

MIE315 – Design for Environment

Project 43: Natural Gas vs. Solar Thermal Hot Water Heating

Group 12

TA:



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Note: The three sources I have chosen are based on three questions I would like to answer, specifically questions I found while filling out Worksheet 1 with my team.

Project: Solar Hot Water Heating Vs. Natural Gas Hot Water Heating in Toronto

Question 1: What are some issues that may occur with using solar panels in a cold climate like Canada or in general?

Source	[1] A. Hobbi and K. Siddiqui, "Optimal design of a forced circulation solar water heating system for a residential unit in cold climate using TRNSYS", <i>Solar Energy</i> , vol. 83, no. 5, 2020 [Online]. Available: https://www.sciencedirect-com.myaccess.library.utoronto.ca/science/article/pii/S0038092X08002880?via%3Dihub . [Accessed: 26- Jan- 2020]
Research Tool	Article
Search Term / Conditions / Parameters	Solar Domestic Water Heating Cold Climate
Number of Search Results	341
How Source was Selected	Had all search words in link, research article with data, based in Canada

This journal entry was written by Alireza Hobbi and Kamran Siddiqui, who are currently attending the University of Concordia and the University of Western. Both authors have written many articles on topics related to solar and thermal energy processes. Furthermore, the source was found on Compendex, one of the most comprehensive bibliographic databases of engineering research. The journal provides the data they determined through their research based on a residential home in Montreal, Canada. This information can therefore be highly applicable to a residential home in Toronto. Furthermore, the sources they have linked in their journal are all mostly credible and unbiased.

A very important question my team and I want to answer is how reliable a solar water heating system is in an area where weather is variable. The journal entry is a based-on research they had conducted, specifically on how successful a solar water heating system was in heating a

residential home in Montreal. This article is therefore directly applicable to our situation, and the data measured in this journal can be referenced as reasonable metrics as we conduct our own analysis.

Question 2: What is the life cycle of Natural gas (where it comes from, how is it extracted, what waste occurs)?

Source	[2]"What Is Natural Gas and Where Does It Come From CAPP", CAPP, 2020. [Online]. Available: https://www.capp.ca/natural-gas/what-is-natural-gas/ . [Accessed: 20- Jan- 2020]
Research Tool	Website
Search Term / Conditions / Parameters	How natural gas is produced, Canada
Number of Search Results	About 376,000,000 results (0.93 seconds)
How Source was Selected	Canadian Lobby Group created in 1992 that oversees the Canadian oil and gas industry

The Candian Association of Petroleum Producers is a lobby group founded in 1992 that oversees the Canadian oil and gas industry, focused on advocating the responsible growth of the industry environmentally, economically, and socially [1]. CAPP is a group of about 90 members, called the board of governors, from different technological backgrounds; economists, engineers, communicators, accountants, political scientists, lawyers and administrative staff. All the names of these members and their respective companies are listed on the website for validation. Furthermore, every member is in one way or another involved in the oil and gas industry, proving that they can be considered reliable sources for what was and is happening in the oil and gas industry.

Because the Candian Association of Petroleum Producers are an advocacy group towards oil and gas production in Canada, it can be assumed that there may be some bias in their website. Specifically, they may try to withhold information that makes natural gas and oil seem harmful to the environment and may push for the benefits of natural gas. Although this may be expected, it is evident that they do address the harmful emissions that the oil and gas industry have and is producing. Furthermore, they have many pages explaining how they are looking to decrease the industries environmental footprint with many initiatives that have started.

This source is an extremely helpful tool due to its clear and detailed explanation of the complete life cycle of natural gas. Furthermore, every sub-topic has a link you can follow for a more detailed explanation of the subject. The source consists of explaining what natural gas is made of, where it comes from, the types, where it is found, and the economic benefits. I specifically was looking for more information on life cycle of natural gas, and a more detailed link found in the "Types of Natural Gas" subtopic answered all my questions.

The greatest benefits from this source, as already stated, is the abundance of information there is on various topics concerning natural gas. Exploring the home page and menu options from this website led me to find answers to many other questions my team and I were looking to answer. Specifically, topics such as Transportation of natural gas, the Economic benefits, Environmental concerns (with data), and informative sections on the history of natural gas and oil sands. There is also a link to credible news and media articles that describes the latest of what's happening in Canada's oil and gas industry. Ultimately, this information can be used when conducting LCA analysis, economic analysis, environmental analysis, and for finding metrics for objectives. However, I would also find information from another source that depicts the cons of natural gas power to counteract the bias that may be present in this source.

Question 3: How reliable is Solar Heating, does it need a backup source? How does solar thermal water heating work?

Source	[3] C. Laughton, <i>Solar domestic water heating</i> . London: Earthscan, 2010.
Research Tool	Book
Search Term / Conditions / Parameters	Solar Domestic Water Heating
Number of Search Results	41
How Source was Selected	Title was very clear as to the contents of the book, various copies in different libraries, content is easy to read

The author of the text “Solar Domestic Water Heating” is Chris Laughton, a heat engineer in the solar thermal heat pump industry [2]. Aside from this text, Laughton has produced various articles for building and energy related publications, is a part of many committees focused on sustainability and has spoken of said topics at international conferences. His career is focused of about 17 years at the Solar Design company is focused on implementing renewable energy, so it there may be some bias in this book, specifically about what the disadvantages of solar heating could be. The publisher, Earthscan, adds credibility to the source, as their goal is to produce reliable work that can lead to sustainability through educating readers [1]. Of course, potential bias and the book being published in 2010 must be considered, especially due to the possible changes that may have occurred in the last 10 years and should therefore be paired with other sources.

This book covers all aspects of solar domestic water heating in a clear and easy-to-read format, that can be used in many parts of our project. As solar water heating is one of the alternatives that we are comparing, a very important question in our research was how the process of solar heating works. This text provides a detailed description of the different parts of a solar heating system, the different systems that may be used, and how this system generates the heat required domestic hot water use. The integration of visuals and diagrams as well as real life examples allows for a greater understanding to be made.

The advantages of this text are not limited to its answers to the question stated above. I chose this source as applicable to this project because of the information it contains on other concepts of solar water heating that my team and I will require for future analysis. This includes topics on solar collectors, system layouts, factors that go into the design of a system, and the economics of solar water heating. Overall, I believe this text will play a significant role in impacting our final consensus for the project.

Project Timeline

TASK NAME	START DATE	END DATE	DURATION* (WORK DAYS)	DAYS COMPLETE*	DAYS REMAINING*	TEAM MEMBER	PERCENT COMPLETE
Deliverable 1: Preliminary Literary Review - 5%							
Research	1/16	1/26	10	6	4	All	100%
Worksheet	1/16	1/23	7	6	1	All	100%
Sources	1/16	1/26	10	6	4	All	80%
Deliverable 2: Preliminary Consultant's Report - 10%							
Goal and Scope	1/23	1/25	3	0	3	All	10%
Functions, Objectives, Constraints	1/27	2/2	7	0	7	All	0%
Start writing report	2/2	2/24	22	0	22	All	0%
Streamlined Life Cycle Assessment	2/2	2/17	15	0	15	All	0%
Deliverable 3: Final Consultant's Report							
Economic Analysis	2/24	2/29	5	0	5	All	0%
Quantitative/Hybrid LCA	3/1	3/4	3	0	3	All	0%
Societal Analysis	3/5	3/10	5	0	5	All	0%
Sensitivity Analysis	3/5	3/10	5	0	5	All	0%
Summary/Recommendations	3/11	3/12	1	0	1	All	0%
Deliverable 4: Portfolio							
Introduction	3/1	3/13/2020	12	0	12	All	0%
Two Entries	3/13	3/25	12	0	12	All	0%
Deliverable 5: Group Presentation & Cluster Round-Table Discussion							
Group Presentation	3/27	4/6	9	0	9	All	0%
Cluster round-table discussion	4/6	4/6	0	0	0		0%

References

[1]"CAPP | A Unified Voice for Canada's Upstream Oil and Gas Industry", *CAPP*, 2020.

[Online]. Available: <https://www.capp.ca/>. [Accessed: 27- Jan- 2020]

[2]2020. [Online]. Available: <https://www.linkedin.com/in/laughtonchris/>. [Accessed: 27- Jan- 2020]

[3]2020. [Online]. Available: <https://www.linkedin.com/company/earthscan/about/>. [Accessed: 27- Jan- 2020]