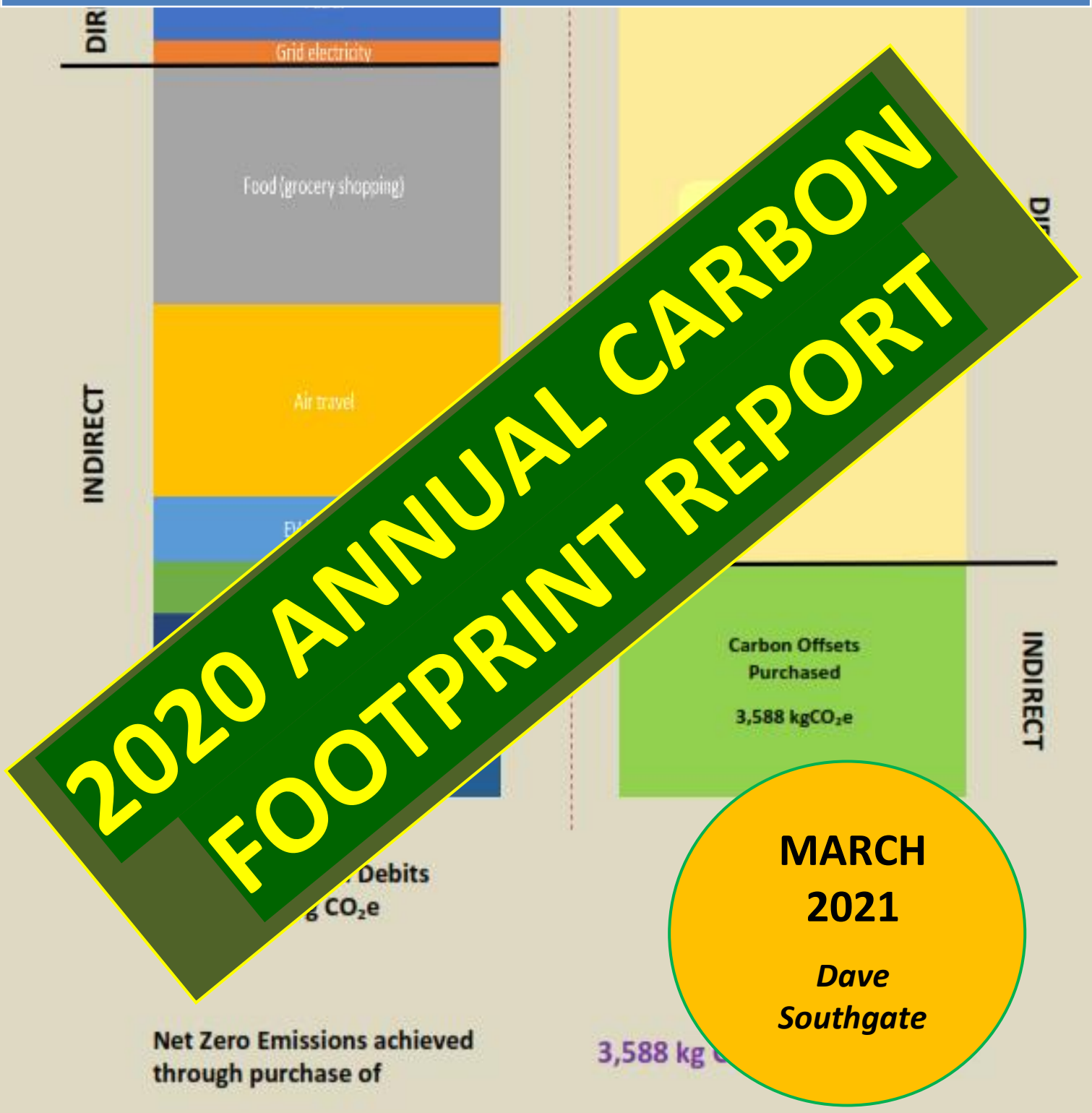
Net Zero Emissions Household

Becoming a Fossil Fuel Free Family



2020 ANNUAL CARBON FOOTPRINT REPORT

MARCH 2021

Dave Southgate

Foreword

This carbon footprint report updates the first annual carbon footprint report for our household which I released in March 2020. I have re-worked the data to reflect the changes in our energy and other consumption that took place over 2020. However, as far as possible I have left the format of the report unaltered in order to facilitate easy comparison of our total household carbon footprint between the years.

After some years of thinking only about our household direct carbon footprint, I believe I have now embedded our indirect carbon footprint into my carbon footprint thinking. I find exploring options for reducing our indirect footprint to be very interesting because the options are almost limitless. Having said that, unfortunately the carbon gains from taking any one initiative tend to be small.

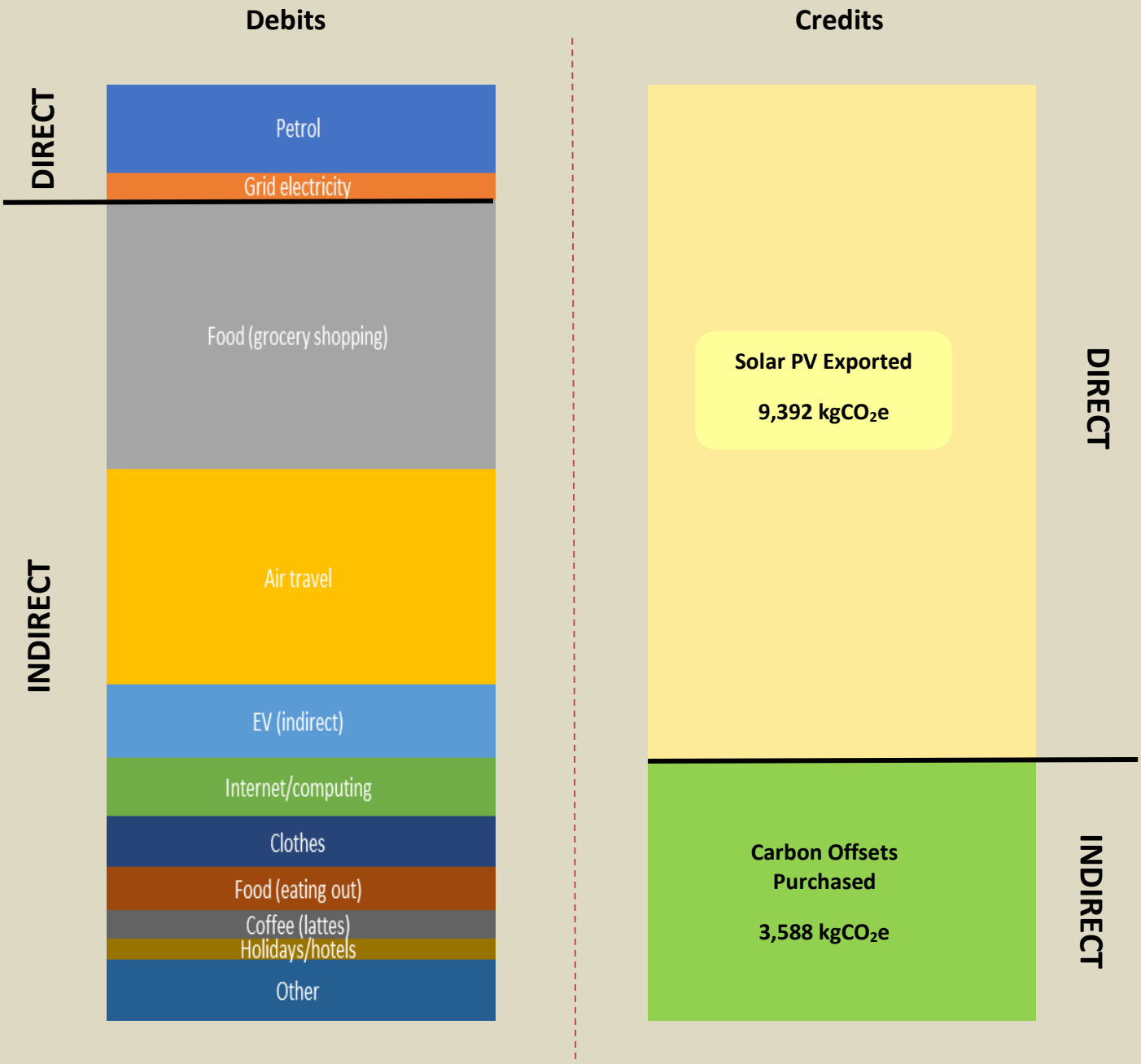
In 2020 I needed to buy significantly fewer carbon offsets than in 2019 to achieve a 'net zero emissions' outcome for our household. I envisage that I will be able to achieve a carbon neutral outcome for 2021 without having to buy any carbon offsets.

Dave Southgate

Canberra

March 2021

Household Carbon Balance Sheet 2020



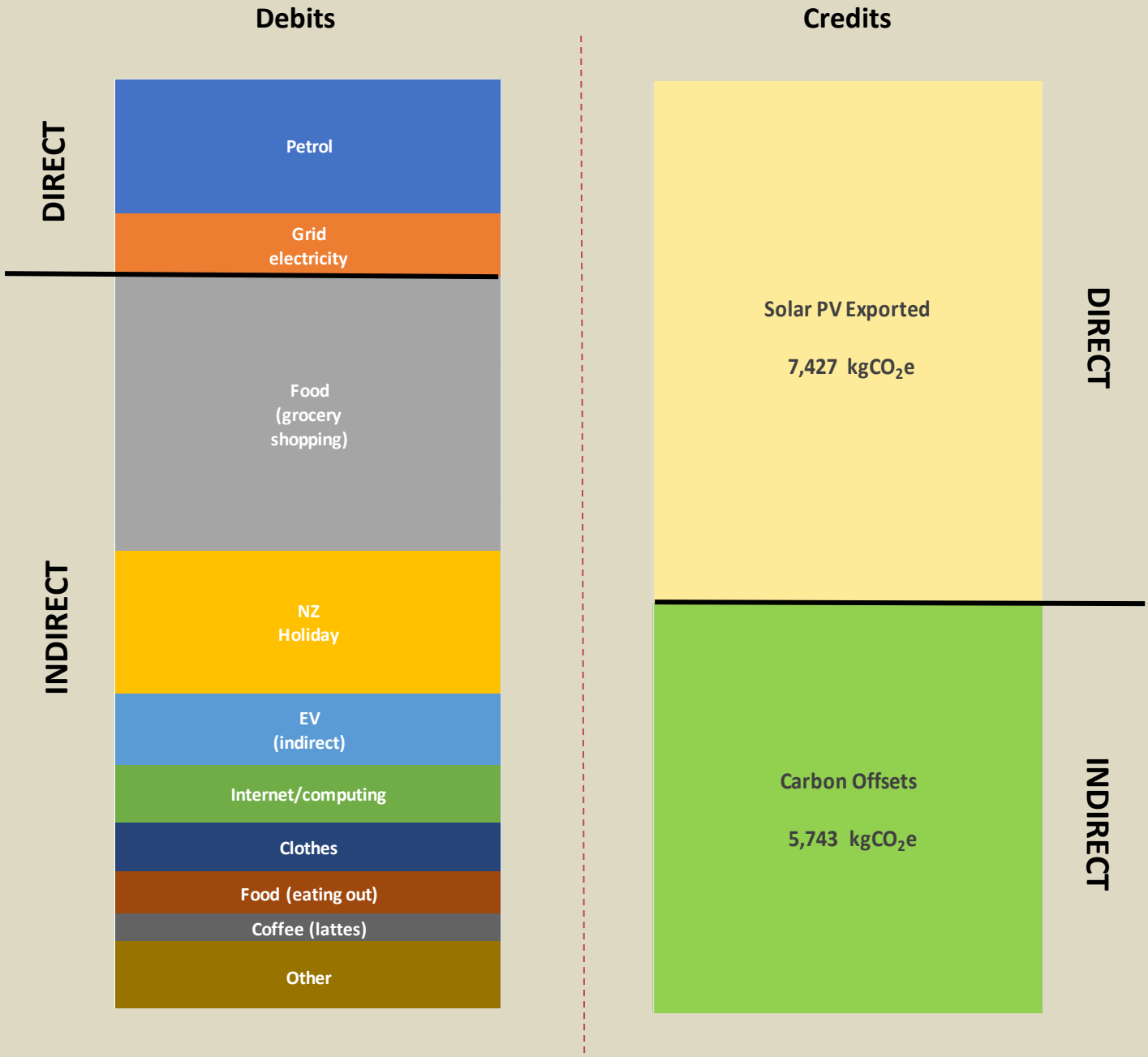
TOTAL Carbon Debits
= 12,980 kg CO_2e

TOTAL Carbon Credits
= 12,980 kg CO_2e

Net Zero Emissions achieved through purchase of

3,588 kg CO_2e carbon offsets

Household Carbon Balance Sheet 2019



TOTAL Carbon Debits
= 13,170 kg CO_2e

TOTAL Carbon Credits
= 13,170 kgCO_2e

Net Zero Emissions achieved through purchase of

5,743 kgCO_2e carbon offsets

Background

I produced the first Carbon Footprint Report for our household in early 2020. The reader may wish to refer to this document for a more detailed account of the background to this latest carbon footprint report.

In essence, this Carbon Footprint Report is part of a suite of documents I have released which describe our transition from being a 100% fossil fuelled household to one which I intend, eventually, will be totally powered by renewable energy.

In this document I report the quantum of both our direct and indirect carbon footprints. I have been computing and reporting the value of our household's direct carbon footprint (ie the carbon footprint of the fuels we directly buy to run our household (namely grid electricity and petrol)) for a number of years. I consider the data used to compute our direct footprint as very solid. On the other hand, I only commenced computing our indirect carbon footprint (ie the carbon embedded in the goods and services we use/buy) last year and at this stage I only consider the valuations I have arrived at as preliminary.

In this year's report I have attempted to keep the structure, formatting and footprint computation methodology as close as possible to that which I used in my first carbon footprint report. In some parts I have retained large sections of text from my earlier report. I have done this not only to make my job easier, but also to facilitate the transparent tracking of changes between years (within, what I hope, is a largely standalone document).

Overview

In the two previous pages I have shown an overview of our household carbon balance sheet for 2020 and for 2019. While our total household carbon footprint was approximately 13 tonnes in both years, there are some significant differences between the years.

Our direct carbon footprint was somewhat lower this year due to a decrease in our consumption of both petrol and grid electricity (I give details in my project 2020 Annual Report). However, our indirect footprint increased, primarily as a result of an increase in our air travel footprint (we took our family holiday in NZ in 2019 while we spent our 2020 holiday in Singapore (very luckily we managed to get away for 10 days in January 2020 just before COVID-19 restrictions hit)).

The credit side of our carbon ledger also changed somewhat. We installed an extra 6kW of solar PV on our roof early in 2020 and this enabled us to export about 25% more carbon free electricity in 2020 compared to 2019. The outcome of this was that in order for us to reach carbon neutrality for the year, I only needed to purchase about 3.5 tonnes of carbon credits in 2020 compared to around 5.5 tonnes in 2019.

As a result of my first attempt at footprinting our indirect carbon emissions, we made a few changes in our food consumption patterns over 2020. I also bought a number of devices aimed at reducing our indirect footprint in a few specific areas. I discuss these in Chapter 8 of my 2020 Annual Report. While I very much enjoyed this exercise, and felt I really got a lot out of my new directions (particularly using bidets and obtaining a very nice e-ink device), I would not claim that they made any great inroads into the magnitude of our indirect carbon footprint.

In last year's Carbon Footprint Report I included some discussion about the validity of the carbon footprint values I am obtaining. The reader is encouraged to refer to this if they wish to gain a feeling for the level of confidence that can be placed on my results.

Direct Carbon Footprint

Chapter 1 Direct Debits & Credits

Debits

As discussed in the Background, we have been working for a number of years to reduce our direct use of fossil fuel based energy as part of our project to become a Fossil Fuel Free Family.

Figure 1 gives a breakdown of our direct energy use over 2020. This Figure is extracted from my Annual Report for 2020 and the reader is invited to look at that document if you want more detailed information.

It can be seen that in 2020 we sourced about 60% of our household energy use from our solar PV systems.

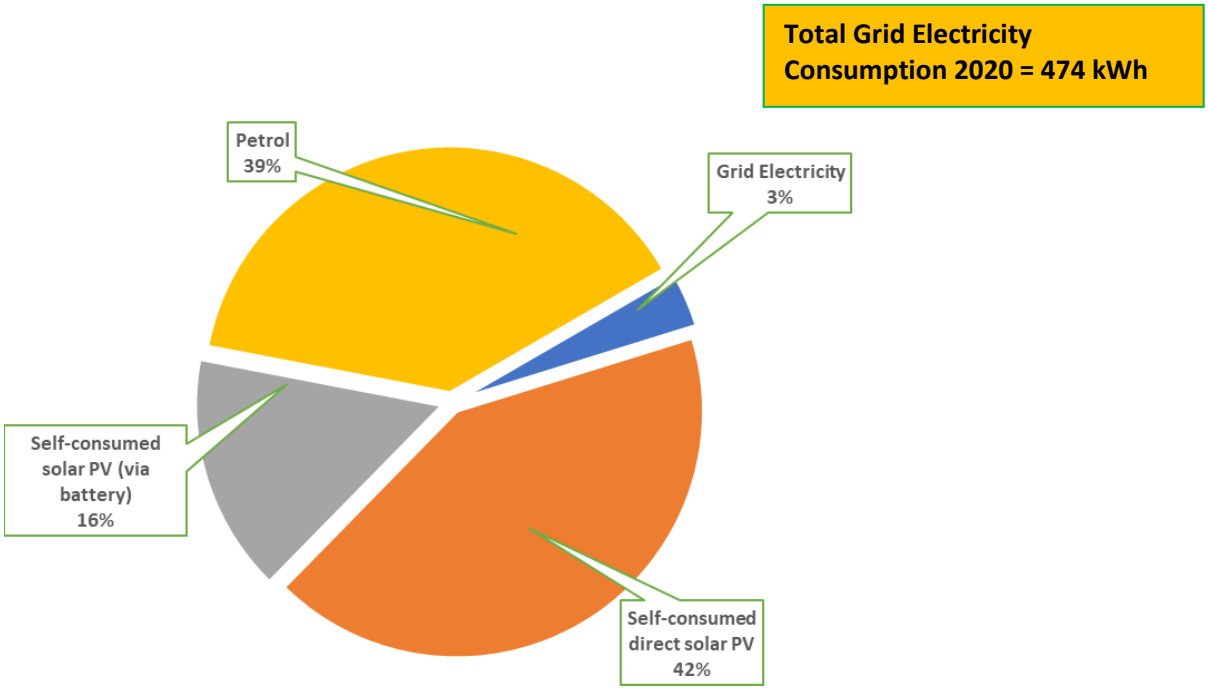


Figure 1: Breakdown of our household energy use 2020

I have converted our fuel consumption data into CO_2e emissions using the Government's published greenhouse accounts factors for 2020. The values for our petrol and grid electricity carbon footprints are shown in **Figure 2** in the next Section.

Credits

In my 2020 Annual Report I also discuss our solar PV production and export for the year. We exported 11,595 kWh of solar PV electricity in 2020. I have converted this to a carbon credit of **9,392 kgCo_2e** using the published greenhouse accounts factors and assuming that each kWh of solar PV (carbon zero) electricity that we exported displaced one kWh of grid (mainly coal based) electricity.

Indirect Carbon Footprint

Chapter 2

Introduction

Computing one's **direct carbon footprint** is very straightforward. The energy user knows very accurately, from their energy bills, how much fuel they have used over a period of time. The amount of fuel used can easily be converted into carbon emissions through the application of published greenhouse accounts factors.

By way of contrast, computing one's **indirect carbon footprint** is not straightforward. It generally involves delving into many layers of data and making many assumptions. For example, if I buy a widget I can normally find out which country it is 'made' in. However, the product may contain many components which have been sourced from all over the world. Indeed, different batches of the same product may have components from quite different origins or be made from different materials. All these unknowns impact on the magnitude of a product's carbon footprint. Unless one is carrying out a detailed examination of a particular product one has to accept that the outcome of indirect carbon footprinting computations is only ever likely to be a gross estimate.

This document is not intended to be a scientific treatise. I have therefore tried to keep the language and concepts simple by avoiding many of the niceties that the specialist carbon accountant would use. I have done this not only to appeal to a wider audience but also because I see little value in getting bogged down in detail when I am only seeking to obtain high level estimates of my family's indirect carbon footprint.

Computing our Indirect Footprint

In this, the second of my carbon footprint reports, I have decided not to change any of the values of the carbon intensity of individual actions (ie the CO_2 emissions per unit of consumption) that I used in the first report. Last year I spent some time researching values for how much CO_2 is emitted for each of the actions we undertake in our day-to-day living (eg eating different types of food, using the internet, etc) and it was very apparent that the values I arrived at could only be considered 'guesstimates'; as indicated above, there are just so many variables and unknowns that I don't believe I would arrive at any more reliable CO_2 output figures/unit of activity if I repeated the exercise.

Maybe in a few years' time, carbon footprinting will have matured, and low carbon agriculture, manufacturing and transport will have emerged to such an extent that there will be material reductions in unit carbon footprints.

Given the above, I worked through the list of CO_2 generating activities that I reported in **Figure 2** of last year's report and updated the values for the levels of consumption where I believed they varied from last year. **Figure 2** which follows captures my new estimates. Some of the changes are quite significant (eg an increase in our air travel in 2020); others are notable (eg the inclusion of toilet paper) but don't make any great difference to the quantum of the total carbon footprint.

In my first carbon footprint report I discussed some obvious omissions in the list of activities/products shown in **Figure 2.** I have not tried to resolve any of the missing gaps – while there are obvious data holes in our indirect footprint, as far as I can tell the ones I have identified are not of great significance as far as the magnitude of our family indirect carbon footprint is concerned.

CO_2 Emissions Type	CO_2e Source	Amount	Wt CO_2e (kg)	Comments
DIRECT	Petrol	5,168 kWh	1,250	
	Grid Electricity	474 kWh	380	
	TOTAL Direct		**1,630**	
INDIRECT	Food (grocery shopping)		3,730	See Appendix 1
	Air travel		2,970	Family holiday in Singapore
	New EV (Leaf) (mfr)	1	1,000	10tCO_2e. Count over 10 years
	Clothes	100 items	700	7 kgCO_2e/garment
	Food (eating out)		600	5 lunches + 1 family meal/week
	Coffee	760 cups	380	0.5 kgCO_2e/cup
	Internet	4 persons	320	80 kgCO_2e/person
	Desk top computing	4 computers	300	60 kgCO_2e/y + printer
	Holidays/hotels	1	300	30kgCO_2e/night for hotel Singapore
	Mobile phone	4	200	50kg/yr
	Public Transport	5,000 km	200	
	Electricity (indirect for both grid + solar PV)		180	35 kgCO_2e for grid + 145 kgCO_2e for solar PV
	Shoes	10 pairs	150	
	Library books	250	125	5 kgCO_2e/book; book read 10 times
	Petrol (indirect)		65	Scope 3 emission factors
	Toilet paper	$4x10^4$ sheets	60	1.5 g CO_2e / sheet
	Washing clothes	200 washes	45	220 gCO_2e/wash for washing machine
	New bike (mfr)	1	25	250 kgCO_2e. Count over 10 years
	TOTAL Indirect		**11,350**	
TOTAL CARBON FOOTPRINT			**12,980**	

Figure 2: Breakdown of my family's direct and indirect carbon footprints for 2020

Discussion

I have translated the indirect carbon data in **Figure 2** into the visualisation in **Figure 3.** Food immediately jumps out as the overwhelming contributor to our household indirect carbon footprint. It makes up about 40% of this footprint. Given the importance of this component I have given a detailed breakdown of food's contribution to our family footprint in Appendix 1.

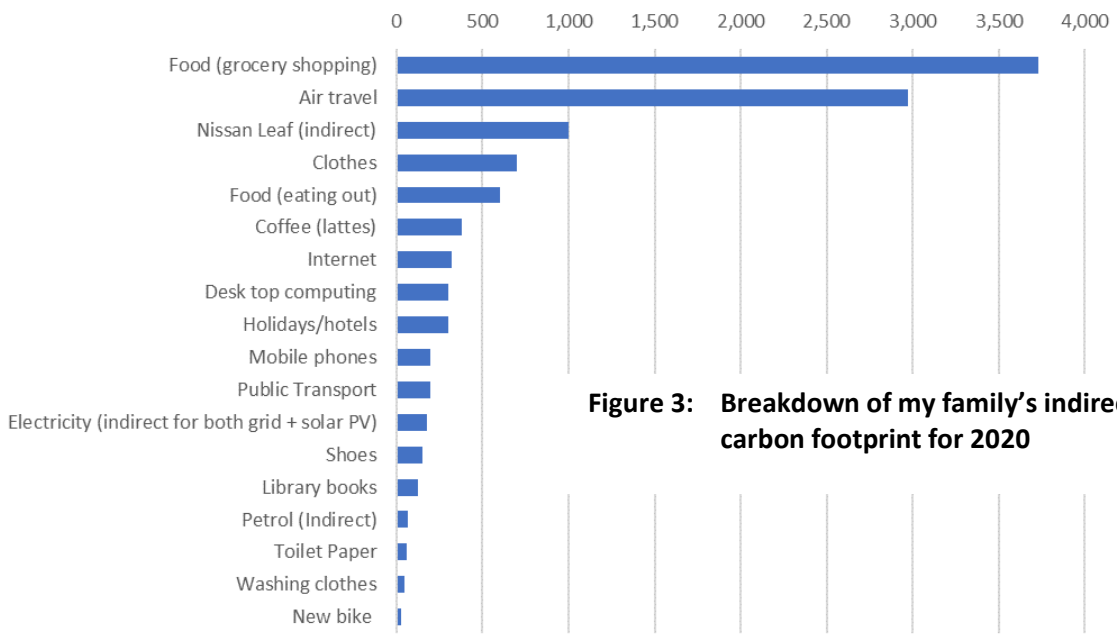


Figure 3: Breakdown of my family's indirect carbon footprint for 2020

If the food carbon footprint is broken down into broad food groups an interesting picture emerges (**Figure 4**). About 85% of our food carbon footprint falls into only three groups: meat/fish; veg/fruit; and dairy. I'm not sure what a dietician would say about this. Anyway, it is easy to see why a vegan diet is being promoted as a good way to reduce your carbon footprint!

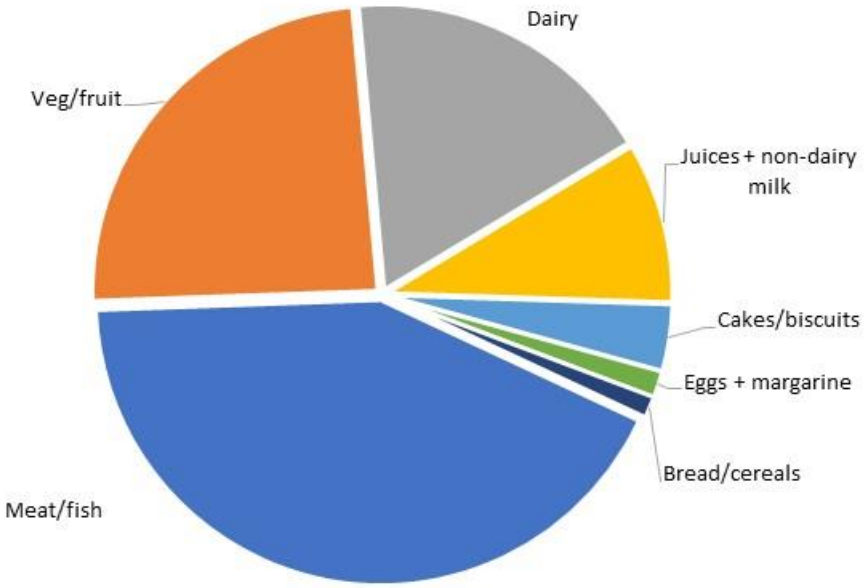


Figure 4: Broad breakdown of my family's food carbon footprint for 2020

It is also interesting to breakdown our total (direct + indirect) footprint into broad categories. This picture is shown in **Figure 5**.

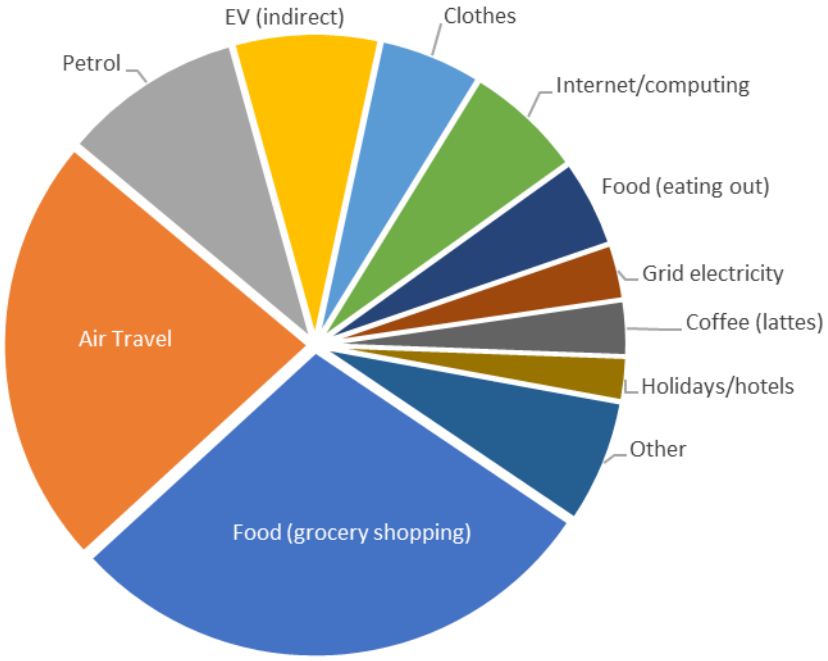


Figure 5: Our total 2020 carbon footprint shown in broad categories

Amongst other things, this shows the significant contribution that is made by a short overseas holiday taken relatively close to home (although the footprint for our holiday in Singapore in 2020 is significantly greater than that for our holiday in NZ in 2019). It is also interesting to note that apart from 'clothes' and 'EV (indirect)' all the categories in the Figure involve products that are, to all intents and purposes, immediate consumables. Sadly, these days even 'clothes' are often little more than short term consumables. I see our New Nissan Leaf, which we bought in August 2019, as a long-term product and it can be seen that its indirect footprint makes quite a sizeable contribution to our total footprint. It is estimated that 10 tonnes of CO_2 are generated in the manufacture of a Leaf. I intend to allocate 1t CO_2/yr to our carbon debits for 10 years to pay off this carbon debt.

What Carbon Footprint do I Choose?

After I released last year's report I entered into an extremely useful debate about the way I allocate a CO_2 value to a product. When computing the carbon footprint of a product or service, should I use the value of the actual amount of CO_2 emitted in providing that product/service, or should I use the derived value if the carbon in the product/service has already been offset by the provider?

For example, the ACT Government has entered into PPAs (power purchase agreements) with renewable energy providers to the extent that all the electricity consumed in the ACT can now be considered to be net carbon neutral. Therefore, can I now ignore any CO_2 emissions associated with consuming grid electricity in the ACT or should I compute our indirect carbon footprint using the actual CO_2 emissions made when our electricity is generated (the actual electricity consumed in the ACT is primarily delivered by the NSW grid which is heavily coal based)? [Data for the actual carbon intensity of ACT electricity is published in the Federal Government's Annual Greenhouse Factors reports.]

After giving this some thought, I am most comfortable with aiming to use the actual emissions, and not derived emissions, when carrying out my carbon footprinting. It seems to me that using derived emissions can lead to double counting and all sorts of complications. For example, the ACT claims its electricity is carbon neutral while at the same time South Australia, where much of the ACT's carbon free electricity is generated, is also claiming that its electricity is carbon neutral (apparently based on renewable electricity where much of the carbon has been allocated to third parties through PPAs). I don't think this is necessarily a problem, but I think everyone needs to be extremely careful about their carbon claims.

I believe my approach is more robust and conservative. In essence our indirect carbon footprint will only approach zero when the grid, and all other parts of the economy, are actually decarbonised.

Chapter 3

Managing Our Carbon Footprint

As indicated earlier, the key aim of our energy transition project is now to have net zero emissions, computed on an annual basis, from this year going forward. In simple terms I will compute our direct and indirect carbon footprints at the end of each year to work out our annual 'carbon debt'. At the same time, I will compute the carbon footprint of our total solar PV export to give us our annual 'carbon credit' [see discussion below]. If our credit exceeds our debt, I will take no action. If our debt exceeds our credit, I will buy some form of external carbon credits to provide us with a balanced annual carbon budget.

Direct Footprint

As discussed earlier, I have regularly reported on our efforts over the past seven years to reduce our household direct carbon footprint. At the current time we are about 95% fossil fuel free as far as energy use within our house is concerned. I believe that this is about the practical limit and I am no longer focussing on this as a key area for action.

By way of contrast, we are not going so well on reducing our use of petrol. Our consumption of petrol reduced quite significantly in 2020 due to a range of changed circumstances but I don't think this reduction will be sustained. I have yet to persuade my wife to give up her petrol car – we need to make this step if we want to seriously reduce the direct carbon footprint of our household transport. Compounding this issue is the fact that our son has just turned 18 and is getting into cars. I imagine that as long as he lives at home I will have to just relax about our petrol use.

Indirect Footprint

Throughout 2020 I kept a look out for ways in which we could reduce our household indirect carbon footprint. I have reported on our efforts in **Chapter 8** of my transition Annual Report for 2020.

While we made some minor adjustments in our diet, in particular we made really significant cuts in our consumption of dairy milk (replaced with oat; soy; cashew milk), the total quantum of the reduction was not large. As I've noted earlier, I really enjoyed some of the new habits I adopted to reduce my personal indirect carbon footprint (eg using bidets and greater use of e-ink devices) but I very much recognise that this alone isn't going to change the course of global climate change. Having said that, if enough people around the world simply adopt new climate friendly habits in their day-to-day lives then things can change for the better.

Working against the minor reductions we achieved in our indirect carbon footprint, last year we were lucky enough to sneak in a short break in January in Singapore before the COVID-19 barriers came down. This increased our indirect carbon footprint over our 2019 footprint when we took our family holiday in New Zealand. Holidays involving air travel have a great influence on the size of your indirect carbon footprint!

Clearly it is not going to be easy for us to reduce our indirect carbon footprint on a sustained basis. I guess that ultimately we will be relying on all product manufacturers, service providers, transport providers, etc de-carbonising their offerings. When shopping if I can identify a low carbon product I am very inclined to buy that product even if competing, higher carbon, options are cheaper.

Carbon Credits

To repeat what I said in last year's report, this is a grey area. When you move into the world of 'net' carbon footprinting you are, by definition, moving into an area where there is some form of trading between positive and negative footprints. To achieve 'net zero emissions' some form of carbon credit will usually be used to balance a carbon debit. This can be done in a number of ways, but it is often a contested space which leaves many people feeling that any carbon reductions are 'notional' rather than 'actual'.

I see that there are two broad routes that are open to us to offset our carbon emissions. We can generate our own offsets by putting carbon free electricity back into the grid or we can buy offsets from a third party.

Generating our own credits

I am most comfortable with using credits which I can physically generate and monitor myself. Therefore, I have placed a fair bit of emphasis on maxing out the solar PV on our roof and then exporting as much of our 'carbon free' electricity as possible (while minimising our use of grid electricity).

As noted elsewhere, we installed an additional 6kW solar PV system on our roof at the end of March 2020. This meant that our exports of solar electricity increased by around 25% in the year. I am of course expecting a further significant increase in our exports over 2021 given that we will have three additional months of solar generation (during a quarter with high solar PV production).

This increase in our exports meant that there was an approximate 40% reduction in the amount of carbon offsets I needed to purchase for our household to reach a 'net zero emissions' status for 2020.

Buying offsets

I noted in last year's carbon footprint that I was disappointed in the range of carbon offsets that are available for individuals to buy. Anyway, this year, given that we needed to buy a smaller amount of offsets I did not go to any great lengths to seek out better offsets. I purchased the offsets from the same provider that I used in 2020 (the offset certificates are included in **Appendix 3**).

I am reasonably confident that we will not need to buy carbon offsets for 2021 since we will not be going on an overseas holiday this year (COVID-19 restrictions); and as noted above, we should see a significant increase in the amount of our 'home grown' solar PV credits. Weighing against those two factors will be the fact that my now adult, but still at home, son is likely to start running around the ACT in a petrol car.

Going forward, if we need to buy offsets in the future I envisage that I will invest in a community solar PV project. I may well do this anyway, as I plan to take my family into carbon positive territory once we have a good handle on our total carbon footprint.

Appendices

Appendix 1 Food

For completeness, I have only lightly edited this Appendix from the version I included in my 2019 carbon footprint report.

It can be seen from the information I have provided in **Chapter 2** that for my family food dominates our indirect carbon footprint. I imagine this is the same for most families. In fact for us, after years of working on our direct carbon footprint, food also dominates our total carbon footprint. Given this, I had little choice but do a more detailed assessment of the footprint contributions of the all the different things in our grocery shopping basket. I have shown the outcomes of this work in **Figure A1**.

As with my analysis in **Chapter 2**, I relied on searching the internet to find CO_2 emission factors for each of the food types I needed to cover. It is important to note that there are very diverse values in the literature for the carbon footprint of any given food type. When selecting my references I tried to use a consistent approach: ideally Australia based; preferably academic research; and give preference to the most recent work. In many cases in the end I just picked a value for the carbon footprint which was somewhere in middle of the range of published values. Therefore, I believe all of the CO_2 values I have computed need to be treated with some caution.

Figure A1: Itemised family food carbon footprint for 2020

Description	Weight (kg/wk)	Carbon Intensity (kg CO_2e/kg)	Total CO_2 e (kg/year)
Meat: beef; lamb; chicken			
Beef	1	23	1,000
Lamb/pork/other	0.5	12	300
Chicken	0.5	3.7	200
Fish	0.5	3.4	85
Vegies	3	1	150
Fruit	5	1	250
Dairy: yoghurt; milk; cheese			
Milk	5	1.3	100
Cheese	0.5	20	500
Yoghurt	1	1.3	65

Description	Weight (kg/wk)	Carbon Intensity (kg CO_2e/kg)	Total CO_2e (kg/year)
Non-dairy: milk; margarine			
Almond milk, etc	5	0.6	250
Margarine	0.5	1	25
Juices	3	0.6	90
Breakfast cereals	0.3	1.2	20
Cakes; biscuits; chocolate	1	1.5	75
Eggs	6 eggs	1.5	30
Bread	0.5	1	25
Spreads	0.1	2.9	15
Frozen: veg; ice cream			
Veg	1	2	100
Ice cream	0.5	2	50
Tinned/bottled: beans; fruit; etc	4	2	400
TOTAL			**3,730**

In order to get a better visualisation of the importance of the individual food types shown in the Table, I have produced the bar graph shown in **Figure A2.**

The information in the Figure has been categorised into groups to provide the picture shown in **Figure 4**.

When computing our food carbon footprint, I only tried to capture the foods which make up our normal weekly shop. There are of course many other items which we use often in the kitchen but only need to buy from time to time – eg herbs, spices, sauces, etc.

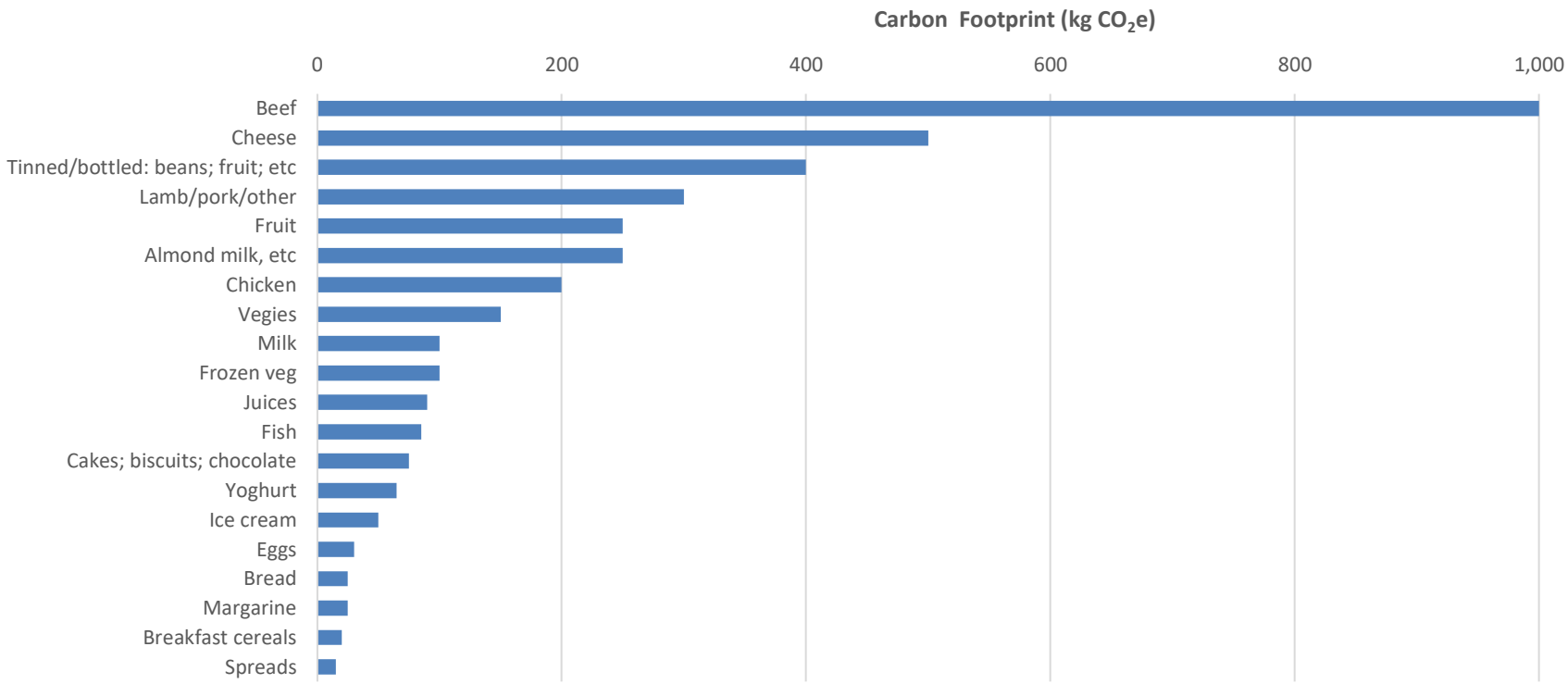


Figure A2: Visualisation of our itemised family food carbon footprint for 2020

Appendix 2 References

In a similar vein to Appendix 1, for completeness and to assist transparency, I have included an unedited version of this listing of the references I used for deciding upon the carbon intensities I use throughout this, and last year's, report.

When trying to ascertain the carbon emission factors I simply Googled for the activity/product groups listed in **Figure 2** and the food types listed in **Figure A1**. I did not do this in a particularly rigorous way: I always selected at least three separate sites to ascertain the range of the claimed emission factors; if the first few sites gave a similar answer I did not go further and I picked what I thought was a good round number for the average value; if there was no apparent agreement I opted for the figure that was shown on what I judged to be the most credible site. This process was crude and involved lots of judgement – the figures in the Tables should therefore be considered to be purely indicative.

When I was going through this process I noted down values and/or captured the links of particular sites which I've listed below essentially unedited. These may, or may not, have been the sites which I used to obtain the final emissions factor values which appear in the Tables.

While my Googling appears to be haphazard, I deliberately did not want to get too bogged down in detailed examination of very diverse papers - I think it is self-evident that very carefully working through masses of poor and inaccurate data is not likely to give you any more reliable results. Against that background, I reiterate that the computations for our indirect carbon footprint should only be treated as indicative.

My informal notes/web site links are listed below, this only represents a small sample of the sites that I looked at:

Beef 50-60 kgCO2e/kg (at best): https://www.theland.com.au/story/6527876/beef-must-stop-ignoring-its-large-co2-footprint/

Beef 75 kgCO2e/kg beef (derived from figure in article): http://www.fao.org/news/story/en/item/197623/icode/

Beef massive variation in published figures most common figure about 25 kgCO2e/kg (most of these studies not Australian). CSIRO similar figure: https://www.publish.csiro.au/an/an11030

Fruit and vegies (US): http://www.circularecology.com/news/wonky-fruit-and-veg-the-carbon-footprint-of-food#.XlYJMWgzZhE

Food Australia (RMIT): https://www.rmit.edu.au/news/all-news/2016/november/new-study-provides-carbon-footprint-league-table-for-food

Australian cheese: https://milkmaidmarian.com/2018/06/07/the-aussie-dairy-carbon-hoofprint/

Milk – major differences in different publications (could be global differences)

Margarine: https://www.bettermeetsreality.com/the-impact-footprint-of-producing-eating-butter-margarine/

Coffee: https://www.ecowatch.com/coffees-invisible-carbon-footprint-1882175408.html

Food miles debate: https://www.theguardian.com/environment/2008/mar/23/food.ethicalliving

Eggs: https://www.australianeggs.org.au/dmsdocument/521-environmental-assessment-of-an-egg-production-supply-chain-using-life-cycle-assessment

Bread: https://blog.csiro.au/how-green-is-your-bread/

Cakes etc detailed study: https://www.sciencedirect.com/science/article/pii/S2352550918303087

Sandwich: https://www.theguardian.com/lifeandstyle/2018/jan/25/scientists-calculate-carbon-emissions-of-your-sandwich

Juices: https://stanfordmag.org/contents/getting-the-most-sustainable-squeeze-from-your-oj-essential-answer

Peanut butter: https://www.farmprogress.com/peanut/peanut-s-environmental-footprint-stretches-beyond-farm

Frozen veggies: https://stud.epsilon.slu.se/6377/7/gottfridsson_l_140304.pdf

Ice cream: https://www.benjerry.com/values/issues-we-care-about/climate-justice/life-cycle-analysis

Nissan Leaf indirect: https://www.carbonbrief.org/factcheck-how-electric-vehicles-help-to-tackle-climate-change

Latte 340g CO2: https://www.ecowatch.com/coffees-invisible-carbon-footprint-1882175408.html

List of footprints for food: https://www.greeneatz.com/foods-carbon-footprint.html

Australian study food list: http://www.australasianscience.com.au/article/issue-december-2016/study-provides-carbon-footprint-table-food.html

Family footprint/year: http://shrinkthatfootprint.com/food-carbon-footprint-diet

Wooden furniture: https://www.panelsfurnitureasia.com/en/news-archive/un-wooden-furniture-reduces-more-carbon-emissions-than-other-materials/462

Newspaper: https://www.theguardian.com/environment/green-living-blog/2010/nov/04/carbon-footprint-newspaper

Bicycle: https://www.theguardian.com/environment/bike-blog/2012/mar/15/lifecycle-carbon-footprint-bike-blog

Books: https://www.csbsju.edu/Documents/CSB%20Sustainability/SHM%20e-readers%20vs.%20books%20poster(0).pdf

Shoes: http://news.mit.edu/2013/footwear-carbon-footprint-0522

Clothes: https://www.systain.com/wp-content/uploads/2015/09/Systain_Studie_Carbon_Footprint_English.pdf

Internet shopping: https://ctl.mit.edu/sites/default/files/library/public/Dimitri-Weideli-Environmental-Analysis-of-US-Online-Shopping_0.pdf

Use of internet:
https://www.researchgate.net/publication/238634031_Carbon_footprint_of_the_Internet

Mobile phone: https://www.theguardian.com/environment/green-living-blog/2010/jun/09/carbon-footprint-mobile-phone

Desktop computers:
https://h22235.www2.hp.com/hpinfo/globalcitizenship/environment/productdata/Countries/_MultiCountry/productcarbonfootprint_deskto_2017104233915185.pdf

Washing clothes: https://www.theguardian.com/environment/green-living-blog/2010/nov/25/carbon-footprint-load-laundry

Hotel room: https://considerategroup.com/carbon-emissions/

Buses efficiency: https://the-riotact.com/the-efficiency-of-buses/57534

Electrical appliances: https://pubs.acs.org/doi/abs/10.1021/es201459c

Appendix 3

Carbon Offset Certificates


THIS CERTIFICATE OF SUSTAINABILITY IS PROUDLY PRESENTED TO
DADD
7,000 lbs of Carbon Offsets from the
Personal Carbon Offset Package
terrapass
RESTORE THE BALANCE
terrapass
SQXKRHS8-28067
Certificate Number
December 2, 2019
Date


THIS CERTIFICATE OF SUSTAINABILITY IS PROUDLY PRESENTED TO
Dave Southgate
1,000 lbs of Carbon Offsets from the
Personal Carbon Offset Package
terrapass
RESTORE THE BALANCE
terrapass
IYTHRDW6-45030
Certificate Number
February 26, 2021
Date

About the Author

Dave Southgate retired from the Australian Government Public Service in July 2012 after a 31-year career as an 'environmental bureaucrat'. After working for 8 years in government environmental agencies at both the State and Federal levels he joined the Australian Government Transport Department in late 1989 and stayed there until he retired. Throughout his time in Transport he specialised in aircraft noise; in the latter years he also became involved in aviation climate change issues and developed a particular interest in carbon footprinting.

From 2004 to 2012 Dave was the Australian Government representative on the United Nations International Civil Aviation Organization (ICAO) Committee on Aviation Environmental Protection (CAEP). He pursued his interest in carbon footprinting while on CAEP and was a member of the group that oversaw the development of the ICAO Carbon Calculator.

Not long after his retirement Dave began a process aimed at transforming the energy use patterns in his 100% fossil fuelled house. This project is aimed at his family becoming 'Fossil Fuel Free' (in essence the goal is for his household to no longer directly buy any fossil based fuels, namely grid electricity, gas or petrol). Dave has written numerous reports and articles about this project. These can be viewed and/or downloaded from his website.

Dave has a science/engineering background and has degrees from the Universities of Liverpool, London (Imperial College) and Tasmania.

You can find consolidated information on our household energy transition project at my website: https://netzeroemissions.net/