



Name _____

Class _____

Teaching Sequence

Work through this resource material in the following sequence:

25 minutes – Part A: Introduction to Climate Change and Transport

25 minutes – Part B: Your Household's Transport

45 minutes – Part C: Statistics, Population, and Transport

75 minutes – Part D: Take Action

10 minutes – Reflection

Part A: Introduction to Climate Change and Transport

Step 1. This lesson looks at innovative ways of changing our consumer habits to reduce climate change. Before conducting this lesson it is a good idea to get an understanding of your class's understanding of climate change. To begin, you might like to conduct a HEADS and TAILS activity (instruction in the green box below) using the following questions:

- Carbon dioxide is a naturally occurring gas in the atmosphere. (TRUE)
- Climate describes extreme weather events. (FALSE) *Climate is the long-term changes in patterns of weather over a long period of time, such as 20 years.*
- Burning fossil fuels contributes to excessive amounts of carbon dioxide in the air, which traps heat in the atmosphere. (TRUE)
- Global warming is completely out of our control. (FALSE) *Humans can take action to slow global warming and can also sequester carbon dioxide out of the atmosphere by planting trees, plants, and seaweed. (See www.drawdown.org)*
- There is no evidence that humans have caused climate change. (FALSE) *Variations in climate have been proven to have significantly increased since the industrial revolution (which jump started the increased burning of fossil fuels: for example, the mass manufacturing of cars). There is a direct link between the serious increase in climate and human behaviour/population - this has become most noticeable over the past 200 years. (See www.temperaturerecord.org and www.drawdown.org)*
- Changing our transport habits can make a significant difference in reducing climate emissions. (TRUE)

HEADS and TAILS

HEADS and TAILS is a basic true or false activity. Students stand, and when asked questions, they respond by putting both hands on their head for TRUE or both hands on their hips for FALSE. If they are unsure, they can put one hand on each.

For extra fun, (and challenge) you can run this as an elimination game.

If you notice that your students need a refresher on climate change, you can show them this informative [Climate Change clip](https://vimeo.com/showcase/6167669/video/336498352) from 2040 (**Password: 2040_EDU** <https://vimeo.com/showcase/6167669/video/336498352>). Alternatively, you could distribute copies of the [Climate Change Factsheet](#) to students.

Step 2. Invite students to form pairs and use an internet enabled device to find one example of how statistics can be used to communicate a message and persuade/influence the reader/viewer.

Hint: Inform students to use Google Images and use search terms such as “infographics statistics” and “using statistics in advertising”.

Step 3. Invite some students to share their findings and explain how they think what they have found uses numbers to persuade or influence. You may wish to refer to <https://thevisualcommunicationguy.com/2017/10/06/statistics-appeal-advertising/> to support facilitation of this activity.

Step 4. Explain that, soon, you will be playing a clip for the documentary 2040. Then, distribute the Student Worksheet to each student and explain that they will be writing any comments or thoughts they have on the about the clip using the SEE, THINK, WONDER table. Ask students to especially take note of any figures or statistics they notice.

SEE - THINK - WONDER

SEE – What did you SEE in this clip?
THINK – What did you HEAR in this clip?
WONDER – What does this clip make you WONDER about?

Step 5. Relate to students that the following clip is part of a larger documentary and is the narrator’s vision for transportation in the year 2040 based on research he has done around existing innovative technologies. He is predicting what might happen if we brought these technologies into the mainstream.

Now, view the 2040 transport clip:



2040 - Car of the Future Password

2040_EDU (<https://vimeo.com/showcase/6167669/video/336510915>)

Step 6. Invite students to share any statistics they noticed and any other key ideas or takeaways they made note of while viewing the clip.

Part B: Your Household's Transport

Step 1. Display the following information or read it to the students:

- Transport is Australia's third largest source of greenhouse gas emissions, with the highest rate of growth.
- Cars are responsible for roughly half of Australia's transport emissions. Australian cars emit about the same as Queensland's entire electricity supply.
- An international scorecard ranked Australia second-worst for transport energy efficiency.
- Key climate solutions for transport involve:
 - providing viable alternatives to driving, such as expanding access to reliable, comfortable public transport
 - electrifying and powering cars, buses, trains and trams with 100% renewable energy
 - adopting stringent, mandatory greenhouse gas emissions standards for cars and other vehicles

(Source: <https://www.climatecouncil.org.au/resources/transport-fact-sheet/>)

Conduct a group discussion using the following sentence starters:

- I used to think...
- Now I think...

Step 2. Invite students to complete Activities 2 and 3 on the Student Worksheet. For Activity 2, students will list the members of their family and their regular transport activities. By doing Activity 3, students will then use their family transport information from activity 2 and, use the **Australian Greenhouse Gas Calculator** (<https://www.epa.vic.gov.au/AGC/home.html>), estimate the greenhouse gas emissions (ghg) from transport in their household.

It is important to remind students that this activity is just a personal transport audit so they can plan to improve their emissions where possible. This is not a name and shame activity.

Hot tip: You can also do this activity on the board while students are working.

Step 3. Invite students to then complete another THINK, PAIR, SHARE activity on the Student Worksheet and consider how they may be able to reduce their household transport emissions.

THINK PAIR SHARE is a collaborative learning strategy in which students work together to solve a problem or answer a question.

THINK – Students independently think about an issue or question and record their thoughts.

PAIR – Students work in pairs to discuss their ideas and record new thoughts.

SHARE – Students share their thoughts with the whole group or with other pairs to reach consensus.

Part C: Statistics, Population, and Transport

Step 1. Inform students that they will now investigate Australia's transport emissions and growing population and establish if there is a link (correlation) using scatterplots.

Ensure each student has access to the **Scatterplot Factsheet**. Go through the theory and worked example in the factsheets with the class. As you work through the factsheet ensure that students ask any clarifying questions they may have.

Step 2. Let students know that they will be completing the first unfinished data table on the Student Worksheet, labeled 'Group Task'. Draw their attention to the fact that this data is related to Australia's projected population between 2020 and 2030 and Australia's projected transport emissions over this time.

Step 3. Allocate students into groups of 3-4. Give each group an A3 piece of paper and ruler.

Either, recreate this data table below on your whiteboard or project it from the downloaded version of this Teacher Worksheet:

According to the Australian Bureau of Statistics, Australia's population numbers from 2020 to 2030 will be:

Year	Projected Australian population
2020	25,936,500
2021	26,402,046
2022	26,873,947
2023	27,349,900
2024	27,829,520
2025	28,311,405
2026	28,796,151
2027	29,283,507
2028	29,773,492
2029	30,264,147
2030	30,755,046

Source: [https://www.abs.gov.au/ausstats/abs@.nsf/latestProducts/3222.0Media%20Release12017%20\(base%202066](https://www.abs.gov.au/ausstats/abs@.nsf/latestProducts/3222.0Media%20Release12017%20(base%202066)

NOTE: You may want to share with the class that these projections are not predictions, but reflect the change in population that would occur if certain beliefs about future levels of fertility, mortality, overseas migration, and internal migration were to ensue over the projection period. Read to this [ABS article](https://www.abs.gov.au/AUSSTATS/abs@.nsf/mf/3222.0) (https://www.abs.gov.au/AUSSTATS/abs@.nsf/mf/3222.0) for more information about the projections.

Step 4. Now either, recreate or project the table below. This table shows that according to the Australian Department of Energy and the Environment, greenhouse gas emissions from all Transport from 2020 to 2030 will be:

Year	Emissions from transport MtCO ₂
2020	105
2021	106
2022	107
2023	108

Year	Emissions from transport MtCO ₂
2024	109
2025	110
2026	110
2027	111
2028	111
2029	111
2030	111

*All transport includes; Railways, Domestic navigation, Domestic aviation, Motorcycles, Articulated trucks, Rigid trucks, Buses, Light commercial vehicles, Cars and other. Source:

<https://www.environment.gov.au/climate-change/publications/emissions-projections-2018>

NOTE: Emissions projections are estimates of Australia's future greenhouse gas emissions. Data from a range of government agencies is used to prepare the emissions projections and includes data about the economy, energy and business. To learn more about how the emissions projections are calculated, visit [Australia's emissions projections](https://www.environment.gov.au/climate-change/climate-science-data/emissions-projections) (https://www.environment.gov.au/climate-change/climate-science-data/emissions-projections)

What is MtCO₂?

MtCO₂ mean Metric tons of carbon dioxide equivalent.

CO₂ is the primary greenhouse gas emitted through human activities and the unit MtCO₂ refers to its global warming impact.

Did you know that 1 MtCO₂ is equivalent to charging 127,512 smartphones?

Step 5. Now, explain to the class that you will be using the combined data table (below) to demonstrate how to construct a scatterplot that displays the relationship between Australia's projected population growth and Australia's projected emissions from transport, starting from 2020 to 2030.

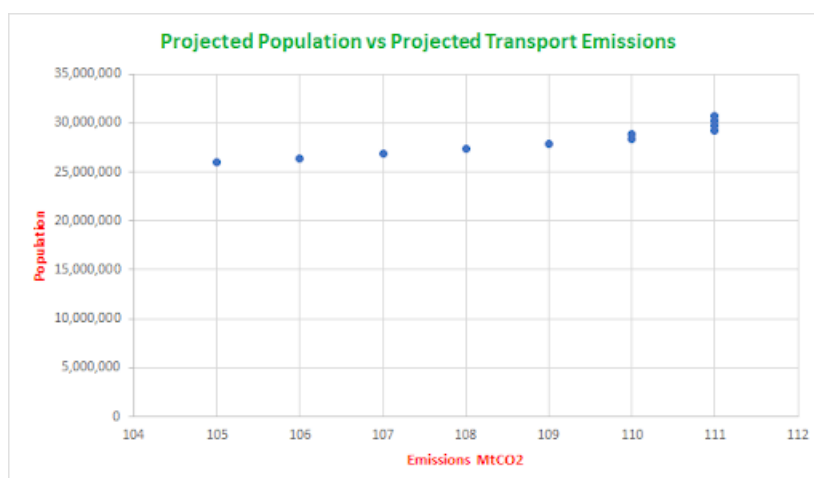
Year	Projected Australian population	Emissions from transport MtCO ₂
2020	25,936,500	105

Year	Projected Australian population	Emissions from transport MtCO ₂
2021	26,402,046	106
2022	26,873,947	107
2023	27,349,900	108
2024	27,829,520	109
2025	28,311,405	110
2026	28,796,151	110
2027	29,283,507	111
2028	29,773,492	111
2029	30,264,147	111
2030	30,755,046	111

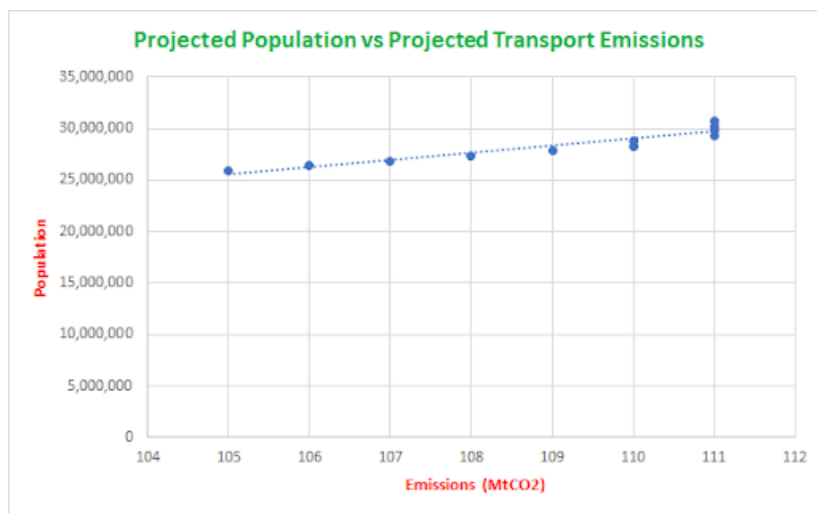
Step 6. Plot the emissions on the horizontal (x) axis and the population on the vertical (y) axis. Make sure you label your axes with equal increments that will allow all of the data to fit.

Hint: look at the worked example, to help you identify what units to use on the x and y-axes.

It is unimportant that you explain to students which axis is used for which data set, but make sure that the population axis intervals are labeled in 1 million increments between 25,000,000 and 31,000,000 at the very least. The emissions axis should be labelled with increments of 1 from 104-112 at the very least e.g.:



Step 7. Now, create a line of best fit that has an equal number of dots on either side of the line and best represents the trend in the data, as below:



Scatterplot with line of best fit (trend-line)

Step 8. Encourage students to discuss with the person next to them and write your own individual responses on their Worksheet to the following question; 'What is the direction of the relationship between the two variables?' Answer - Both of the variables increase

Step 9. Now invite students to discuss and answer the next question on the Student Worksheet:

- Question - *'What does this suggest about our growing population and greenhouse gas emissions from transport in the future? Why do you think that this is so?'*
- Possible answer - *As our population increases, so will our transport emissions.*

Step 10. Now, explain to the students that they will be constructing their own scatterplot to investigate Australia's projected population between 2020 and 2030 and Australia's projected car emissions over this time, and then compare the two scatterplots and comment on what they observe between population numbers and car emissions only versus emissions from all forms of transport.

Invites students to complete the data table and scatterplot activity on the Student Worksheet individually.

TIP: You might like to provide each group with a piece of string or cotton to help them try a few options for their lines of best fit before committing it to paper.

Step 11. Observe and support students while they construct their axes and plot the data. Pay close attention to the way they are labelling increments and axes.

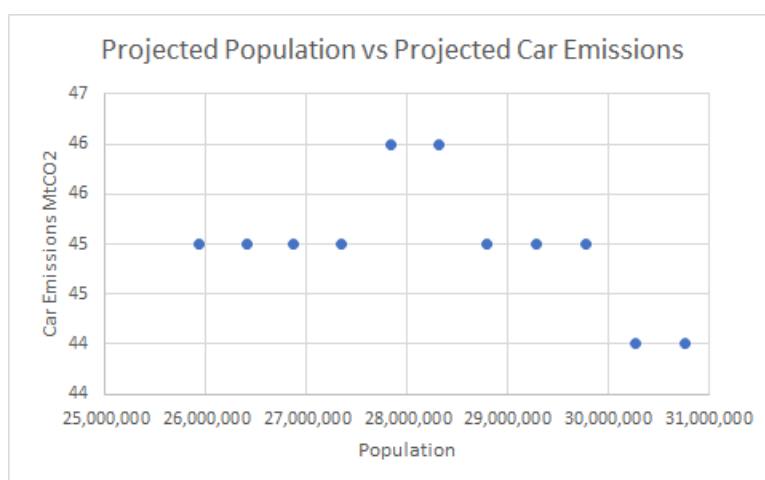
Here is the completed data and scatterplots for your reference.

- According to the Australian Bureau of Statistics, Australia's population numbers from 2020 to 2030 will be: (see column 2)
- According to the Australian Department of Energy and the Environment, greenhouse gas emissions from all Transport from 2020 to 2030 will be: (see column 3)

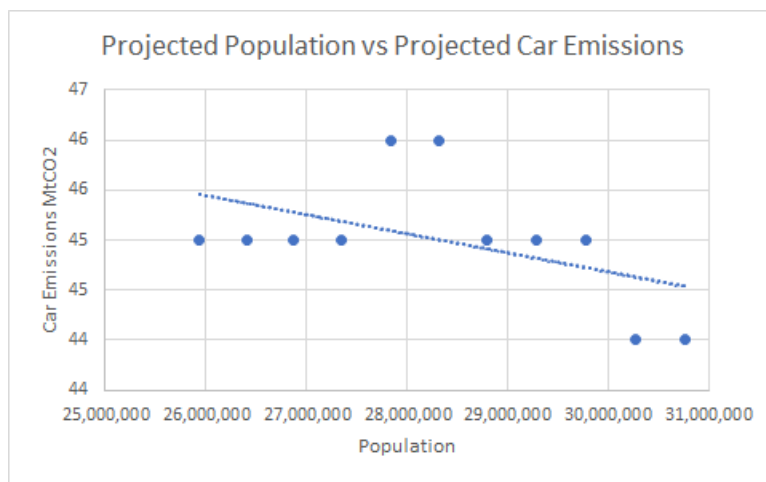
Year	Projected Australian population	Emissions from cars MtCO ₂
2020	25,936,500	45
2021	26,402,046	45
2022	26,873,947	45
2023	27,349,900	45
2024	27,829,520	46
2025	28,311,405	46
2026	28,796,151	45
2027	29,283,507	45
2028	29,773,492	45
2029	30,264,147	44
2030	30,755,046	44

Population projections

from: [https://www.abs.gov.au/ausstats/abs@.nsf/latestProducts/3222.0Media%20Release12017%20\(base\)%202066](https://www.abs.gov.au/ausstats/abs@.nsf/latestProducts/3222.0Media%20Release12017%20(base)%202066)



Scatterplot



Scatterplot with line of best fit (trend-line)

Step 12. Ask students to examine their scatterplots and answer the questions in the second THINK, PAIR, SHARE table. Give them 5 minutes to complete column A before they pair up to complete column B. You might like to conduct a class discussion to collect and analyse interpretations after this activity is completed.

- Describe the scatterplot by looking for patterns. *(Negative correlation, as the line is going down.)*
- What does this suggest about our growing population and greenhouse gas emissions from cars in the future? Why do you think that this is so? [Think back to the video about the future of transport] *(GHG emissions decrease as the population grows. This is most likely due to the production of more energy efficient cars and the increasing use of electric and hybrid vehicles.)*
- Compare the two scatterplots that you have created and discuss what you observe between population numbers and car emissions only versus emissions from all forms of transport. *(Transport emissions will continue to rise as the population increases, however, those produced by cars, will decrease.)*

Part D: Take Action

Step 1. Assign students to small groups and explain the task:

Conduct some research on sustainable transport using the websites provided below and then make a poster, video or social media campaign that presents how transport of the future can be more efficient.

- <https://www.climatecouncil.org.au/resources/transport-climate-change/>
- <https://www.drawdown.org/solutions/transport/electric-vehicles>
- <https://www.drawdown.org/solutions/transport/cars>
- <https://www.greenvehicleguide.gov.au/>

RULE: You must find a way to include one of the scatterplots from this lesson in order to build a case for why we need to move towards more sustainable transport options.

1. Consider your audience and their main needs, desires and obstacles
2. Brainstorm what kind of information they need in order to:
 - Get their attention
 - Meet their needs and desires
 - Overcome their anticipated obstacles and resistance
3. Think about what kind of data, statistics and graphs/charts you might need in order to build credibility and persuade this chosen audience.

OPTIONAL: For some inspiration on how statistics can be used to inspire and persuade, you might like to check out this TED talk from Uber founder, **Travis Kalanick** (https://www.ted.com/talks/traviskalanickubersplantogetmorepeopleintofewer_ca

Reflection

Have the students complete these sentences on the Students Worksheet:

- *I used to think...*
- *But now, I think...*

Prompt students to reflect on their learning, opinions or assumptions regarding climate change and consider if they think differently about transport in general. You might like to ask them to think about how they now feel about owning a car in the future and/or what type of vehicle they might like to consider.

Differentiated Learning

Extension - Students may choose to

Do some research about your local area by visiting the Australian Bureau of Statistics (ABS) website: <https://stat.abs.gov.au/itt/r.jsp?databyregion>

Instructions:

- Enter name of suburb
- Select electorate on map
- Click view data
- Scroll down and expand 'population and people'
- Scroll down to "Persons total"
- Record data in a table
- Scroll down and expand 'Economy and Industry'
- Scroll down to 'registered motor vehicles'.
- Select which data set you would like to examine.
- Student then develops their own inquiry question/s and find an interesting and persuasive way to use the data uncovered about their area in relation to population and transport.
- Write an article for the school newsletter (or other appropriate school communication channel) that discusses their findings and advocates for use of the Australian Greenhouse Calculator by students and their families.
- Write a letter to their local Member of Parliament to help strengthen the voice for climate change action in Australia. Encourage them to include data and statistics to make their message more persuasive. They might like to refer to: <https://www.climatecouncil.org.au/how-to-write-an-effective-letter-to-your-mp/>
- Research Australian emission targets and work in pairs to interpret the range of graphs displayed on this government website:
<https://www.environment.gov.au/climate-change/publications/factsheet-australias-2030-climate-change-target>
(They might like to write a report on the effectiveness of different kinds of graphs for achieving various purposes.)

Provisions for Learning Support -

- Help students develop a glossary of commonly used climate change terms, particularly related to transportation and new/arising forms of transport.
- Pair students that require extra help with another student for the individual graphing task.

Take It Further

To expand on student's learning in this activity, consider following up with this lesson; [***2040 Vision For Your Community***](#).

Teacher Reflection

Take this opportunity to reflect on your own teaching

- * What did you learn about your teaching today?
- * What worked well?
- * What didn't work so well?
- * What would you share?
- * Where to next?
- * How are you going to get there?

What's Your 2040?

Record your students' work in their communities with the hashtag #whatsyour2040 and share their visions in the '2040: [The Regeneration' Facebook Group](#).

The 2040 crew would love to see your class' work.

These lessons have been created in partnership with
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