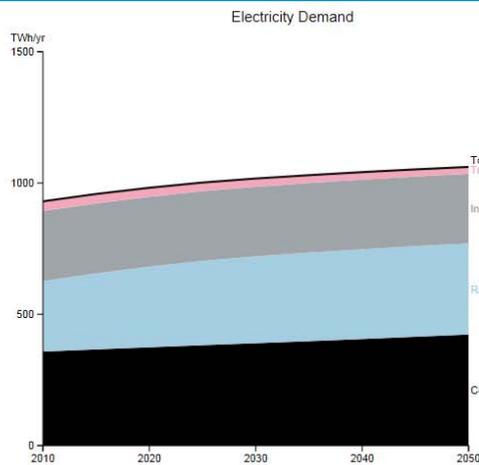
Example pathway: Maximum efforts from supply side



Society Scenario: **Research and Development (R&D) society** | Made-In-Japan (MIJ) society | Service and Brand (SB) society | Resource Independent (RI) society | Share society

Energy Electricity Security Flows Costs Share

Examples



- All at level 1
- All at level 2
- All at level 3
- All at level 4
- Maximum efforts from demand side
- Maximum efforts from supply side
- Renewable energy scenario
- Nuclear sector scenario

Passenger Transport Behaviour	?	1	2	3	4
Passenger Transport: Shift to Zero Emission	?	1	2	3	4
Passenger Transport: Choice of FCV or EV	?	1	2	3	4
Passenger Transport: Biofuel Blending	?	1	2	3	4
Freight Transport Behaviour	?	1	2	3	4
Freight Transport: Shift to Low Emission	?	1	2	3	4
Freight Transport: Biofuel Blending	?	1	2	3	4
Home Energy Management Level (for residential space heating, cooling and hot water)	?	1	2	3	4
Residential Heating and Cooling: Home Insulation	?	1	2	3	4
Residential Heating and Cooling: Electrification	?	1	2	3	4
Residential Heating and Cooling: Energy Efficiency	?	1	2	3	4
Residential Hot Water Supply: Technology Choice	?	1	2	3	4
Residential Hot Water Supply: Energy Efficiency	?	1	2	3	4
Residential Hot Water Supply: Solarthermal Boilers	?	1	2	3	4
Commercial Energy Service Demand for Heating, Cooling and Hot Water	?	1	2	3	4
Commercial Heating, Cooling and Hot Water: Building Insulation	?	1	2	3	4
Commercial Heating, Cooling and Hot Water: Technology Choice	?	1	2	3	4
Residential Appliances: Energy Demand per Household (Behavior)	?	1	2	3	4
Residential Appliances: Energy Efficiency	?	1	2	3	4
Commercial Appliances: Energy Demand per Floor Space (Behavior)	?	1	2	3	4
Commercial Appliances: Energy Efficiency	?	1	2	3	4
Industry: Energy Intensity per Industrial Output	?	1	2		
Industry: Energy mix in the industry	?	1	2	3	4

Nuclear: Restart Existing Power Plants	?	?	?	?	4	5
Nuclear: Building of New Power Plants	?	?	?	?	4	5
Fossil Fuel Power Plants: Fuel Mix	?	?	?	?	4	
Solar PV	?	?	?	?	4	5
Onshore Wind	?	?	?	?	4	5
Offshore Wind	?	?	?	?	4	5
Floating Wind	?	?	?	?	4	5
Small-Medium Hydropower	?	?	?	?	4	5
Geothermal Power	?	?	?	?	4	5
Ocean Power	?	?	?	?	4	5

Fossil Fuel Power Plants: Availability of CCS: [?] [?] [?] [?] [?] [?]

Based on excel version 1. For inquires, please contact the Green Economy Area, IGES. E-mail: ge-info@iges.or.jp



Example pathway: Maximum efforts from supply side



Society Scenario

Research and Development (R&D) society

Made-In-Japan (MIJ) society

Service and Brand (SB) society

Resource Independent (RI) society

Share society

Energy Electricity Security Flows Costs Share

Examples

Dependence on imported energy

The calculator assumes that any available biomass is preferred over fossil fuels and that domestically produced fuels are preferred over imports. It assumes that fossil fuels are imported to cover any shortfall.

Imports	2010		2050	
	Mtoe/yr (2010=100)		Mtoe/yr (2010=100)	
Coal	112	100	56	50
Oil Products	215	100	146	68
Gas	90	100	49	55
Nuclear	60	100	44	74
Imported Biomass	0	--	7	--
Imported energy	477	100	303	63

Diversity of energy sources

There may be a benefit from maintaining a diversity of energy sources:

Proportion of energy supply	2010		2050	
Nuclear	9%		11%	
Solar	0%		5%	
Wind	0%		2%	
Hydro	4%		8%	
Geothermal	0%		1%	
Ocean power	0%		2%	
Bioenergy	2%		4%	
Coal	17%		15%	
Oil	58%		38%	
Gas	10%		13%	

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Home Energy Management Level (for residential space heating, cooling and hot water)	?	1	2	3	4
Residential Heating and Cooling: Home Insulation	?	1	2	3	4
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Residential Hot Water Supply: Solarthermal Boilers	?	1	2	3	4
Commercial Energy Service Demand for Heating, Cooling and Hot Water	?	1	2	3	4
Commercial Heating, Cooling and Hot Water: Building Insulation	?	1	2	3	4

Nuclear: Restart Existing Power Plants	?	1	2	3	4	5
Nuclear: Building of New Power Plants	?	1	2	3	4	5
Fossil Fuel Power Plants: Fuel Mix	?	1	2	3	4	5
Solar PV	?	1	2	3	4	5
Onshore Wind	?	1	2	3	4	5
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Fossil Fuel Power Plants: Availability of CCS

?	1	2	3	4
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All at level
All at level
All at level
All at level
Maximum demand
Maximum supply side
Renewable
Nuclear s

Example pathway: Maximum efforts from supply side



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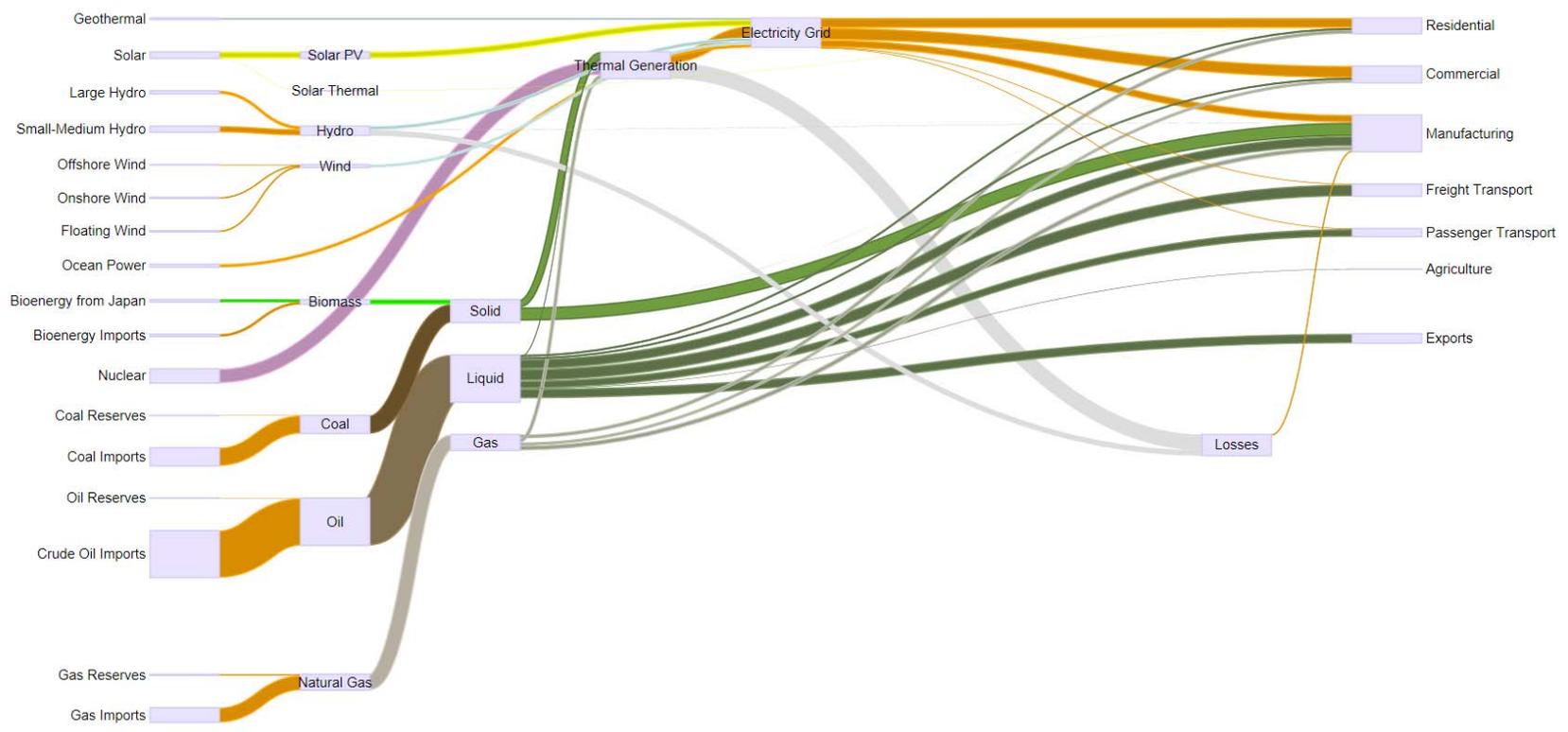


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Society Scenario

- Research and Development (R&D) society
- Made-In-Japan (MIJ) society
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- Resource Independent (RI) society
- Share society

Energy Electricity Security Flows Costs Share Examples





Example pathway: Maximum efforts from supply side

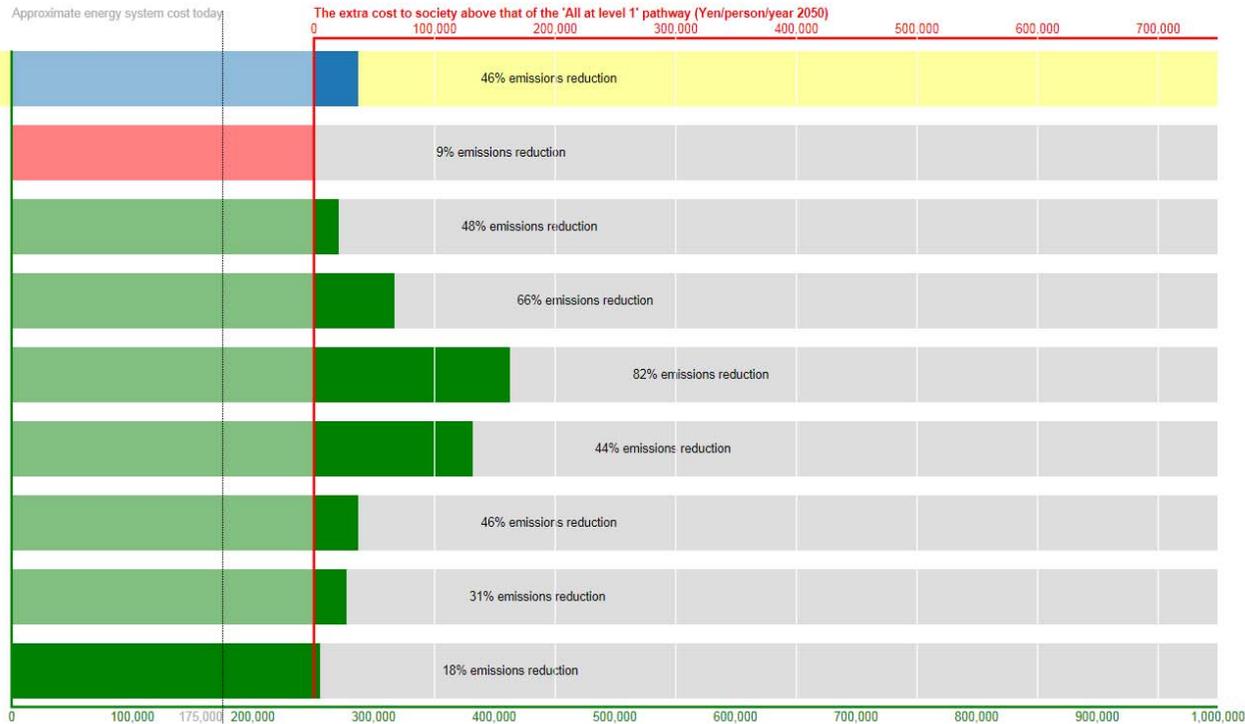


Society Scenario ? **Research and Development (R&D) society** Made-In-Japan (MIJ) society Service and Brand (SB) society Resource Independent (RI) society Share society

Energy Electricity Security Flows **Costs: context** Share

Examples

The cost to society of your pathway. This is not your energy bill.
For comparison, Japan average GDP 2010-2050 is forecast to be roughly ¥5.3 million per person.



The absolute cost to society of the whole energy system (mean undiscounted real yen per person per year 2050)

Note: The cost of failing to tackle climate change is not included. [Show the caveats again](#)

Passenger Transport Behaviour

? 1 2 3 4

Nuclear: Restart Existing Power Plants

? 1 2 3 4 5

Fossil Fuel Power Plants: Availability of CCS

? 1 2 3 4 5

Passenger Transport: Shift to Zero Emission

? 1 2 3 4

Nuclear: Building of New Power Plants

? 1 2 3 4 5



Example pathway: Maximum efforts from supply side



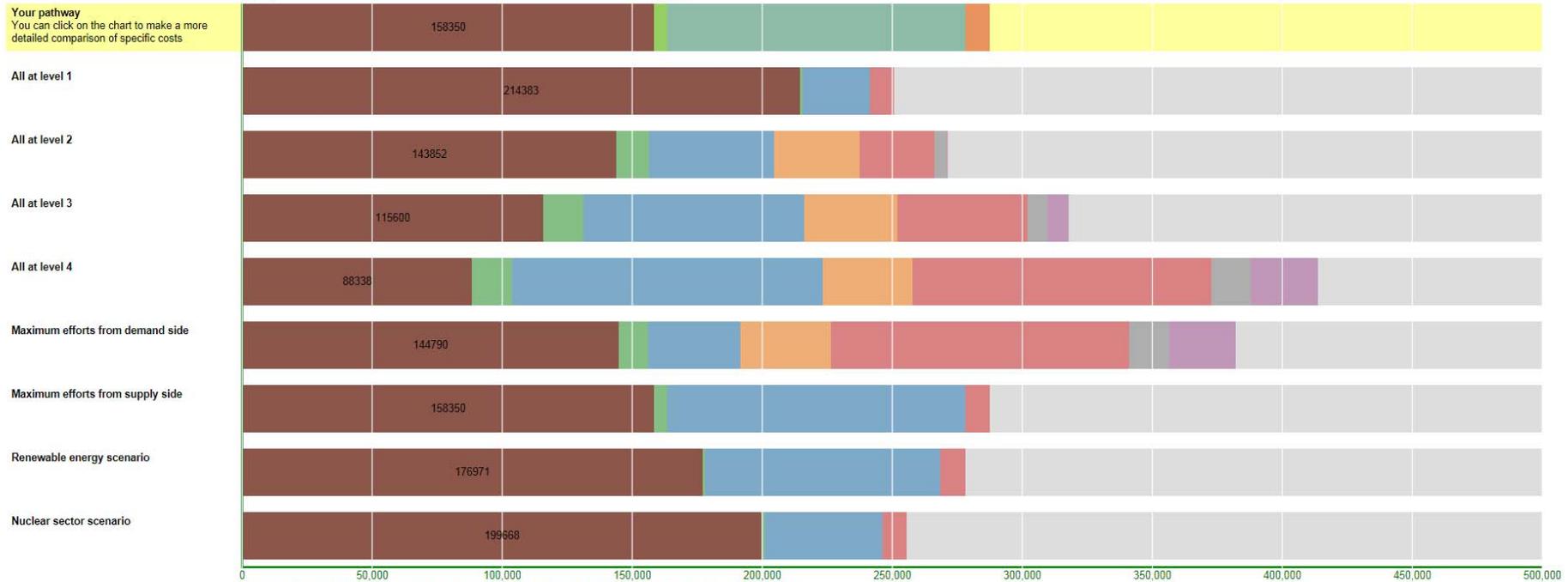
Society Scenario Research and Development (R&D) society Made-In-Japan (MIJ) society Service and Brand (SB) society Resource Independent (RI) society Share society

Energy Electricity Security Flows **Costs: compared** Share

Examples

The cost of your pathway, compared with other pathways. This is not your energy bill.

Fossil Fuels for use in buildings, transport, electricity generation and industry detail



The absolute cost to society of the whole energy system (undiscounted real pounds per person per year 2050)

Note: The cost of failing to tackle climate change is not included. [Show the caveats again](#)

Passenger Transport Behaviour 1 2 3 4
 Passenger Transport: Shift to Zero Emission 1 2 3 4
 Passenger Transport: Choice of FCV or EV 1 2 3 4
 Passenger Transport: Diesel Blend 1 2 3 4

Nuclear: Restart Existing Power Plants 4 5
 Nuclear: Building of New Power Plants 4 5
 Fossil Fuel Power Plants: Fuel Mix 4 5
 Solar PV 4 5

Fossil Fuel Power Plants: Availability of CCS 4



Example pathway: Maximum efforts from supply side



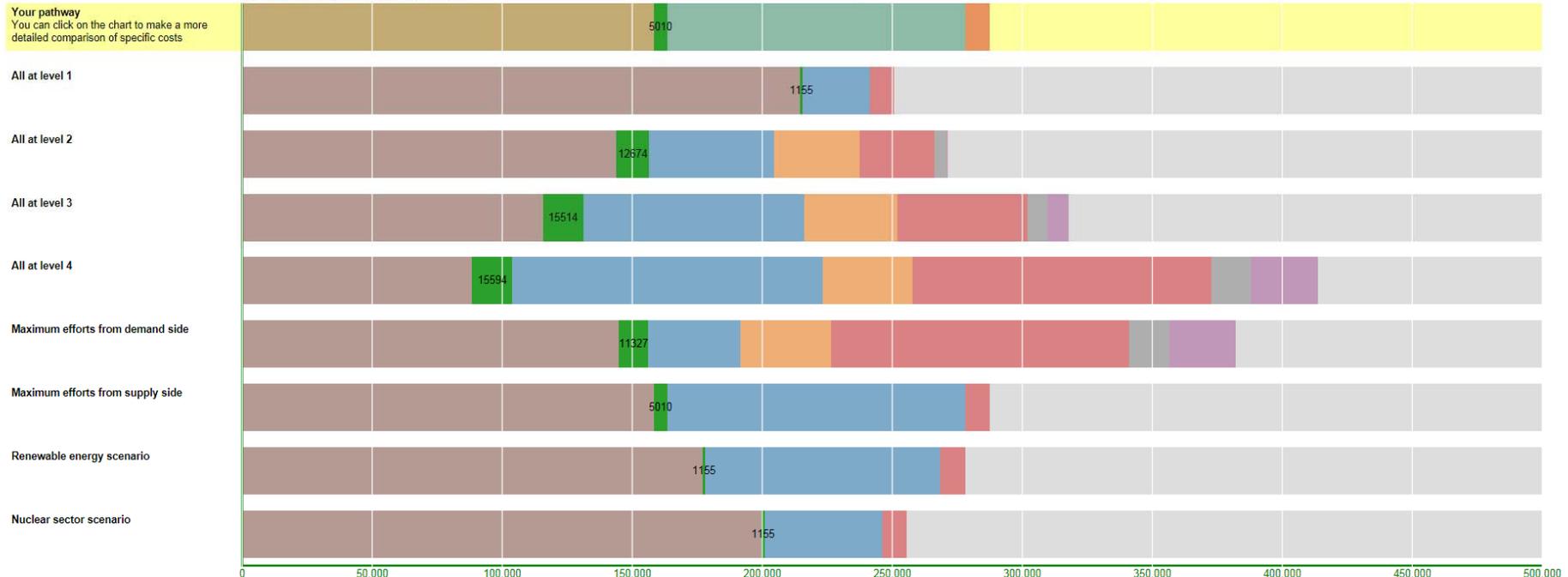
Society Scenario

Energy Electricity Security Flows **Costs: compared** Share

Examples

The cost of your pathway, compared with other pathways. This is not your energy bill.

Move your mouse over a coloured bar to see what **Bioenergy for use in buildings, transport, electricity generation and industry**



The absolute cost to society of the whole energy system (undiscouted real pounds per person per year 2050)

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Passenger Transport Behaviour
 Passenger Transport: Shift to Zero Emission
 Passenger Transport: Choice of FCV or EV
 Passenger Transport: Diesel Blend

Nuclear: Restart Existing Power Plants
 Nuclear: Building of New Power Plants
 Fossil Fuel Power Plants: Fuel Mix
 Solar PV

Fossil Fuel Power Plants: Availability of CCS



Example pathway: Maximum efforts from supply side



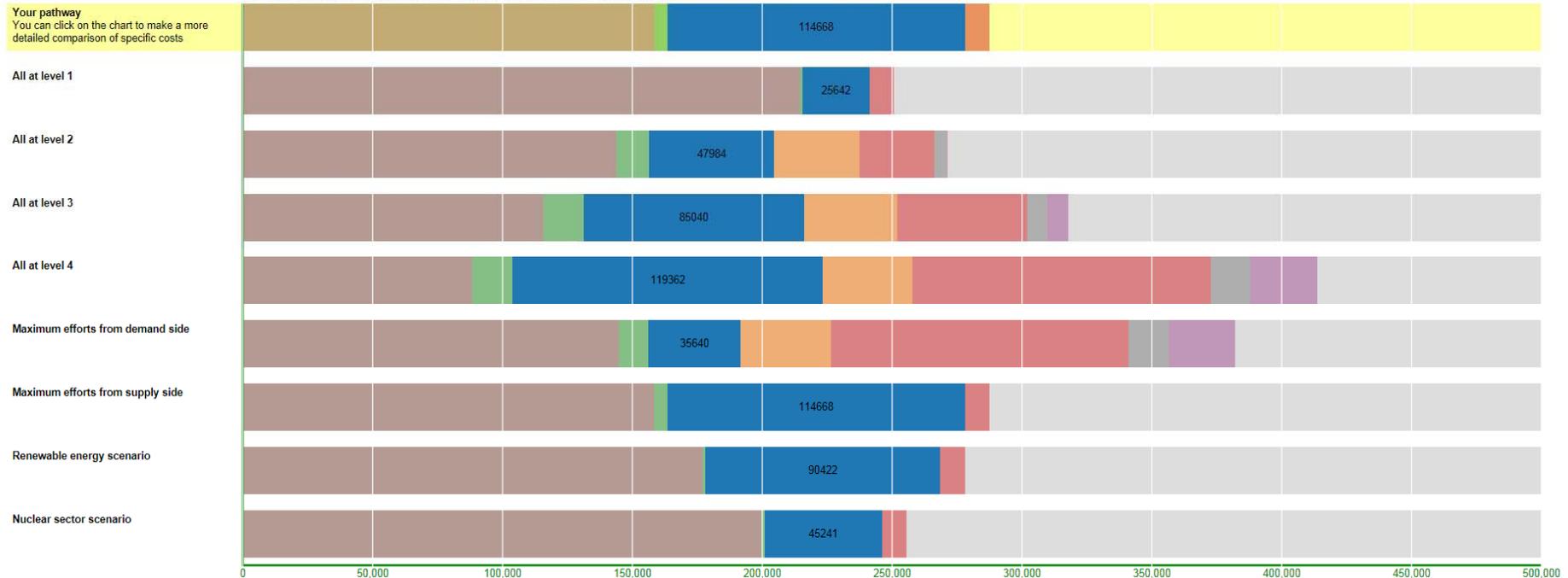
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Energy Electricity Security Flows Costs: compared Share Examples

The cost of your pathway, compared with other pathways. This is not your energy bill.

Electricity

Move your mouse over a coloured bar to see what it refers to. Click on a bar to see more detail



The absolute cost to society of the whole energy system (undiscouted real pounds per person per year 2050)

Note: The cost of failing to tackle climate change is not included. [Show the caveats again](#)

Passenger Transport Behaviour 1 2 3 4
 Passenger Transport: Shift to Zero Emission 1 2 3 4
 Passenger Transport: Choice of FCV or EV 1 2 3 4
 Passenger Transport: Diesel Blending 1 2 3 4

Nuclear: Restart Existing Power Plants 1 2 3 4 5
 Nuclear: Building of New Power Plants 1 2 3 4 5
 Fossil Fuel Power Plants: Fuel Mix 1 2 3 4 5
 Solar PV 1 2 3 4 5

Fossil Fuel Power Plants: Availability of CCS 1 2 3 4



Example pathway: Maximum efforts from supply side



Society Scenario

Energy Electricity Security Flows **Costs: compared** Share

Examples

The cost of your pathway, compared with other pathways. This is not your energy bill.

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Transport

Your pathway
You can click on the chart to make a more detailed comparison of specific costs



The absolute cost to society of the whole energy system (undiscounted real pounds per person per year 2050)

Note: The cost of failing to tackle climate change is not included. [Show the caveats again](#)

Passenger Transport Behaviour

Passenger Transport: Shift to Zero Emission

Passenger Transport: Choice of FCV or EV

Nuclear: Restart Existing Power Plants

Nuclear: Building of New Power Plants

Fossil Fuel Power Plants: Fuel Mix

Fossil Fuel Power Plants: Availability of CCS



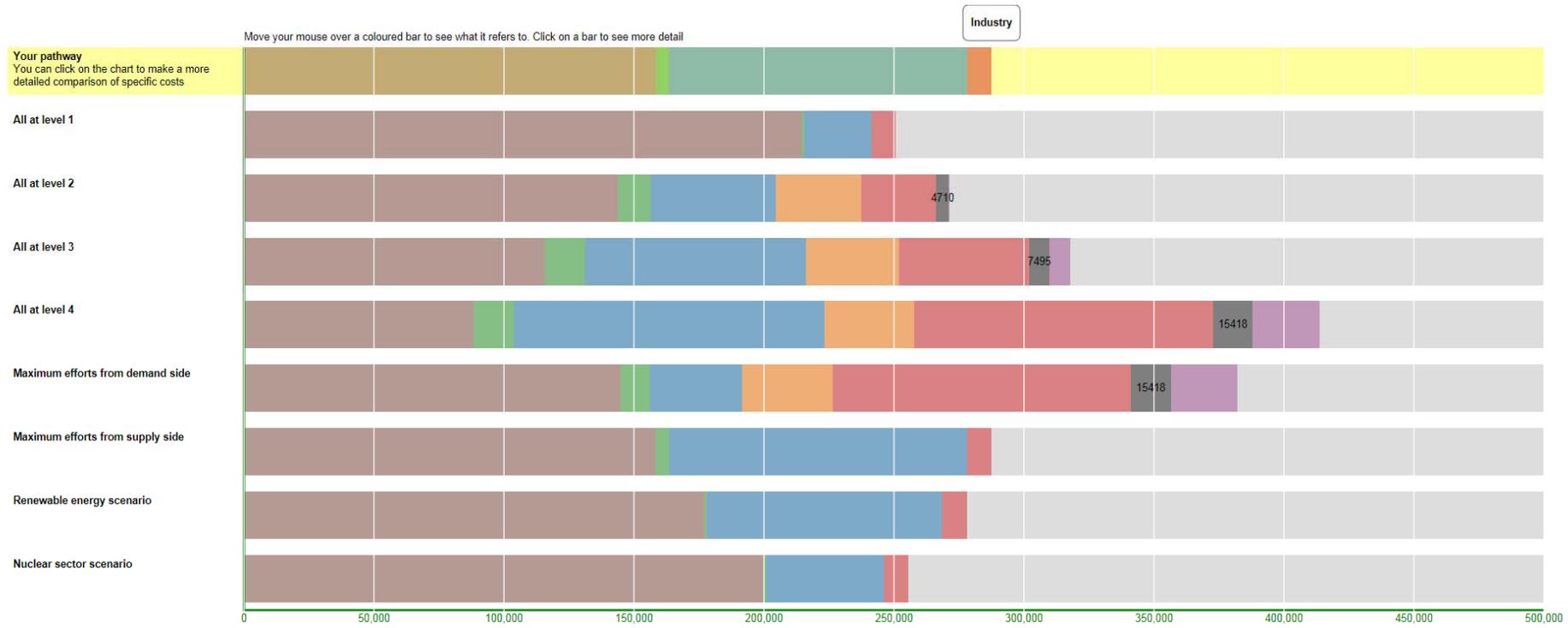
Example pathway: Maximum efforts from supply side



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Energy Electricity Security Flows **Costs: compared** Share Examples

The cost of your pathway, compared with other pathways. This is not your energy bill.



Passenger Transport Behaviour 1 2 3 4
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Nuclear: Restart Existing Power Plants 1 2 3 4 5
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Fossil Fuel Power Plants: Availability of CCS 1 2 3 4



Example pathway: Maximum efforts from supply side



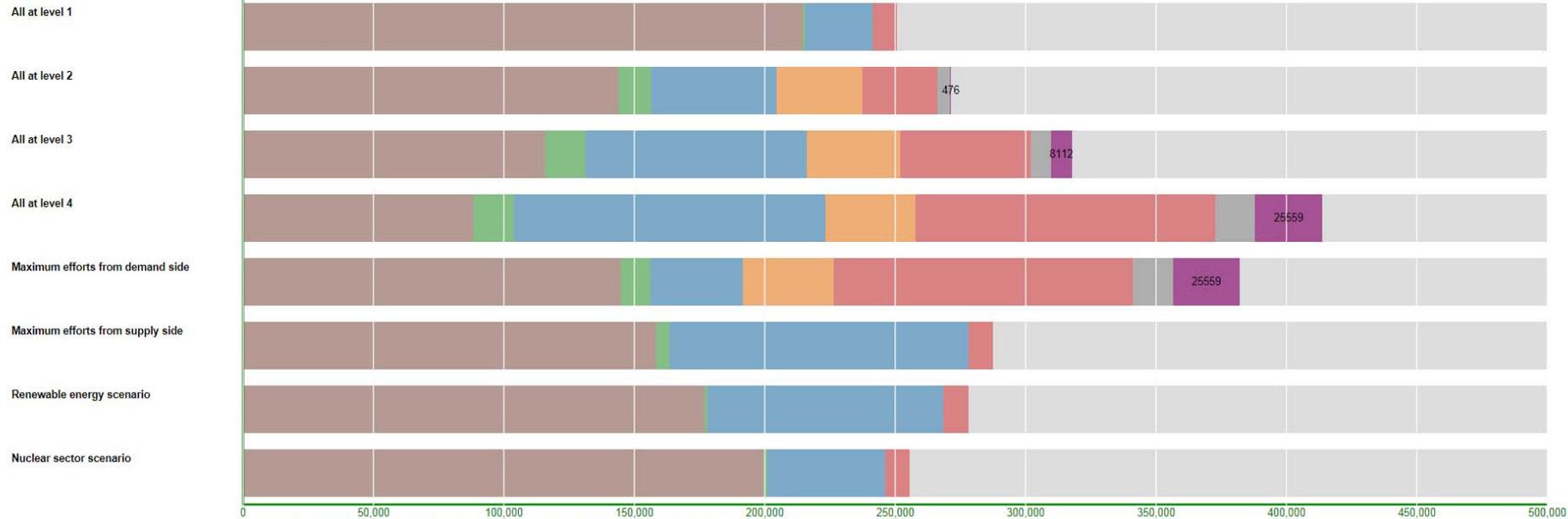
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Fossil Fuel Power Plants: Availability of CCS 1 2 3 4

*Join us to explore your own pathways by
using the Low Carbon Navigator!*



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For information:

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Contact us and share your opinions and ideas:

E-mail: ge-info@iges.or.jp