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Supplementary Information (SI)

Are interactive web-tools for environmental scenario visualization worth the effort? An experimental study on the Swiss electricity supply scenarios 2035

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S.1. Online survey script

Note: the survey was presented to the participants originally in German and it has been translated below into English.

S.1.1. Introduction

Thank you for your participation in this survey.

Electricity supply in Switzerland: how should it look like in 2035? Do you know which electricity supply sources can be used and what impacts they might have on the environment, safety and economy? In the next 10-15 minutes, you have the chance to broaden your knowledge about them through an information website. In this way, we will test which information format works best in communicating information about the energy transition to the public.

This survey is conducted by the Renewable Energy Systems group at the University of Geneva as part of a Swiss National Science Foundation project (No 160563). The aim of the project is to understand the preferences of the public, stakeholders, and experts for the Swiss electricity supply in the future.

Your participation is voluntary. All your information will be evaluated anonymously and treated in accordance with the provisions of data protection. Your details cannot be associated with your person and will not be disclosed to third parties.

S.1.2. Demographics

1. What is your gender?
 - Female
 - Male
2. What year were you born?
3. Please indicate your highest level of education.
 - Compulsory education, e.g. primary or lower secondary education
 - Basic vocational education
 - High school or higher vocational education
 - Professional education and training, e.g. professional colleges

- Higher education, e.g. universities or universities of applied science
4. What is the best description of your current employment situation?
- In education
 - Employed (up to 50%)
 - Employed (50-100%)
 - Job seeking
 - Self-employed
 - Retired

S.1.3. Prior interest in electricity supply topics

To what extent do you agree or disagree with the following statements? (7-point Likert scale: 1 = Strongly disagree, 2 = Disagree, 3 = Somewhat disagree, 4 = Neither agree or disagree, 5 = Somewhat agree, 6 = Agree, 7 = Strongly agree)

1. If I lack knowledge about electricity supply topics in Switzerland, I will inform myself.
2. I think frequently and intensively about electricity supply topics in Switzerland.
3. I discuss about electricity supply topics in my private environment.
4. I read articles in the media about electricity supply topics.
5. I do not follow political discussions on electricity supply topics.
6. Public events, television broadcasts or documentaries about electricity supply topics arouse my curiosity.
7. In general, electricity supply in Switzerland is an exciting topic for me.

S.1.4. Prior knowledge of electricity supply topics

To what extent do you agree or disagree with the following statements? (7-point Likert scale: 1 = Strongly disagree, 2 = Disagree, 3 = Somewhat disagree, 4 = Neither agree or disagree, 5 = Somewhat agree, 6 = Agree, 7 = Strongly agree)

1. I do not feel well informed about the different electricity supply sources in Switzerland.
2. Within my circle of friends, I am one of the 'experts' on electricity supply sources.
3. Compared to most other people, I know less about electricity supply.

4. I am well informed about the advantages and disadvantages of electricity supply sources.
5. I know more than most people about the plans and possibilities to develop the Swiss electricity supply in the future.
6. I don't know the approximate proportions of individual sources in the total electricity supply of Switzerland.
7. In general, I know a lot about the different electricity supply sources in Switzerland.

S.1.5. Frequency of media use to inform on electricity supply topics

How often do you use these resources to get general information on electricity supply topics? (7-point Likert scale: 1 = Never, 2 = Hardly ever, 3 = Rarely, 4 = Occasionally, 5 = Often, 6 = Very often, 7 = Always)

1. Newspapers, magazines, books
2. Acquaintances and family
3. Internet search
4. Social media (e.g. Twitter, Facebook)
5. News websites
6. TV and radio
7. Public events or direct contact with experts

S.1.6. Website navigation skills

To what extent do you agree or disagree with the following statements? (7-point Likert scale: 1 = Strongly disagree, 2 = Disagree, 3 = Somewhat disagree, 4 = Neither agree or disagree, 5 = Somewhat agree, 6 = Agree, 7 = Strongly agree)

1. I find it easy to find a website I visited before.
2. I get tired when looking for information online.
3. Sometimes I end up on websites without knowing how I got there.
4. I find the way in which many websites are designed confusing.
5. I find it hard to decide what the best keywords are to use for online searches. (e.g. Google).

S.1.7. Subjective numeracy

To what extent do you agree or disagree with the following statements? (7-point Likert scale: 1 = Strongly disagree, 2 = Disagree, 3 = Somewhat disagree, 4 = Neither agree or disagree, 5 = Somewhat agree, 6 = Agree, 7 = Strongly agree)

1. I am good at calculating fractions. (e.g. a quarter).
2. I am good at calculating percentages.
3. I am not good at calculating a 15% tip.
4. When I am reading the newspaper, I find tables and graphs helpful.
5. I often find numerical information useful.

S.1.8. Link and invitation to visit the interactive web-tool / website with four scenarios with storylines

To expand or refresh your knowledge for the electricity supply in Switzerland, we have created the following information website. Please visit the website, explore it for about 2-3 minutes, and then return to the survey to continue.

Do not close the information website yet, as we will ask you to use it later to answer some questions.

The website works in the following browsers: Chrome, Firefox, Safari, Edge and Internet Explorer 10+. If you have any problems with the website, please try reloading it or updating your browser.

S.1.9. Understanding – tested

Now that you are familiar with the information website, we would like to ask you to answer the following questions about electricity supply sources and their impacts in Switzerland. All questions refer to the information of the website. (Scale: True, False, I don't know)

1. Every electricity supply scenario for 2035 includes small hydropower.
2. The impact of electricity supply on local air pollution is low in any scenario.
3. There is at least one scenario where the Swiss electricity demand is covered without imports and nuclear power.

4. The impacts to climate change are high in every scenario.
5. Scenarios with large gas power plants have minimal accidental impacts.
6. Scenarios with only renewable electricity sources (solar cells, wind, hydropower, biogas, woody biomass, waste incineration and deep geothermal) lead to high impacts on electricity supply reliability.
7. The website shows that almost a tenth of the total electricity demand in Switzerland can be reduced by electricity saving and efficiency measures.

S.1.10. Understanding – self-reported

To what extent do you agree or disagree with the following statements? (7-point Likert scale: 1 = Strongly disagree, 2 = Disagree, 3 = Somewhat disagree, 4 = Neither agree or disagree, 5 = Somewhat agree, 6 = Agree, 7 = Strongly agree)

1. I learned something new about the electricity supply in Switzerland from this website.
2. On the whole, it was easy to understand the information.
3. The website corrected some of my misconceptions about Switzerland's electricity supply.
4. The website explained the complex issue of electricity supply in a simple and understandable way.
5. The website is not adequate to clearly inform about electricity supply and its impacts.
6. Certain information was too simplistic in my opinion.
7. Overall, electricity supply and its impacts are presented clearly on the website.

S.1.11. Trust – self-reported

To what extent do you agree or disagree with the following statements? (7-point Likert scale: 1 = Strongly disagree, 2 = Disagree, 3 = Somewhat disagree, 4 = Neither agree or disagree, 5 = Somewhat agree, 6 = Agree, 7 = Strongly agree)

1. The website is not objective.
2. The website is coming from a reliable source.
3. If it was publicly available, people would trust the website.
4. The website is based on expert knowledge.
5. On the website I received accurate information.
6. This website could provide information for decisions on electricity supply.

7. The website is of dubious credibility.

S.1.12. Engagement – self-reported

To what extent do you agree or disagree with the following statements? (7-point Likert scale: 1 = Strongly disagree, 2 = Disagree, 3 = Somewhat disagree, 4 = Neither agree or disagree, 5 = Somewhat agree, 6 = Agree, 7 = Strongly agree)

1. I enjoyed using this website to learn more about electricity supply.
2. I would be willing to share this website on social media.
3. Using the information website was a valuable use of my time.
4. I would not want to spend any more time with this website.
5. Overall, I like this website.
6. If I would want to know something about Switzerland's electricity supply in the future, I would return to this website.
7. The website was an exciting way to find out about electricity supply.

S.1.13. End of the survey

Thank you for your participation! Your data has been saved, you can now close this window.

S.2. Storylines and compositions of the four electricity supply scenarios in the four scenarios condition

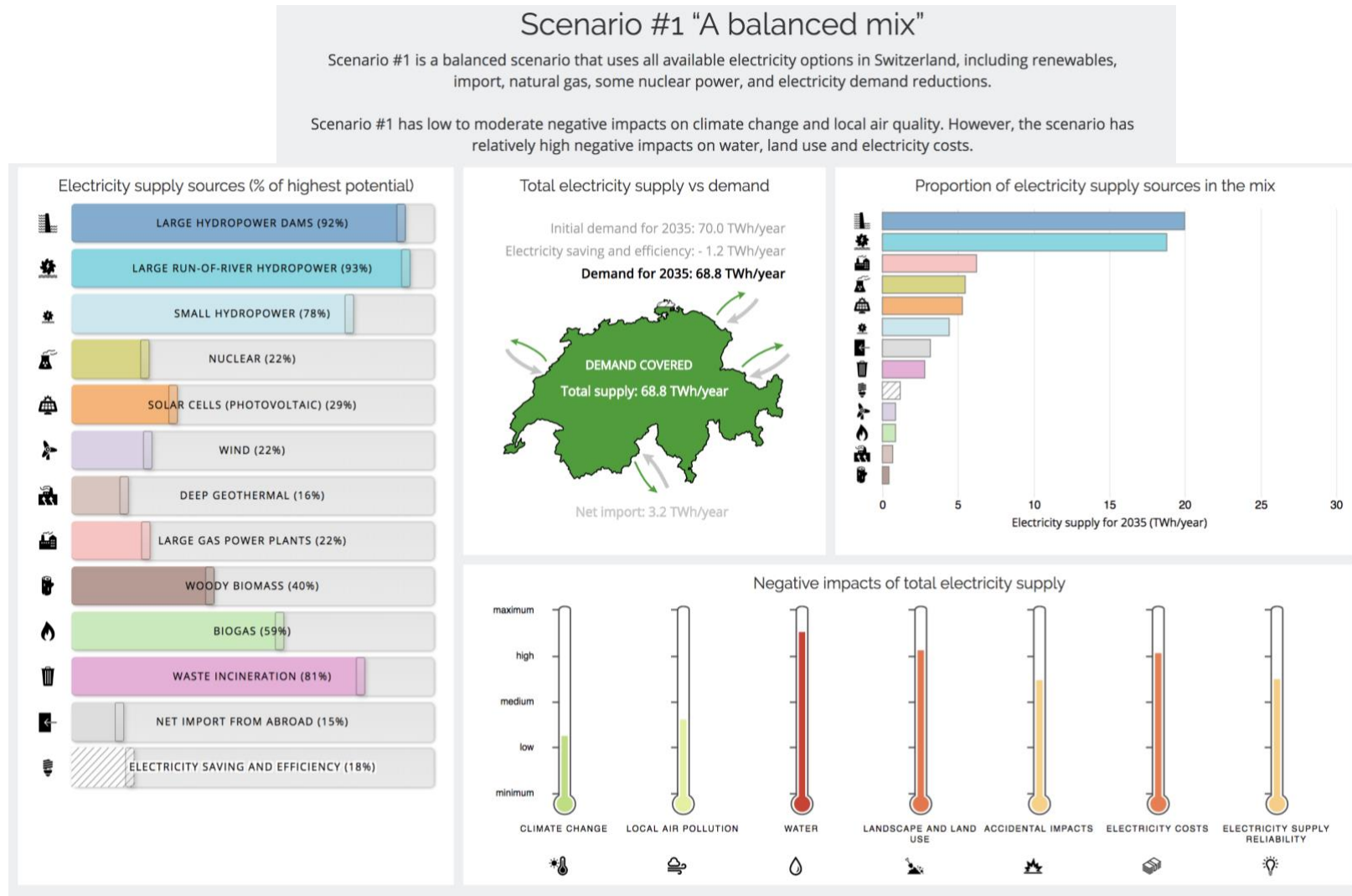


Figure S.1. Storyline and composition of the first electricity supply scenario in the four scenarios condition.

Scenario #2 "Relying on import"

Scenario #2 assumes that Switzerland withdraws from nuclear power, but without developing an analogous supply through renewables or natural gas and hence also relies on electricity imports from Germany and France.

Scenario #2 has moderate negative impacts on climate change and electricity supply reliability, but relatively high negative impacts on all other categories.



Figure S.2. Storyline and composition of the second electricity supply scenario in the four scenarios condition.

Scenario #3 "Renewable mix"

Scenario #3 depicts the case, where renewable energy has been developed in Switzerland rapidly, facilitating nuclear withdrawal and avoiding natural gas or import.

Scenario #3 leads to low negative impacts on climate change, local air pollution, and accident risks, but counterbalances them with comparatively high negative impacts on water, land use, electricity costs, and electricity supply reliability.

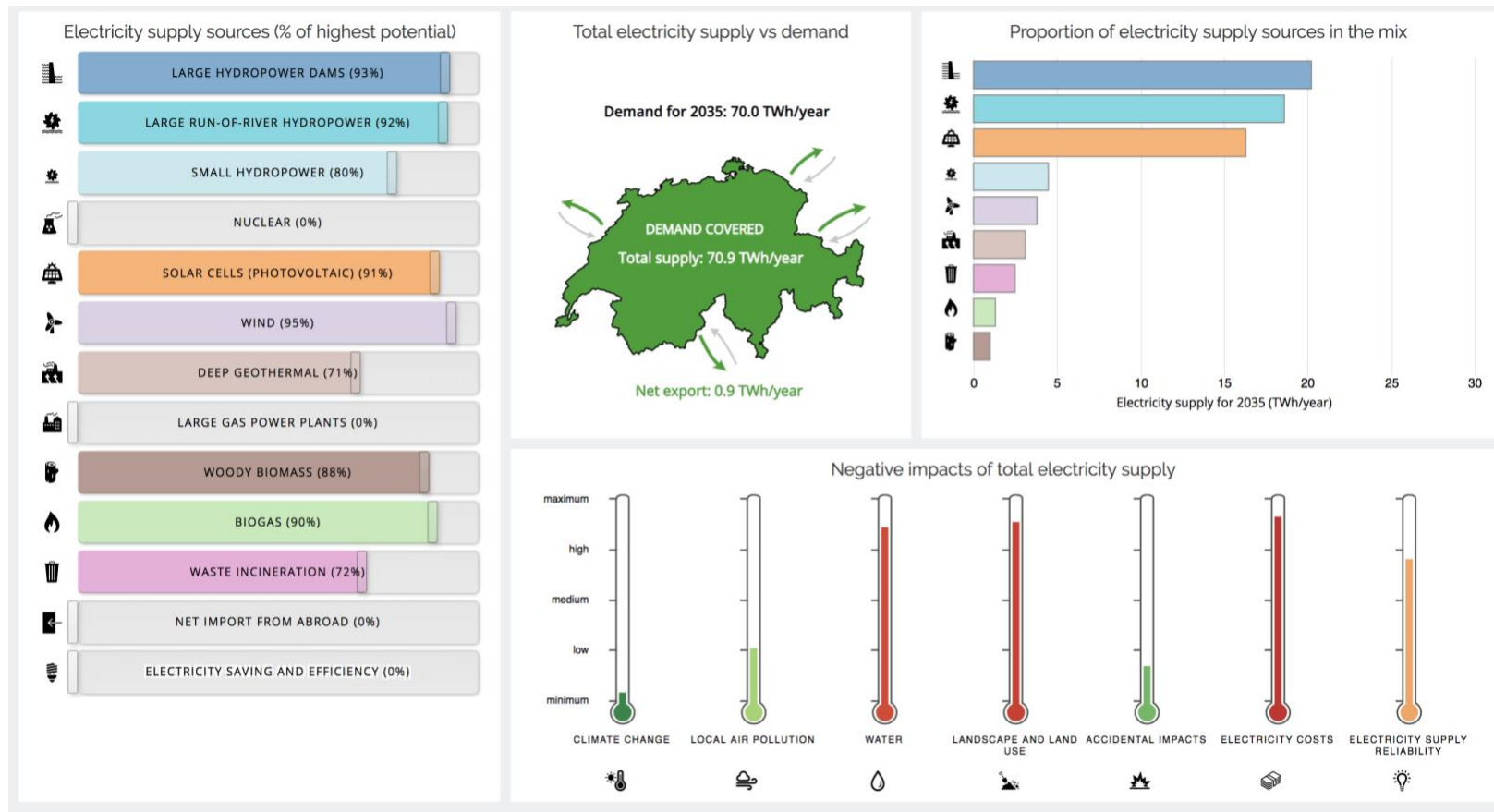


Figure S.3. Storyline and composition of the third electricity supply scenario in the four scenarios condition.

Scenario #4 "Reducing demand"

Scenario #4 shows an electricity mix with high deployment of renewables as well as high demand reduction through electricity saving and efficiency improvements.

Scenario #4 has low negative impacts on climate change, local air pollution and accident risks. The scenario, however, has relatively high negative impacts on water, land use, and electricity costs.

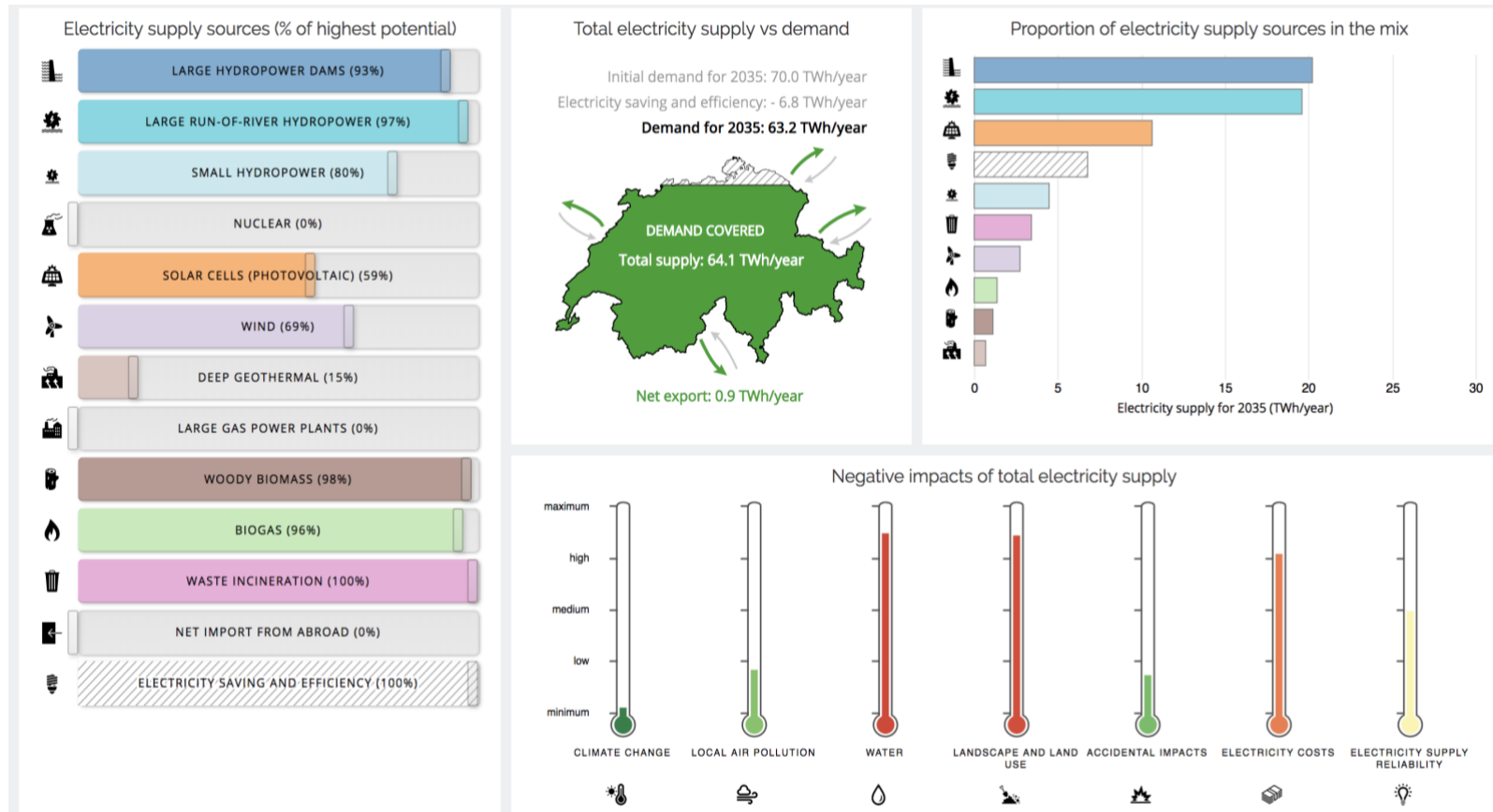


Figure S.4. Storyline and composition of the fourth electricity supply scenario in the four scenarios condition.

S.3. Detailed answers to the quiz for tested understanding

Table S.1. Detailed answers to the quiz for tested understanding

Quiz questions for tested understanding (score scale is 0-1 for every question)	Experimental conditions		Statistic
	Four scenarios	Interactive	
	with storylines	web-tool	
	(<i>n</i> = 157)	(<i>n</i> = 156)	
	<i>M</i> ± <i>SD</i>	<i>M</i> ± <i>SD</i>	
Every electricity supply scenario for 2035 includes small hydropower.			
Correct answers	.64 ± .48	.58 ± .49	<i>t</i> = .971
Wrong answers	.18 ± .38	.26 ± .44	<i>t</i> = -1.676
Don't know answers	.18 ± .39	.16 ± .37	<i>t</i> = .571
The impact of electricity supply on local air pollution is low in any scenario.			
Correct answers	.62 ± .49	.42 ± .50	<i>t</i> = 3.624**
Wrong answers	.17 ± .37	.37 ± .49	<i>t</i> = -4.219**
Don't know answers	.22 ± .41	.21 ± .41	<i>t</i> = .108
There is at least one scenario where the Swiss electricity demand is covered without imports and nuclear power.			
Correct answers	.72 ± .45	.68 ± .47	<i>t</i> = .775
Wrong answers	.13 ± .33	.13 ± .34	<i>t</i> = -.189
Don't know answers	.15 ± .36	.19 ± .39	<i>t</i> = -.777
The impacts to climate change are high in every scenario.			
Correct answers	.63 ± .49	.57 ± .50	<i>t</i> = 1.083
Wrong answers	.25 ± .44	.26 ± .44	<i>t</i> = -.162
Don't know answers	.11 ± .32	.17 ± .37	<i>t</i> = 1.323

Scenarios with large gas power plants have minimal accidental impacts.

Correct answers	.42 ± .50	.49 ± .50	$t = -1.299$
Wrong answers	.29 ± .45	.30 ± .46	$t = -.284$
Don't know answers	.29 ± .46	.21 ± .41	$t = 1.800$

Scenarios with only renewable electricity sources (solar cells, wind, hydropower, biogas, woody biomass, waste incineration and deep geothermal) lead to high impacts on electricity supply reliability.

Correct answers	.43 ± .50	.34 ± .48	$t = 1.584$
Wrong answers	.38 ± .49	.49 ± .50	$t = -1.993^*$
Don't know answers	.19 ± .39	.17 ± .37	$t = .562$

The website shows that almost a tenth of the total electricity demand in Switzerland can be reduced by electricity saving and efficiency measures.

Correct answers	.57 ± .50	.46 ± .50	$t = 1.984^*$
Wrong answers	.16 ± .38	.28 ± .45	$t = -2.211^*$
Don't know answers	.25 ± .44	.26 ± .44	$t = -.162$

Note: $*p < .05$; $**p < .001$. All statistics assume the four scenarios condition as the reference group.