How to Solve Climate Change – a logical plan

Summary

This plan promotes two fundamental ideas: firstly, that we specify an exact year-by-year gross emissions reduction pathway for New Zealand, called the **Required Emission Reduction Pathway** (RERP), and secondly, that people or organisations emitting above this line pay a penalty. Those emitting below the line are paid a reward. The whole economy, including agriculture, is completely tied 100% to this system from the outset. Thus in year one, because we start from today's emissions, noone pays or receives anything. In year two, though, people would have to be exactly on the RERP to pay or receive nothing. This plan gets rid of the current barrier to bringing agricultural emissions into a carbon scheme - that a dairy farm which emits 1,200 tonnes/yr would pay $120,000 if CO2 was priced at $100/tn.

The Logical Plan

There are only three questions to be answered to find a solution to climate change. But these questions depend on one principle: **we in New Zealand only have the power to do things within New Zealand.** It is only by being an example to the rest of the world that we can encourage them to follow our pathway, and it must be a pathway which, if the whole world followed it, would save the world from the impending disaster of climate change.

The three questions

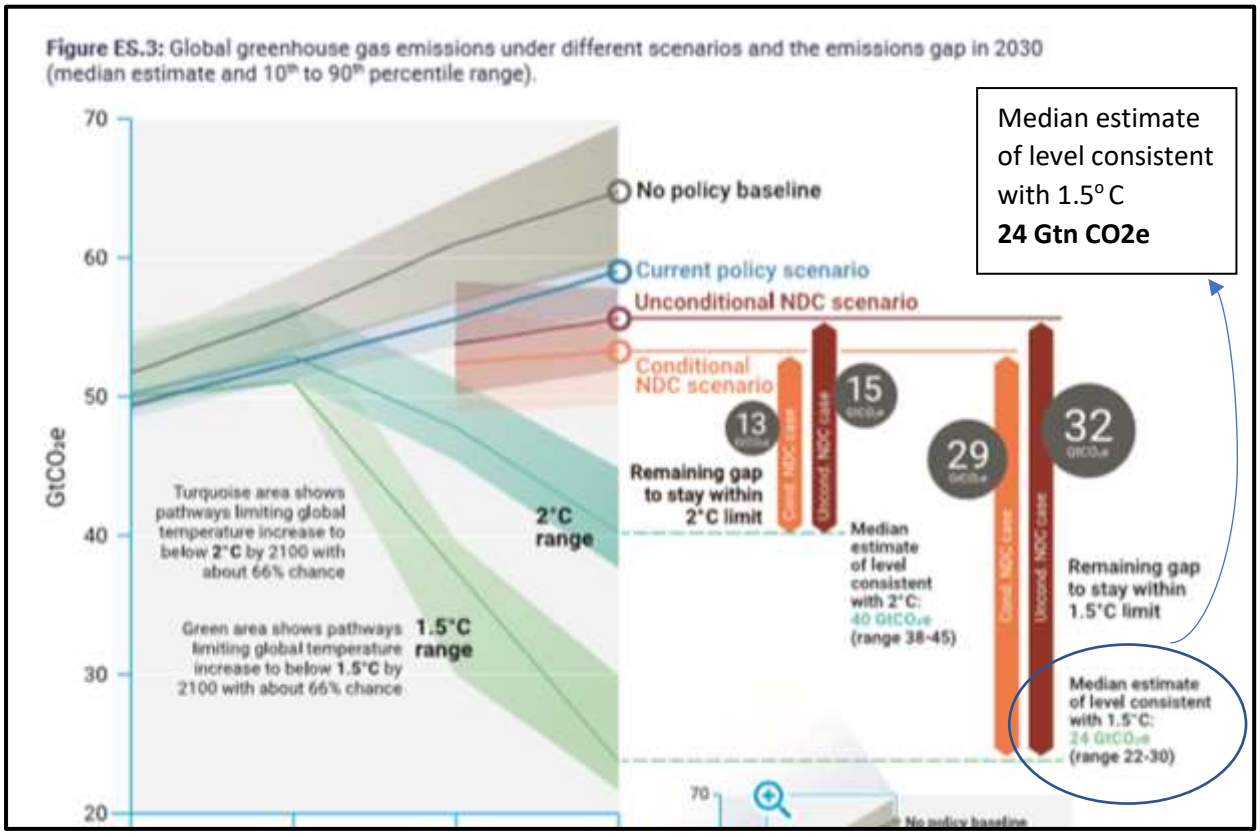
1. By how much must the world reduce greenhouse gas emissions to avert the coming catastrophic climate change leading to the sixth mass extinction?

2. What should New Zealand's fair share of this world reduction be?

3. How would NZ go about making these reductions?

Question 1. The UNEP (United Nations Environmental Programme) in its 2018 'GAP' report[1], Chart 1, estimates that **world greenhouse gases need to reduce in a straight line from the current 52 billion tonnes down to 24 billion tonnes in 2030** in order to keep global warming to less than 1.5 degrees above pre-industrial levels, and avoid a catastrophic climate change scenario.

Chart 1. GAP Report 2018



Question 2.

Following the principle **that each human is entitled to emit an equal amount**, New Zealand, with a population of 4.7 million (0.066% of the world's 7 billion people), is entitled to emit 0.066% of the world's 24 billion tonnes net emissions in 2030. **That comes to 15.85 million tonnes in 2030, down from 56 million tonnes in 2016.**

Question 3.

Following the principle **that the emission reduction burden must be equally and fairly shared among each economic sector,** emission reductions must be made in proportion to current emissions. For example, the agriculture sector emits 49% of NZ emissions[2], therefore, it should make 49% of the cuts.

There are three steps in deciding exactly how much each part of the economy can emit.

Step one is building up a picture of which parts of the economy emit the most.

Table 1. shows NZ gross emissions by sector and NZ total net emissions after the forest sink is subtracted.

NZ TOTAL					
				% of	Mtns
By Sector				Total	
	Agriculture			49.2	38.73
	Energy			39.8	31.3
	!nd. Processes			6.2	4.85
	Waste			4.9	3.83
	Total gross emissions			100	78.71
	Forest sink (LULUCF)			29	-22.8
	Total net emissions				55.91

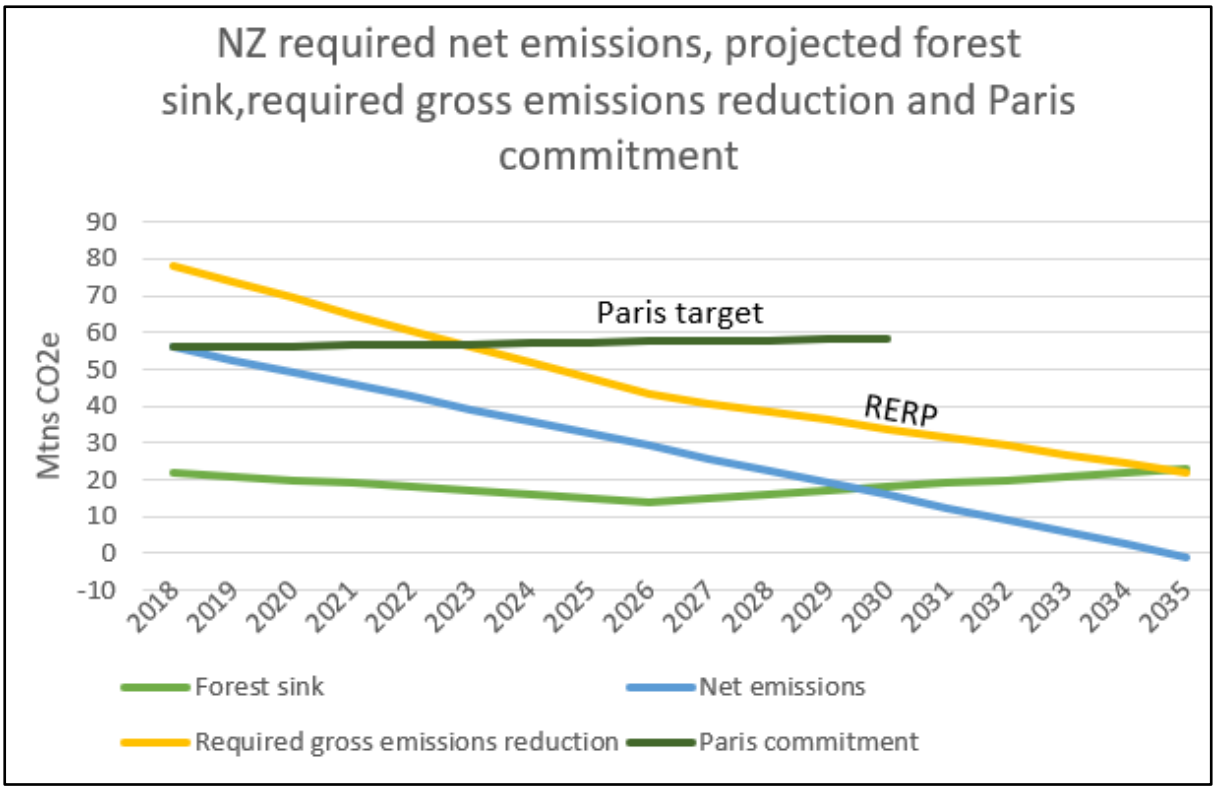
Table 2 gives a further breakdown into subsectors, both in sectors and in descending order of size of emissions

				% of	Mtns	In order of emissions	
				NZ total		Mtns	
AGRICULTUR	Dairy			23.9	18.8	18.8	Dairy
	Non-Dairy			11.7	9.2	15	Transport
	Sheep			13.2	10.4	10.4	Sheep
	Minor livestock			0.42	0.33	9.2	Non-Dairy
ENERGY	Energy Industries			5.2	4.1	6.9	Manufacturing
Combustion	Manufacturing			8.76	6.9	4.1	Energy Industries
	Transport			19.05	15	3.44	Solid waste disposal
	Other (commecial, residentialetc)			4.06	3.2	3.2	Other (commecial, residentialetc)
	Fugitive em			2.54	2	2.3	Metal industry
IPPU	Mineral industry (cement)			0.9	0.726	2	Fugitive em
	Chemical industry (petrochemicals			0.4	0.316	1.39	Poduct uses as substitutes for ODS
	Metal industry			2.9	2.3	0.726	Mineral industry (cement)
	Non-energy products from fuels			0.058	0.046	0.396	Wastewate treatment and discharg
	and solvents used					0.33	Minor livestock
	Poduct uses as substitutes for ODS			1.76	1.39	0.316	Chemical industry (petrochemicals)
	Other products			0.096	0.076	0.076	Other products
WASTE	Solid waste disposal			4.4	3.44	0.046	Non-energy products from fuels
	Incineration and open burning			0.03	0.024		and solvents used
	Wastewate treatment and dischar			0.5	0.396	0.024	Incineration and open burning
				99.874	78.644		

Source: NZ GHG Inventory 2018 and https://www.climatefirstnz.org/

Step two is deciding what our overall emission reduction pathway should be, bearing in mind that our reductions will be to gross emissions while our target of 15.86 Mtns in 2030 is expressed in net emissions (Net emissions are our gross emissions less our considerable forest sink). Obviously then, we must estimate the forest sink for the next 12 years, and the figures are not promising! In 1990 our forest sink was 30 Mtns or 46% of our emissions, but by 2016 it was down to 22.8 Mtns or 29%, but with the huge 1990's plantings due for harvest over the next few years, it looks like falling further. If we assume it will fall to 14 Mtns by 2026, then rise again to 23 Mtns by 2035, then we get the following scenario, shown in Chart 2

Chart 2. The Required Emissions Reduction Pathway (RERP)



The RERP (Required Emission Reduction Pathway), the yellow line, is the reduction pathway needed to be followed by all parts of the NZ economy. Notice that after 2026, when the sink begins to grow again, the yellow line bends up making the emission cuts easier.

Note than this chart is based on the 2018 inventory (1990-2016), and that it will be slightly adjusted each year when a new inventory is published. The chart does, however, graphically show the huge emission reduction task we have ahead of us, and especially the serious gap between our Paris Agreement intentions and what we need to do.

Incidentally the GAP report (Chart 1) shows the gap between the world's collective Paris commitments and the 1.5 degrees goal as 32 Gtns or 61% of current world emissions. For NZ, the gap is 40 Mtns or 72% of current net emissions!

Table for chart 2				
	Estimate of Forest sink	Net emissions for 1.5deg	Required Gross (RERP)	Annual reduction
	Mtns	Mtns	Mtns	Mtns
2018	22	56	78	
2019	21	52.65	73.65	4.35
2020	20	49.31	69.31	4.35
2021	19	45.96	64.96	4.35
2022	18	42.61	60.61	4.35
2023	17	39.27	56.27	4.35
2024	16	35.92	51.92	4.35
2025	15	32.57	47.57	4.35
2026	14	29.23	43.23	4.35
2027	15	25.88	40.88	2.35
2028	16	22.53	38.53	2.35
2029	17	19.19	36.19	2.35
2030	18	15.84	33.84	2.35
2031	19	12.49	31.49	2.35
2032	20	9.15	29.15	2.35
2033	21	5.80	26.80	2.35
2034	22	2.45	24.45	2.35
2035	23	-0.89	22.11	2.35

This table shows that the annual reduction is 4.35 Mtns until 2026 and 2.35 Mtns thereafter.

Step three is calculating the exact reduction required by each subsector. For example, dairy farming, which currently produces 23.9% of our total emissions each year (18.64 Mtns), needs to make 23.9% of the annual reduction each year, which is 1.04 Mtns annually until 2026 and 0.56 Mtns thereafter.

Table 3. RERP for two top emitting subsectors

	NZ's required reductions for two big subsectors								
	NZ	Dairy			Transport				
	Annual	23.90%	Annual	Herd size	19.05%	Annual	Light fleet	Lightfleet	Annual
	Reduction		reduction	2.9 tn/yr		reduction	RERP	size	vehicle
	Mtns	Mtns		millions	Mtns		Mtns	millions	reduction
2018		18.64		6.43	14.86		6.16	3.80	
2019	4.35	17.60	1.04	6.07	14.03	0.83	5.82	3.59	0.21
2020	4.35	16.56	1.04	5.71	13.20	0.83	5.48	3.38	0.21
2021	4.35	15.53	1.04	5.35	12.37	0.83	5.13	3.16	0.21
2022	4.35	14.49	1.04	5.00	11.55	0.83	4.79	2.95	0.21
2023	4.35	13.45	1.04	4.64	10.72	0.83	4.45	2.74	0.21
2024	4.35	12.41	1.04	4.28	9.89	0.83	4.10	2.53	0.21
2025	4.35	11.37	1.04	3.92	9.06	0.83	3.76	2.32	0.21
2026	4.35	10.33	1.04	3.56	8.23	0.83	3.41	2.11	0.21
2027	2.35	9.77	0.56	3.37	7.79	0.45	3.23	1.99	0.11
2028	2.35	9.21	0.56	3.18	7.34	0.45	3.04	1.88	0.11
2029	2.35	8.65	0.56	2.98	6.89	0.45	2.86	1.76	0.11
2030	2.35	8.09	0.56	2.79	6.45	0.45	2.67	1.65	0.11
2031	2.35	7.53	0.56	2.60	6.00	0.45	2.49	1.53	0.11
2032	2.35	6.97	0.56	2.40	5.55	0.45	2.30	1.42	0.11
2033	2.35	6.41	0.56	2.21	5.11	0.45	2.12	1.31	0.11
2034	2.35	5.84	0.56	2.02	4.66	0.45	1.93	1.19	0.11
2035	2.35	5.28	0.56	1.82	4.21	0.45	1.75	1.08	0.11

Step four is to calculate what the specified annual reduction means for each subsector.

The dairy herd would reduce by 358,620 cows year on year to 2026 and then by 155,172 cows until 2035. Total numbers reduce from 6.4 million in 2018 down to 1.82 million in 2035.

On the average farm, cow numbers would reduce by 31 cows year-on-year from 2019 to 2026 and then by 13 cows year-on-year until 2035.

The calculations

If there are 6.4 million dairy cows[3] but only 4.8 million of these are lactating[4], (The others are either younger or temporarily out of production and therefore emitting fewer ghgs), and they emit 18.64 Million tonnes of CO2e, then each cow emits 2.9 tonnes a year on average. Therefore, the annual reduction of 1.04 million tonnes to 2026 and 0.45 from then to 2035, represents a herd reduction of 358,620 each year for 8 years, then155,172 for the next 9 years. This would take the dairy herd size from 6.4 million now to 3.56 million in 2026, 2.79 million by 2030 and 1.82 million by 2035 when our net emissions would reach zero.

It is also easy to look at the implications for an individual farmer too; In 2017 there were 11,590 dairy farms[4] averaging 431 cows each. 358,620 cows divided by 11,590 gives 31 cows. So, each farm would have to get rid of 31 cows every year up to 2026, then 13 cows per year from 2027 to 2035, or take other actions to reduce emissions by an equivalent amount, such as using less fertilizer or breeding less-emitting cows or planting trees on the farm.

Step five is finding a way either through regulation or incentivization to achieve this goal and this is where the RERP coupled with a carbon tax becomes a winner. If we assume a carbon tax of say $100 a tonne of CO2e, then a farmer whose emissions tracked exactly on the RERP would pay no tax, one who reduced more than 31 cows in year one would be below the line and get a cash payout. Another who didn't reduce at all would be above the line and have to pay a carbon tax. Here are some numbers: The former who reduced say 40 cows would be 9 below the line and would get (2.9 x 9 x 100 = $2,610 cash). The latter who did nothing would pay (2.9 x 31 x 100 = $8990). In the second year the former would reduce another 40 and receive another $2610, but the latter who did nothing for a second year would be 61 cows above and would pay (2.9 x 62 x 100 = $17,980). All dairy farmers would be immediately 100% inside the carbon tax system, but pay no tax if they conformed to the RERP!

The big objection to this whole proposal is that dairy represents a huge proportion of our export earnings and the country would be much poorer. My reply would be to look at what we use those overseas dollars to import. It's largely cars, trucks and petrol. If we reduced dairy exports 10% and reduced car and petrol imports 10% that would be a reduction of 18.64 Mtns x 10% = 1.864 Mtns for dairy Plus 15 x 10% = 1.5 Mtns for cars and petrol – in total, 3.38 Mtns, a big part of the country's entire one year required 2019 reduction total of 4.35 Mtns.

This process can be applied to each subsector and to each business within it. It could also be a per-person guide and a target for a city where transport would be the biggest emitter.

Example two: the light vehicle fleet

For New Zealand's light vehicle fleet, 210,000 cars and vans need to be removed from our roads every year from 2019 to 2026, then 110,000 each year from 2027 to 2035. Alternatively, there could be an equivalent reduction in the kilometres travelled.

The calculation

The NZ light vehicle fleet has 3.8 million vehicles[5] (including light passenger and light commercial). They emit 74.1 % of the road transport emissions of 13.61 Mtns[6], which is 10.08 Mtns, which is 12.9% of NZ total emissions. Therefore, in order to meet the RERP the light vehicle fleet would have to reduce 12.9% of the annual 2019 reduction of 4.35 Mtns, which is 0.56 Mtns. Now if 3.8 million light vehicles emit 10.08 Mtns then each vehicle averages 2.65 tonnes per year. In order to reduce 0.56 million tonnes, then 210,000 cars and vans need to be removed from the road each year for the next 8 years. Unfortunately, over the last few years more than 60,000 new cars have been added per year! The reduction could alternatively be achieved by reducing the average distance driven or improving the efficiency of cars from the current 9.3 litres/100km, or some combination of the three. Obviously, a carbon tax of $100 /tonne is going to cost a motorist $265 per year, hardly enough to incentivize a change of the required magnitude.

Conclusion

By quantifying New Zealand's current subsector emissions (Table 2) and combining those with a scientifically derived Required Emissions Reduction Pathway (Chart 2), the exact annual emissions reductions can be calculated and fairly allocated for almost all of our society. The RERP also gives a reliable forecast so that businesses, councils, the government and individuals can predict and manage with certainty the large emission reductions which will be needed if New Zealand is to be an example to persuade the world to make similar reductions and thus avert the coming climate change catastrophe. Lastly, the plan outlined in this essay highlights the dramatic reductions needed in this country, demanding a crisis response immediately, not just an incremental one.

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