**Chapter 7 – Inventions**

***How can we mitigate climate change?***

**Chapter overview**:

At this point, students should have a firm understanding of (i) climate change and (ii) how renewable energy technologies (particularly wind and solar) aim to mitigate climate change. In this chapter, students will learn about other ways that scientists and other researchers are trying to counter climate change. This lesson will include discussions on carbon capture and storage, and electricity producing algae, reducing methane from cows/pigs by more veggie friendly diet, behaviour science and how we make decisions / change our behaviours, electric vehicles vs gas, intermittent energy and how storage compensates for that, among other options!

**Topics**:

microbiology, atmospheric sciences, invention, behavioural sciences, climate change

**Essential Questions:**

* What else, besides energy emissions, influences the climate?
* Can we reverse the impact of climate change?
* What is a practice we can do every day to mitigate climate change?

**Enduring Understandings:**

* There is more contributing to climate change than just coal and natural gas emissions
* Many different fields of science, and even non-science fields are working on the problem, therefore, interdisciplinary learning and collaboration is key!
* More inventions and innovative ideas are needed to fix the problem – and they are all part of the solution!

**Vocabulary:**

Behaviour, carbon capture, absorb, intermittent, batteries, storage, invention

**Outline: Chapter 7a outline (total run time = 45 min)**

**Review/critical thinking (10 min)**

Ask:*Is renewable energy the only one way to fight climate change, can you think of others?*

* Make a list of the thoughts from the students. Note what they contribute, where is their mindset? Only science, only other energy forms?
* Once you have a list, ask them again what is causing climate change, this should give them a chance to both review and critically think about the atmosphere

**Presentation (30 min)**: Introduce other inventions out to counter climate change and go through how they work, and why they might help. There are a lot of solutions in the links below. No need to be exhaustive but introduce the ones that might be most interesting to the class. Use Powerpoint as a guide and have the students discuss the implementation of each.

Learn about Drone-planting trees, plastic recycling innovations, new materials for batteries, and geothermal energy. We have a Sustain/Ed Changemaker for each!

1. Drone Planting: Watch this video (3.5 minutes): <https://www.youtube.com/watch?v=EkNdrTZ7CG4&ab_channel=Mashable>, which is run by CEO of Droneseed: **Grant Canary**
2. Plastic Recycling: Watch this 2-min video: <https://www.youtube.com/watch?v=EkNdrTZ7CG4&ab_channel=Mashable>, As a young kid, **Jerry de Vos** I was always tinkering and making things, I glued small magnets on toy cars to make more efficient cars and at the age of 6 I drew my first perspective drawing. He was educated as a product designer I love to come up with new crazy but innovative ideas, from windmills in pylons to giving someone a voice by throwing garbage. By turning these ideas into prototypes the true value of the idea appears and gets shape. Designing these prototypes into sustainable products takes a whole other approach, a path which is also familiar for me. By traveling, unscrewing everything I can lay my hands on and by showing persistence I try to satisfy my hunt for the unknown. <https://jerrydevos.nl/en/index.html>
3. New Materials for Batteries: Watch this 2-min video: <https://youtu.be/JZbIkdcRuSA>, 15-year-old **Sahil Doshi** recently won the title of America’s Top Young Scientist from the Discovery Education 3M Young Scientist Challenge for his PolluCell project. The PolluCell is a battery that uses recycled materials and carbon dioxide to generate electricity. With this experiment Sahil is attempting to address both the global carbon dioxide pollution issue and the energy crisis in developing countries. To read more about Sahil's PolluCell and similar projects visit youngscientistchallenge.com.
4. Watch this (1.5 min fun video about tectonic plates): <https://www.youtube.com/watch?v=XkODbyTVR5I&ab_channel=Netflix>, the splitting of tectonic plates are easy access points to extract geothermal energy, which is why Iceland is such a great location for this. **Sandra Snæbjörnsdóttir and Marta rós Karlsdóttir**
5. These women are the geologists and managing directors of the hellisheiði geothermal power plant. An interview with Marta (2 min): <https://youtu.be/gw1S-BT3km4> based on this website: <https://www.eib.org/en/stories/iceland-volcanos-produce-energy-fight-climate-change>

Write in your eco-diary: Did these examples spark any new ideas to you?

What do you think of them? Any that you think are more important than some of the others? Do you think they will work?

References:

1. <https://www.globalcitizen.org/en/content/8-crazy-inventions-that-can-save-the-planet/>
2. <https://architizer.com/blog/inspiration/collections/pollution-solution/>
3. <https://www.livescience.com/7992-top-10-craziest-solutions-global-warming.html>
4. Carbon reduction, batteries: <https://www.bresslergroup.com/blog/innovative-technology-for-climate-change-7-solutions/>
5. Behavioural: <https://www.unenvironment.org/news-and-stories/story/five-ways-behavioural-science-can-transform-climate-change-action>
6. Behavioural: <https://behavioralscientist.org/fight-climate-change-with-behavior-change/>
7. Behavioural: <https://rare.org/wp-content/uploads/2019/02/2018-CCNBC-Report.pdf>
8. Farmers: <https://www.bbc.co.uk/news/uk-49044072>
9. Algae: <https://qz.com/1718988/algae-might-be-a-secret-weapon-to-combatting-climate-change/>

**Outline: Chapter 7b outline (total run time = 50 min)**

**Activity (20 min) Research Opportunities from Current Solutions**

use a laptop to investigate the website *table of solutions* (<https://www.drawdown.org/solutions/table-of-solutions>),

Split up into groups of 4-5 students (can be the same group as before, or different!): set a challenge to identify: e.g. four inventions that reduce CO2 emission the most – why are these? Why do you think they reduce CO2 so much?

Have a representative of your group highlight your group’s summary

**Activity #2 (30 min) Create your own Future City**

**Future cities (5.5 min video)**

https://www.youtube.com/watch?v=T6mK-Ukr\_ts&ab\_channel=GoingGreen Projects

* Liuzhou Forest City, China
* Malaysia Forest City, Malaysia
* The Sustainable City Dubai, United Arab Emirates
* Masdar City, United Arab Emirates
* Self-Sufficient City, Beijing. China
* Oceanix, [concept] – floating city
* New Clark City, Philippines.
* Amaravati, India.
* Net City, China.

References:

* Stefano Boeri Architects- [https://www.stefanoboeriarchitetti.ne...](https://www.youtube.com/redirect?event=video_description&redir_token=QUFFLUhqbTlLNS0tYzVXSFN2UTllTTBvWmhKaE9tb2psUXxBQ3Jtc0tuRlhjWlRfZXJVRGxkQWZkQTh3RVdGcloydEo1VVVTeXpWTEVhVHhja2xrVG5UMXIzRzNrOWRrODY3OXRGRnpSektMMjIwbUpSZTBDMDBkQ0dZRE56MVBuMDh2Q0x4dE8wbkJQQTdGWmIwcmhSMEFlbw&q=https%3A%2F%2Fwww.stefanoboeriarchitetti.net%2Fen%2F" \t "_blank)
* [https://www.youtube.com/watch?v=XXRu\_...](https://www.youtube.com/watch?v=XXRu_qMhRbs&t=0s)
* Malaysia Forest City- [https://www.sasaki.com/projects/fores...](https://www.youtube.com/redirect?event=video_description&redir_token=QUFFLUhqbWVUeEdyUjVpcmdFQ0NUN3NKcVpCcW95RUVBd3xBQ3Jtc0trOEhaenVkazFucnBBcENOOENHdmlQbEpBRnhqMDQtdERqbmJJV01hdllqc3I5MkVEZkI2ejRacVMyLU1ac0RNVjZtR2tBc3dESEN1aGRSVk1fWC00dFBSNnB2RFFqWFZZV1J6cnQtV0VLZWdSNzlvRQ&q=https%3A%2F%2Fwww.sasaki.com%2Fprojects%2Fforest-city-master-plan%2Fwatch%3Fv%3DDxoFbEyNZL4" \t "_blank)
* Malaysia Forest City- SCM Southern Corridor Malaysia [https://www.youtube.com/watch?v=DuqNl...](https://www.youtube.com/watch?v=DuqNlRMaeNY&t=0s)
* Dubai sustainable city [https://www.youtube.com/watch?v=SGQOn...](https://www.youtube.com/watch?v=SGQOnwbW9HU&t=0s)
* Masdar city [https://masdar.ae/en/masdar-city/the-...](https://www.youtube.com/redirect?event=video_description&redir_token=QUFFLUhqa3VVdFN3YndoamMtV3RIeVd5Q3lTbnBzVlM3UXxBQ3Jtc0ttQnY3ejJaQ1VIdnNucGkyanFoUFBzOVdQX1Fxa3I0YUljdW43SEpCZmdZakJodXNaODVweTRlc0ZoTUpnYkN3SlVicHVuQWR1X0k2TzZrc1NVSDFSaUpZQmlEMElUbGZlOTY5Vk93ck1vbGZwNngydw&q=https%3A%2F%2Fmasdar.ae%2Fen%2Fmasdar-city%2Fthe-city" \t "_blank)
* Guallart Architects [http://www.guallart.com/](https://www.youtube.com/redirect?event=video_description&redir_token=QUFFLUhqbndPM1dBTmxQWmo5VjFzcWpmMVpOT0RGRVc5Z3xBQ3Jtc0tuRE1TXzBFLUNUMWxTYkt0MGlSQXRCNW1VQmdiUkRhcGtTQXN0Rkc2Tl8wRldJSjlZVVJsTXB4Tnk3a0VjUWN3dzVUSGtRNnJXMnQyOWV1SzNJUFFrWUF0eXd6NGg2a0lsM0hXVEV2Q3FCT29yeEswUQ&q=http%3A%2F%2Fwww.guallart.com%2F" \t "_blank)
* Oceanix City [https://big.dk/#projects](https://www.youtube.com/redirect?event=video_description&redir_token=QUFFLUhqa0hQRW0wY0ZERWNkc1dOLUpGNHB2LVNSbWpSd3xBQ3Jtc0trZnJmVEdxaGxpc2ZhY1AzS253Slo3TFZIWGRIMEZtZUh5QTVJRzBlRlVOc29rcmtVYmU4UXJLZzVmQmNfeExBQmxCbVUwN0pnVWJURkR2alJkeEVUSEgxTmlsa2tBRXJ1U001aldoNVE5dnZzcnFaZw&q=https%3A%2F%2Fbig.dk%2F%23projects" \t "_blank)
* New Clark City, Philippines [https://bcda.gov.ph/projects/new-clar...](https://www.youtube.com/redirect?event=video_description&redir_token=QUFFLUhqbmh4dWxiLWQ1czZGXy16WU04ZWhFVTJhN2Nwd3xBQ3Jtc0ttS2Fqclc5Qm11RkNNRGlZSm1rMUVwNFltVUkyRUVIREFrb2JpRVFycURtMlF4Mk02aVpXSmxtcDlZOHpRVmFGRk9Bbm90a0N1NjVNR0I1WVRYYzRQbE5sdjVIMG8ySXo5LWZsVmNHUVBQcXJBc01Xdw&q=https%3A%2F%2Fbcda.gov.ph%2Fprojects%2Fnew-clark-city" \t "_blank)
* Net City- NBBJ.com
* Elon Musk’s future city- [https://www.youtube.com/watch?v=Q1mZ4...](https://www.youtube.com/watch?v=Q1mZ4ADUEZs&t=0s)
* Inside amazons city of future- [https://www.youtube.com/watch?v=DPLme...](https://www.youtube.com/watch?v=DPLme2kG70s&t=0s)

To close off the module (the last chapter is an interactive boardgame so not much time for reflection there), go back to the **eco-diaries** and talk to the children about their concerns about climate change again. How do they feel now? Do they still more or less worried? Get them to look back at their ideas for small things they can do each day and bigger things they can do in the future. Get them to make an action plan that consists of three small daily changes and one big idea for the future. Do this yourself as a teacher to model good practice for your students. Try to revisit this action plan once every couple of weeks and see if the ideas are working. If they are not working, then try something different. If they are working think about adding something new.

**Teacher survey:** <https://forms.office.com/r/weLJL91zi9>