A Vision for 2050: Evaluating the Options

Background Paper No.7

Final Report from the NESC Secretariat

Ireland and the Climate Change Challenge: Connecting 'How Much' with 'How To'

An Chomhairle Náisiúnta Eacnamaíoch agus Shóisialta
National Economic & Social Council

Joe Curtin

December 2012

A Vision for 2050: Evaluating the Options

1. Introduction

The Terms of Reference tasks the NESC secretariat with the 'development of a basis for a long-term socio-economic vision to underpin effective national transition to a low-carbon future by 2050'. There are a number of options for expressing a vision to 2050. This background paper identifies and defines these options and assesses their relative merits, drawing on international approaches..

According to the OECD a long-term vision is essential to deliver an investment grade policy framework for climate change (OECD, 2012). A vision can help articulate and clarify exactly what it is that a country seeks to achieve in the long term, and can be a starting point for thinking about the process of change required to achieve this objective. Generally a vision is articulated in a short and clear mission statement of an aspirational nature, although ideally this statement would lend itself to be translated into objectives, each of which in turn can be associated with key indicators (Kaplan & Norton, 1996); (Nevin, 2003). In this way a vision can provide a framework where necessary actions can be developed, prioritised, agreed, implemented, reviewed, and evaluated.

In considering a vision for Ireland's transition to a low-carbon society, it is worth considering Ireland's unique characteristics, including the structure of its economy, its emissions profile, and potential sources of green growth in the future.

The options explored in this Background paper are as follows:

- A climate or carbon-neutral Ireland;
- An emissions reduction target for 2050 expressed as a per cent reduction; or
- A decarbonised (fossil fuel free, or fossil fuel independent) Ireland;
- An emissions per capita target for 2050.

2. Climate Carbon-Neutral Ireland

2.1 Defining and Measuring

A climate or carbon-neutral economy is defined as one where the net greenhouse gas emissions associated within that economy's geographical area are zero (O'Reilly *et al.*, 2012). 'Carbon' and 'climate' are often be used interchangeably in this context, and this paper assumes an identical meaning. It should be noted, however, that carbon is in fact a malapropism for CO_2, and therefore technically excludes all other greenhouse gas emissions.

'Net' in this definition refers to the total sources or greenhouse gas emissions less total sinks of greenhouse gas emission. This definition refers to a country's geographical area, and might therefore be interpreted not to include the use of offsets. Having said that, generally, as will be seen in the examples below, many countries that aim for climate neutrality by 2050 envisage or at least allow for the use of offsets or credits to achieve this objective. It would ultimately therefore be for each country to define clearly what it means by climate neutrality.

A formula for calculating climate neutrality for an economy is set out below:

All greenhouse gas emissions from industrial processes, energy generation, transport, commercial and residential sectors

+ Emissions associated with on-farm agricultural activities
+ Emissions from waste
+/- Sinks provided by forested lands
+/- Sinks provided by grasslands
+/- Sinks provided by croplands
+/- Sinks provided by peat lands.
+/- International Offsets (depending on how the objective is defined by the country in question)

Embedded emissions associated with imported goods would not be included (as they would be counted in the inventory of the country where they were produced). Embodied emissions in exports from Ireland would conversely be included in Ireland's emissions.

2.2 International Examples

Several countries have made commitments to become carbon neutral, although some express this objective in a different manner, using the words 'emissions', 'carbon' and 'climate' interchangeably. It should be noted, however, that many

members of the (now-defunct) Climate Neutral Network have not taken on any objective of this nature.

The most ambitious case internationally is Costa Rica, that in 2008 declared unilaterally its goal to become a carbon-neutral territory by 2021. It defines its objective as moving to a zero or negative national inventory of emissions, including in its accounting system all sources and sinks of emissions associated with anthropogenic activities and included by the IPCC Guidelines on Inventories of Greenhouse Gases. The most challenging aspect of meeting Cost Rica's objective is associated with reducing transport emissions given that renewables already account for almost all electricity generated.

A similarly ambitious vision has been taken on by Norway, that has declared an objective of becoming carbon neutral by 2030. In this case it is clear that 'carbon' is intended to include all territorial greenhouse gasses and sinks. It should be noted that the strategy is heavily dependent on the purchase of international offsets, (Carbon Neutral Norway, 2008), that as a major oil and gas producer the Norwegian exchequer is in a position to fund.

In the case of Sweden, the Swedish Climate Bill establishes 'a vision of Sweden with a sustainable and resource-effective energy supply and no net emissions of greenhouse gases into the atmosphere in 2050'. This vision is usually expressed using the simple language of 'an emissions neutral economy by 2050' (Swedish Government, 2011). While it is not made fully clear, use of the word 'net' in this context would generally suggest that offsets would be permitted in meeting the target. In addition to these countries, many companies, organisation, cities, islands, and regions have taken on goals to become climate neutral.

2.3 Advantages and Disadvantages

The first advantage of a Climate Neutral objective for 2050 is that it is a vision that has the potential to encompass all of Ireland's sinks and sources of greenhouse gas emissions under one framework. This may be particularly appropriate for Ireland considering that non-CO_2-related agriculture emissions account from a high and increasing proportion of Ireland's overall emissions, and the significant contribution of new (planted since 1990) forestry to meeting Ireland's Kyoto commitments.

Second, a Climate Neutral approach would appear to align with the direction of international negotiations and developments at EU level. New reporting rules could open up a new vista of opportunities for farmers and foresters to sequester emissions arising from activities on their farms. New accounting methodologies have already been agreed for the forestry sector, and active grassland management,

peatland restoration and other sink-enhancing activities have the potential to receive credit in the post-2020 regime (see Box 1). A climate neutral approach takes cognisance of the direction of international negotiations and positions Ireland to take advantage of opportunities that may well arise.

Box 1: Accounting Rules For Sinks

Accounting rules associated with sinks are subject to ongoing international negotiations. Forestry sinks are not currently permitted under EU rules to meeting Ireland's 2020 non-ETS sector EU obligations targets. The final rules for Ireland will depend on the outcome on the discussion of the European Commission's LULUCF proposal. Rules for including emissions sequestered from the forestry sink have, however, been agreed under the Durban rules (FCCC/KP/CMP/2011/10/Add.1)[1] and these rules open up new possibilities (in particular active forestry management and sequestration of emissions in wood products) that could be availed of for future compliance purposes.

In other areas, such as sequestration provided by grasslands, the situation is less certain. Nonetheless it can be said with increasing confidence that agricultural practices, such as grass-based dairy and beef, result in sequestering emissions under certain circumstances. Furthermore, implementing grassland management practices can increase carbon uptake by increasing productivity or reducing carbon losses and can lead to net accumulation of carbon in grassland soils—sequestering atmospheric CO_2. These practices could also potentially enhanced producer income (Conant, 2010).

In the case of Ireland, there is evidence that current management practices on well established agricultural grasslands remain a net carbon sink. Although external variables such as meteorology have significant influence on the carbon uptake over a given annual cycle, the average uptake on improved grassland is of the order of 1-2t C ha^{-1} per year (Byrne *et al.*, 2007). Sequestration rates, however, can be slow and variable across land types, results can be weather and climate dependent, the ability to measure change can be difficult, costs of implementation are more poorly quantified, and the scientific information to inform policy analysis is less complete. Further research is therefore required to verify these result across a range of soils and farming practices. If the results prove valid on a national scale, and are found to persist, the aim would then be to have this potential recognised in international reporting.

These reporting rules are part of ongoing international negotiations. The European Commission is proposing mandatory reporting of cropland management and grazing land management. It is conceivable that a net-net approach would be used where the emission/sink balance in 1990 is subtracted from the emission sink balance in the year being reported. Thus, it would not be the overall sink potential provided by grasslands that could be included in inventories, but the additional potential that could be delivered by active grassland management. A great degree of uncertainty therefore surrounds both sequestration values and reporting rules.

Peat lands can act as a sink or a store, depending on their use. Natural peatlands act as a carbon sink. Industrial cutaway peatlands are highly degraded ecosystems that release significant quantities of carbon dioxide (CO_2) to the atmosphere annually. Their restoration offers the potential to reduce CO_2 emissions and to re-establish the carbon (C) sink function characteristic of natural peatlands (Wilson *et al.*, 2007).

Third, preliminary projections, modeling and other analytical work suggests that it could be technically feasible for Ireland to be climate neutral by 2050. Irish TIMES modeling work suggests that a 95 per cent emissions reduction is technically possible in the energy sector at reasonable cost, albeit with a high marginal cost. According

[1] The new accounting rules will ensure that managed forests that result in sequestration levels over and above business-as-usual will be rewarded, strengthen the environmental integrity of the use of forest-based biomass sourced within and from countries that sign-up to a second commitment period, and provide for the first time an accounting framework for harvested wood products that is based on actual service-life. See: (Nieuwenhuis & Hendrick, 2012).

to the European Commission's Roadmap, a 50 per cent emissions reduction is possible in EU-wide agriculture. Applying these two emissions reductions to Ireland, emissions would be in the region of 12Mt CO_2 eq in 2050. EPA, (O'Reilly *et al.*, 2012), have estimated that the gross contribution from sinks could be up to 9Mt CO_2 eq by 2050, based on paper by Byrne *et al,*. (2007) (although it remains unclear what proportion of this sequestration could be included in reporting inventories). The remaining emissions could be offset through recourse to international carbon markets.

Finally, a Climate Neutral Ireland would be in line with what would be required according to the findings of IPCC 4th Assessment Report and by EU indicative long term targets.

There are, however, difficulties arising in relation to this approach. First, there is great uncertainty surrounding what contribution sinks such as forestry, grasslands, croplands and peat lands could make in Ireland and how this contribution would be measured (Box 1). Theoretically, in a best case scenario, agriculture and land use has the potential to be identified as a net sink rather than source. However, this theoretical situation is unlikely to be fully reflected in accounting methodologies.

There is also uncertainty around the cost of achieving a climate neutral objective. Achieving the objective, is dependent on a number of activities the costs of which are unclear[2]. These activities are: :

- The almost complete decarbonisation of electricity production, transport, residential, commercial and industrial sectors.
- The optimisation and inclusion of all sinks; and
- The purchase of international offsets.

If progress to meeting a Climate Neutrality objective were to be effectively tracked, a parallel national accounting regime in additional to international reporting may be required. It would be important that additional accounting measures would not work in opposition to international obligations and that any potential for confusion among public, stakeholders and industry is minimised.

Finally, while not a reason for inaction, it is worth highlighting that measuring progress on climate neutrality in Ireland will be be difficult. In several cases comprehensive data sets are not available, nor is there agreement or scientific certainty around how certain sinks can reliably be measured.

[2] This statement would also apply to other approaches, such as emissions reduction targets for 2050.

3. Emissions Reduction Target for 2050

3.1 Defining and Measuring

Adopting a long term emissions reduction target in Ireland has been part of an ongoing debate within the context of the introduction of a Climate Law in Ireland. Long term targets are usually expressed as a per cent reduction in total emissions of greenhouse gasses by a future date compared to an agreed baseline year. In the case of a long term target the future year is generally 2050, while the baseline is usually 1990. Generally these targets allow all measures permitted under IPCC reporting guidelines to be accounted for, and are therefore subject to uncertainty to the extent that these reporting guidelines are changeable.

If Ireland were to take on such a target, a key question, explored here is how the level or per cent reduction outlined in such a target could be determined. A starting point for this debate is Ireland's obligation as a developed country to assist in international efforts to avoid a 'dangerous climate change' threshold of 2 degrees celsius, and peaking global concentrations of CO_2 eq at approximately 450 ppm by 2015. This entails a global emissions reduction of at least 50 per cent by 2050, that in turn has been interpreted by the EU to require an emissions reduction of between 80 and 95 per cent emissions across the EU by 2050.

There are at least three approaches to determining what Ireland's target might be within this context:

i) The simplest and most obvious would be to divide this target *pro rata* among member states; and Ireland's 2050 target would therefore be an 80-95 per cent reduction on 1990 levels. This target refers to net emissions, in other words countries could potentially purchase international credits for compliance purposes.

ii) A second approach includes population growth projections into target setting. This is consistent with a Contraction and Convergence approach to international climate negotiations, it assumes a global per capita emissions target is set and all countries converge to it, within a given time period (Agarwal & Narain, 1991); (Meyer, 2000); (Welsch, 1993).

In order to meet a 50 per cent reduction by 2050 total global emissions would need to be in a range of 20Gt CO_2 eq to 24Gt CO_2 eq by 2050, that implies a per capita allowance of between 2.1 to 2.6Mt CO_2 eq (assuming a global population in 2050 of about 9.2 billion). A global deal on this basis (assuming a population of 6 billion (Eurostat, 2011)would require that the Ireland to have emissions in the range of 12.6 to 15.6Mt CO_2 eq.

This approach suggests that, based on 'official' EU projections of population growth, a 'just' target for Ireland consistent with its global responsibility would be a reduction of 77 to 72 per cent on 1990 levels by 2050. It is possible that Ireland could purchase international credits for compliance with a target calculated in this manner.

iii) Ireland will be part of an European 'bubble' in any negotiations in the UNFCCC from which a long term target might arise. Another approach is therefore to focus on what is economically efficient and feasible to achieve across the EU, assuming a global agreement to which the EU is a signatory. Assuming an 80 per cent domestic reduction is required across the EU (this could be consistent with 80-95 per commitment made in the European Council) the *EU Roadmap for moving to a Competitive Low Carbon Economy* models low cost scenarios to meeting this target. What is striking from an Irish perspective is that emissions reductions are best value to achieve in sectors of the economy such as power generation, industry and residential and services. However, transport and agriculture, that make up a far greater proportion of Irish emissions than the EU average, play a significantly smaller role. If one applies these sectoral reductions in Ireland this translates into a more modest reduction of between 66 and 74 per cent (based on an EU-wide reduction of between 79-82 per cent). This is a domestic reduction target, and therefore the purchase of credits could not be used for compliance.

3.2 International Examples

The EU Council of Ministers have agreed that total EU emissions should be 80 to 95 per cent below 1990 levels by 2050. Several EU member states have committed to long term emissions reduction targets. For example, the UK has committed to a legally binding emissions reduction target of 80 per cent on 1990 by 2050 and Germany has also agreed to 'at least' an 80 per cent emissions reduction by 2050.

Table 1: Potential Emissions Reduction Targets for Ireland

	1	2	3	
	Pro Rata Distribution of Indicative EU Target	Contraction and Convergence	79 per cent EU-wide reduction	82 per cent EU-wide reduction
Ireland's 2050 Target (1990 baseline)	80-95 per cent reduction	72 to 77 per cent reduction	66 per cent reduction	74 per cent reduction
International Offsets	Can be used for compliance	Could potentially be used for compliance	Cannot be used for compliance	Cannot be used for compliance

Source: Author's calculations

3.3 Advantages and Disadvantages

A long term target could provide policy makers, stakeholders as well as citizens with a vision of the future as well as a yardstick to measure progress. Because the target is expressed in numerical terms, this enables monitoring of ongoing progress, as well as international comparison, to be assessed on an ongoing basis in a relatively straightforward fashion. A long term target of this nature can help provide certainty to investors and can be part of providing what has been described by the OECD as an 'investment grade policy framework'. Institutional investor experience suggests that investment-grade climate change and clean energy policy should include: clear short term (2015), medium term (2020 – 2025) and long-term (2030 – 2050) greenhouse gas emission reduction objectives and targets, and comprehensive, enforceable legal mechanisms and timelines for delivering on these objectives and targets (Global Investors Network, 2012).

A quantitative target could, however, potentially act as a straight jacket and restrict options in the face of great uncertainty about the future, in particular in relation to economic growth, population growth, technological development etc. A further difficulty arises for countries such as Ireland which operate under the EU ETS. Ireland is effectively unable to control emissions that occur from installations operating under this scheme as they have the option of purchasing credits for compliance rather than reducing emissions. The question would be how to measure compliance to an national objective within this context. In the UK it is the cap (or the amount of credits that companies are allocated for a particular year) that is used to measure compliance to the national target. It should be noted, however, that territorial emissions are not therefore counted to measure compliance with this target.

Setting a long term target in legislation has the disadvantage of pre-empting EU negotiations which are likely to eventually result in a long term target for Ireland. On the other hand, establishing a target which is based on sound analysis may offer the opportunity for Ireland to capture this agenda, demonstrate policy entrepeneurship and ultimately secure a target in line with its best interests.

4. Decarbonisation

4.1 Defining and Measuring

A vision for 2050 could be expressed in terms of decarbonisation: for example, to achieve a decarbonised economy by 2050. While 'carbon' in this sense strictly speaking refers to CO_2 emissions only, it is sometimes used to refer to all greenhouse gas emissions. It excludes under any plausible definition, however, consideration of sinks that could be used to sequester emissions.

One way of unpacking what is meant by decarbonisation is to look at the drivers of CO_2 emissions. This is given by the Kaya identity that states that total CO_2 emission level can be expressed as the product of four inputs: population, GDP per capita, energy use per unit of GDP, carbon emissions per unit of energy consumed.

CO_2 emissions = (population) (GDP per capita) (energy consumption/unit GDP) (emissions/unit energy consumed)

This identity can be used to estimate CO_2 emissions for a range of assumptions around the future development of each of the four inputs. It is a very useful identity in understanding the true nature of the challenge of decarbonisation. For even if a country is decarbonising its energy supply, and an economy is consuming energy more efficiently per unit of output, this will only result in absolute reduction in CO_2 emissions to the extent to that these trends are not offset by population and economic growth.

4.2 International Examples

No country is currently expressing its central vision for 2050 as achieving 'decarbonisation' or 'achieving a decarbonised economy'. Denmark has expressed its objective as transitioning to a 'fossil fuel free' or 'independent' society by 2050. This can be considered similar.

4.3 Advantages and Disadvantages

Decarbonisation encapsulates a large though not whole part of Ireland's low-carbon transition challenge. The energy system is at the core of the climate-change debate

both in Ireland and internationally. It excludes, however, non CO_2 related greenhouse gasses, including Methane, nitrous oxide, and fluorinated gasses. A broader interpretation of decarbonisation (not given by the Kaya identity) may allow for the inclusion of non-CO_2 greenhouse gasses, though under no plausible definition of decarbonisation can changes in sinks be included. It therefore provides a partial picture of how an economy may be performing in its transition to a low-carbon economy. It is perhaps better applied to energy systems analysis.

5. Emissions Per Capita Target for 2050

5.1 Defining and Measuring

Establishing a national target in terms of emissions per capita in 2050 is another option. As noted above, a Contraction and Convergence approach to international climate negotiations suggests that the most equitable way to resolve the climate problem is to divide a notional emissions allowance in 2050 by the projected population, and on this basis national targets. An option for Ireland would be to express a national target in these terms. No countries have taken this approach.

5.2 Advantages and Disadvantages

As noted, provisional estimates suggest average per capita emissions of between 2.1 to 2.6 tonnes CO_2 eq (assuming a global population in 2050 of about 9.2 billion). Unusually for a developed country Ireland's population is projected to increase rapidly in the period to 2050. The main advantage of the per capita approach is that it takes into account these demographic trends in Ireland. The significant emissions reductions required would be in line with international obligations.

While the Contraction and Convergence approach to international negotiations has been tabled by various parties in the past, it is not thought to be one that is under active consideration and is generally opposed by countries with high per capita emissions such as the US. Measuring Ireland's progress on a per capita basis in a scenario where economy-wide emissions were being considered for international compliance purposes could potentially create confusion.

6. Conclusions

There are a number of options for expressing a vision to 2050. This background paper identifies these options, and assesses their relative merits. The legal status or the political acceptability of the options are not analyzed, though these are undoubtedly important considerations.

The first two options have received most attention in Ireland. In the first case, climate or carbon neutrality would appear to have many advantages for a country with a large proportion of non-energy related greenhouse gas emissions and significant sink potential. But there are definitional and measurement issues to be resolved, and the danger of setting up a dual reporting system is one to be avoided.

Long term emissions reduction targets have also been part of an ongoing debate in Ireland. The paper explores, using a global justice approach, what an appropriate target for Ireland might be. What the analysis somewhat surprisingly highlights is that an 80 per cent target, that has been taken on by neighbours such as German and the UK, may not in fact be appropriate. The main reasons for this are the size of the agriculture sector and demographic trends.

An equally important question is how a vision would be used. Would agreeing a vision be a starting point of a longer process? Would it provide a framework within that the necessary actions can be developed, prioritised, agreed, implemented, reviewed, and evaluated? Would it be used to articulate, clarify and communicate to all domestic and international audiences what Ireland is seeking to achieve? The danger with agreeing a vision is that it can in some cases be a substitute for action rather than something that engenders it.

Bibliography

Agarwal, A. & Narain, S. (1991), *Global Warming in an Unequal World,* New Delhi: Centre for Science and Environment.

Byrne, K.A., Kiely, G. & Leahy, P. (2007), 'Carbon sequestration determined using farm scale carbon balance and eddy covariance', *Agricultural Ecosystems and Environment,* 121(4): 357-64.

Carbon Neutral Norway (2008), *Carbon Neutral by 2030: Starting Now*, Ministry of Finance, Norwegian Government. http://www.regjeringen.no/Upload/FIN/cnn/folder.pdf, 18/12/12.

Conant, R.D. (2010), *Challenges and opportunities for Carbon Sequestration in Grassland Systems: a Technical Report on Grassland Management and Climate Change Mitigation,* Rome: Food and Agricultural Organisation.

Eurostat (2011), *Population Projections 2010-2060*, All-Island Research Observatory. http://www.airo.ie/news/europe-2060-population-projections-ireland-increase-465-interact-data, 18/12/12.

Global Investors Network (2012), *Letter from Global Investors Network to the Governments of the World's Largest Economies*. http://www.ceres.org/files/investor-files/2012-global-policy-letter, 18/12/12.

Kaplan, R.S. & Norton, D.P. (1996), *Translating Strategy into Action: The Balanced Scorecard,* Boston: Harvard University Press.

Meyer, A. (2000), 'Contraction & Convergence: The Global Solution to Climate Change. GCI (2005), ' Presentation to the Global Commons Institute, "GCI Briefing: Contraction & Convergence", http://www.academia.edu/680722/GCI_Briefing_Contraction_and_Convergence.

Nevin, P.R. (2003), *Balanced Scorecard: Step-by-step for Governmental and Non-Profit Organizations,* New Jersey: John Wiley and Sons Ltd.

Nieuwenhuis, M. & Hendrick, E. (2012), *Forestry and a Low Carbon Economy - a Background Paper*, Submission to NESC, Dublin: Unpublished.

O'Reilly, G., O'Brien, P. & McGovern, F. (2012), *Addressing Climate Change Challenges in Ireland*, CCRP Report No.25, Wexford: Environmental Protection Agency.

OECD (2012), *Towards a Green Investment Policy Framework,* Paris: Organisation for Economic Co-operation and Development.

Swedish Government (2011), *Sweden; an Emissions-Neutral Country by 2050*. http://www.sweden.gov.se/sb/d/5745/a/181428, 18/12/12.

Welsch, H. (1993), 'A CO2 Agreement Proposal with Flexible Quotas', *Energy Policy,* 21: 748-56.

Wilson, D., Renou-Wilson, F., Farrell, C., Bullock, C. & Müller, C (2007), *Carbon Restore – The Potential of Restored Irish Peatlands for Carbon Uptake and Storage*, Report Series No. 15 (CCRP-1.6), Climate Change Research Programme (CCRP) 2007-2013, Wexford: Environmental Protection Agency. http://www.epa.ie/downloads/pubs/research/climate/CCRP_15_web.pdf.

Images

Sourced online at Kevin Callaghan Construction