David Hall

In the Mix: managing policy complexity in climate change mitigation

Abstract

The policy mix is an analytical framework for understanding the elements, processes, dimensions and characteristics of complex policy systems. This article applies this framework to Aotearoa New Zealand's policy mix for climate mitigation, both to understand why we have the policies we have, and also to stimulate ideas about how to improve outcomes. Instead of a comprehensive analysis, the article focuses on the mix of policy instruments, the evaluative principles that guide policy appraisal, the challenge of harmonising multiple principles, and the influence of economic principles on the scope and intent of policy mixes.

Keywords policy mix, policy appraisal, policy design, climate mitigation, climate change

> It goes without saying that complicated systems of economic policy (for example) will almost invariably be a mixture of instruments.
>
> —Jan Tinbergen, 1952, p.71

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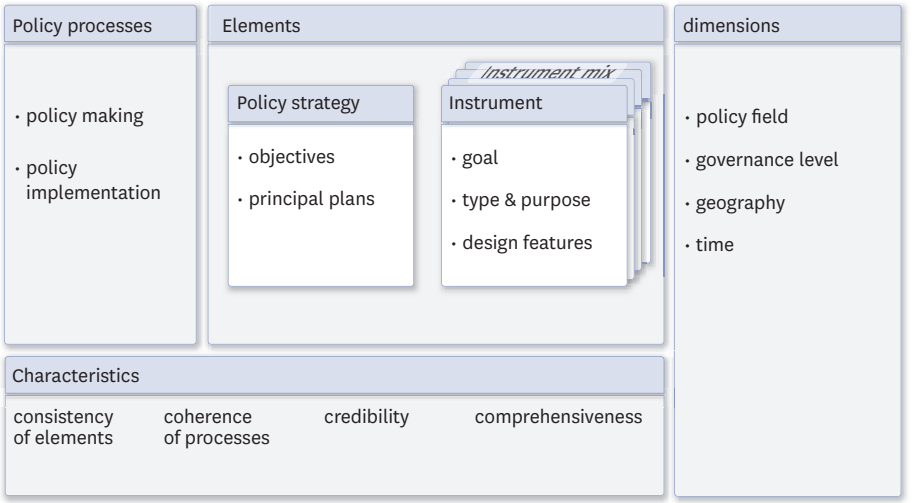
Have you heard the joke about the lost tourist in the Irish countryside who asks a local for the way to Dublin? After considering the matter for a moment, the local answers: 'Well, if I were you, I wouldn't start from here.' This also feels like the right way to think about New Zealand's climate mitigation policy. If we are to take a step back, to honestly take stock of present circumstances – for instance, recent developments in clean technologies, new insights into policy evaluation, the evolution of actual (as opposed to theoretical) carbon markets, international ambition on target setting, the emboldened social licence for climate action – we might well wonder whether we would start with the policy framework we have. It is a product of circumstances that are many years, even decades, old – going back to a time when carbon budgets were not nearly depleted, when clean technology seemed out of reach, when climate change was distant to most people's thoughts and fears. Does it make sense to carry on, given what we now know? Or should we take a step back and ask ourselves, honestly, is our policy pathway consistent with our aims?

Policymakers are rarely afforded – nor afford themselves – this opportunity to reflect. There are, of course, many causes for this: path dependencies, personal legacies, the fallacy of sunk costs, and the frenetic pace and reactive style of contemporary

Figure 1: Policy processes, elements and dimensions



Source: adapted from Rogge and Reichardt, 2016

policymaking. But it is also a consequence of the tragedy in the joke: we are where we are, which is not always where we ought to be. Starting from somewhere else is, if not impossible, then often inadvisable, because retracing our steps is wasted time and energy. We must press on from wherever we happen to be – and yet it would be foolish to do so without understanding how we went astray. If we do not, we may reproduce our mistakes, misbeliefs and misjudgements. Once again, we might find ourselves lost in the countryside, asking for help from strangers and tricksters.

We need new maps, new ways of thinking about complex challenges, where we are and where we want to go. This article introduces the framework of the policy mix as a structured way of evaluating climate mitigation policy in Aotearoa New Zealand. As the term 'policy mix' implies, there is an inherent assumption – like Tinbergen's in the epigraph above – that there will be multiple policies. However, just because multiple policies are justifiable, this does not mean that any particular policy is justified. The aim, rather, is a judiciously selected portfolio of policies that delivers more than the sum of its parts, but refrains from an expensive accumulation of policies that conflict and contradict one another. To achieve this, we need new capabilities in policy appraisal to distinguish good mixes from bad, which is the focus of the latter part of this article.

The policy mix framework

In circumstances of complexity and uncertainty, we need new analytical tools. One such tool is the extended concept of the policy mix (Rogge and Reichardt, 2016; Rogge, 2018; Rogge and Song, 2023), which offers a framework for describing and evaluating the assemblage of elements, processes, dimensions and characteristics that – intentionally or otherwise – make up the policy response to a particular challenge (see Figure 1).

The *elements* of a policy mix are strategies and instruments. *Strategies* refers to policy objectives (such as emissions reduction targets) and also principal plans which set out plausible pathways for achieving these objectives (such as emissions reduction plans and national adaptation plans). *Instruments* refers to the actual policy tools that governments implement to achieve objectives. These might include economic instruments (emissions trading schemes, taxes, subsidies, grants, loans), regulatory instruments (standards, consents, laws, performance targets) and informational instruments (public campaigns, labelling, foresight exercises, roadmaps).

Policy processes refers to policy as a verb, as something people do, rather than policy as an output or instrument. In other words, it is the 'political problem-solving processes among constrained social actors in the search for solutions to societal problems' (Rogge, 2018). As such, it relates to institutional structures and cultures, to the ways that policymakers work to develop, implement and modify policy. But it also relates to the exercise of power and agency, which includes electoral politics and the challenge of holding and retaining office, as well as competition and collaboration within and among policy agencies.

Dimensions refers to the broader context within which the policy mix is operating. These dimensions include the wider policy system, local and global governance, geographic factors, and time. All these impose certain constraints on the policy mix, limits on what is possible; yet may also create policy opportunities that are not available elsewhere.

Finally, *characteristics* refers to the evaluative dimensions of the policy mix, the values by which to make assessments of its performance. Four vital characteristics are consistency, coherence, credibility and comprehensiveness:

- *Consistency* refers to whether the policy elements are synergistic (or mutually detrimental) with each other. Does the strategy align with objectives? Do instruments positively reinforce each other, or do they stand in conflict?
- *Coherence* refers to whether policy processes are aligned (or misaligned) to policy objectives. Is policymaking integrated and holistic, or operating across silos? Is policymaking coordinated by aligning the tasks and efforts of different organisations?
- *Credibility* refers to whether the policies and commitments are believable and reliable (or not). Do the right agents have sufficient commitments? Is greater accountability and transparency needed? Are independent agencies or greater decentralisation required?
- *Comprehensiveness* refers to whether the policy mix is extensive in its coverage of relevant issues and stakeholder engagement. Are all market and institutional failures addressed? Are all barriers and bottlenecks addressed? Has engagement been undertaken for all affected parties?

The literature on policy mixes – also described as policy packages or portfolios – in general is growing (e.g., Bouma et al., 2019; van den Bergh et al., 2021; Dimanchev and Knittel, 2023; Blanchard et al., 2023), as well as that on sector-specific mixes in transport (Bhardwaj et al., 2020; Edmondson et al., 2024), agriculture (Kalfagianni and Kuik, 2017; Rodríguez-Barillas et al., 2024) and forestry (Scullion et al. 2016). The remainder of this article draws on these themes, not to provide a comprehensive analysis of New Zealand's

policy mix, but rather to make a few broad brushstroke observations to illuminate the usefulness of this framework.

Many tools in the toolbox

The idea of an instrument mix is, of course, plural rather than singular. It assumes more than one policy instrument is needed to pursue the target of – in this instance – emissions reductions.

The case for instrument mixes in climate mitigation is well-established. In the IPCC's sixth assessment report, the working group on climate mitigation concluded that: 'Both theoretical and empirical analysis reinforce the argument that single policy instruments are not sufficient (*robust evidence, high agreement*)' (IPCC, 2022, p.461). It acknowledges that the final composition of the policy mix will vary from country to country, depending on contextual factors and local circumstances (the dimensions of Figure 1). However, it recommends an open-minded approach that considers:

> a combination of: (i) standards, nudges and information to encourage low-carbon technology adoption and behavioural change; (ii) economic incentives to reward low-carbon investments; (iii) supply-side policy instruments including for fossil fuel production (to complement demand-side climate policies) and (iv) innovation support and strategic investment to encourage systemic change. (ibid.)

I have written before about the insufficiency of emissions pricing alone to achieve the mitigation pathways that we have (Hall and McLachlan, 2022). I will not rehearse this argument again, except to note that the empirical research cited throughout this article reinforces its thesis. In the context of policy mixes, however, it is important to highlight that this is not a unique deficiency of emissions pricing: the lesson of the instrument mix is that any single instrument will be insufficient. A sole dependence on, say, a subsidy, or supply-side regulation, would also allocate too much responsibility to a single instrument. To drive sufficient emissions reductions, the instrument would need to be so stringently imposed that it would attract political resistance, such as electoral pressure and industry lobbying, just like high emissions pricing does.

This realisation goes back at least as far as Jan Tinbergen's pioneering studies of policy appraisal. The so-called Tinbergen rule is often glossed as if the ideal ratio of instrument (*n*) to policy target (*n*') is 1:1.[1] However, Tinbergen clearly argued for a ratio of $n \geq n'$. He was not unaware of the dangers of 'too many instruments', yet he understood that multiple instruments were needed to manage what he called 'the distribution of pressure' – that is, the tension that policy creates through its effects (Tinbergen, 1952, pp.38, 41). In particular, he singled out 'fairness' and 'efficiency' as reasons to favour additional instruments: first, to manage the uneven impacts of policy and, second, to relieve any single instrument of the full burden of delivering its outcome.

On this latter point, a recent cross-country analysis of energy-related emissions is illustrative. Its policy simulations show that 'given current technologies and substitution possibilities, even significant carbon price hikes will not suffice to meet net-zero emission targets' (D'Arcangelo et al., 2022). Indeed, only steep and persistent increases in emissions pricing to over €1,000 per t/CO_2 by the late 2030s would deliver the necessary emissions reductions. The politics of this, given the pro-inflationary effects on energy and food prices, would be extremely challenging. Yet the same outcome can be achieved by a far more moderate price increase – an annual increase of 10% to reach €220 by 2040 – if price responsiveness (or demand elasticity) is increased five-fold over the same period. In the policy simulations, this was achieved by clean technology support, regulations and standards. This redistributes the pressure and, therefore, reduces the likelihood of backlash.

Are we all mixologists now?

These pragmatic realities go some way to explaining New Zealand's actual policy mix for climate mitigation. Despite the rhetorical prevalence of a 'first-best' approach to climate mitigation which centres on the promise of emissions pricing, our actual experience is suboptimal pricing, political compromise and an insufficient mix of multiple instruments.

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Since its implementation in 2008, the New Zealand Emissions Trading Scheme (NZ ETS) was typically framed as 'the principal policy tool underpinning New Zealand's domestic emissions reduction action' (Ministry for the Environment, 2017). In reality, however, the NZ ETS was never the *only* instrument. Notably, the Energy Efficiency and Conservation Authority was established in 1992 and has managed a variety of regulatory, economic and informational instruments ever since, justified in part by emissions reductions.[2] Other policies were also introduced and maintained alongside the NZ ETS, including various support schemes for forestry and agriculture, public investment in climate-related research, and low-emissions transport policy, including public transport – typically to pursue other policy goals in addition to climate mitigation. Nevertheless, this instrument mix amounted to a policy underreaction

(Dyer, 2023), failing to induce the structural shifts that would deliver gross emissions reductions. Arguably, the primacy of emissions pricing in the policy process – from the initial commitment to a carbon tax in 1997, to a decade-long navigation of serious political resistance, to the eventual implementation of the NZ ETS 11 years later – served to crowd out other policy options. This continued into the first phase of the NZ ETS when its effectiveness was being moderated (Hall, 2020).

As a critical part of the policy process, policy appraisal involves 'providing information or advice to policymakers concerning the relative advantages and disadvantages of alternative policy choices' ...

With the release of the first Emissions Reduction Plan in 2022, there was a notable shift in official framing:

> While emissions pricing plays a central role in reducing our gross and net emissions, *emissions pricing alone cannot support our transition in an equitable way* … Instead, a mix of regulation and policies, such as innovation, equitable transition measures, behaviour change and finance, are needed alongside emissions pricing. (Ministry for the Environment, 2022, p.99, emphasis added)

This signalled a more overt and expansive view of the instrument mix, justified primarily in regard to effectiveness and distributional impacts. However, this process was also characterised by a lack of coherence and systems-wide strategy, and insufficient analysis of the consistency and comprehensiveness of the instruments that proliferated out of sectoral adding-up exercises (Parliamentary Commissioner for the Environment, 2023).

Since then, the pendulum appears to be swinging back, at least partially. The 2024 discussion paper for the second Emissions Reduction Plan consultation asserts that the NZ ETS 'will continue to be the main tool to determine where and how to reduce net emissions'. But it also acknowledges that 'there is a clear role for policies that allow the NZ ETS to work better and support the early adoption of emerging technologies', which requires 'correctly understanding the relationship between complementary policies and the NZ ETS' (Ministry for the Environment, 2024, p.25). The 'correct relationship' is articulated strictly in terms of market failure – that is, complementary policies are only warranted if they target a well-defined market imperfection. I return to this subject in the final section.

The actual disagreement in New Zealand, then, is not so much about single versus multiple instruments; it is about narrow versus wide policy mixes. At the narrow end, the NZ ETS is the primary instrument, adjoined by a small set of complementary policies. At the other end of the spectrum, the NZ ETS is but one of multiple instruments, none of which have *a priori* primacy; indeed, in certain circumstances, the NZ ETS might be complementary to other policies that do the heavy lifting. It is well known, for instance, that direct support for research, development and deployment (RD&D) is critical for innovation and adoption of new technologies (Jaffe, Newell and Stavins, 2005; Grubb et al., 2021). Once such technologies are scaling up, however, the NZ ETS might play a complementary role by creating a price signal that boosts the competitiveness of clean technologies in a market economy, as well as the threat of a regulatory backstop through declining unit supply.

The disagreement over the breadth of instrument mixes is not only technical, it is also political. It will not have escaped the attention of many readers that the back-and-forth over policy design is synchronised with changes in coalition governments. This is to be expected to a point: different political parties bring different values and priorities to the process of policy appraisal. The focus on distributive impacts versus market failures not only implies wider and narrower policy mixes respectively, but also aligns with different political orientations, including different visions of government and its proper role. In a representative democracy, there must be space for reasonable disagreement on policy design.[3]

However, there is also a science to policymaking, a body of empirical evidence which ought to moderate the whims of decision makers. Both narrow and wide instrument mixes might be rationally defensible depending on the consistency and coherency of their elements, the credibility of their implementation, and the real-world circumstances and constraints that they must deal with. However, each can also produce distinct pathologies. On the one hand, a policy mix can be so narrow that it cannot fulfil its target(s) and therefore results in policy underreaction (Maor, 2021). On the other hand, a wide policy mix, if incoherent and internally inconsistent, can evolve into a policy mess (Sorrell et al., 2003; Bouma et al., 2019). The current volatility in policy design, as well as the deficient analyses of policy mixes in policy processes, leaves the door open to the influence of ideology, political whim and reactive policymaking.

Appraising policy

This brings us to the challenge of policy appraisal. As a critical part of the policy process, policy appraisal involves 'providing information or advice to policymakers concerning the relative advantages and disadvantages of alternative policy choices' (Howlett et al., 2015). This is critical for the development of policy, but also the neglected phases of evaluation and ongoing improvement. In the discussion so far, I have already invoked various principles that weigh for or against certain policies: effectiveness, efficiency, feasibility, distributional impacts and so

on. These principles, as well as several others, are summarised in Table 1 (adapted from Peñasco, Anadón and Verdolini, 2021). Aligning the policy mix to a well-articulated set of such principles is critical to its coherence.

Economic efficiency has long played the predominant role in policy processes. Nearly twenty-five years ago, Parr (2000) noted that: 'The overriding objective of New Zealand's climate change policy is that any actions taken to abate climate change must be done at least cost. Yet, for a complex and dynamic challenge like climate mitigation, it would be surprising if not all the principles in Table 1 (and potentially others too) had some role in policy appraisal. Unfortunately, this does not lend itself to a neat and tidy algorithm. On the contrary, trade-offs among principles are unavoidable; their application requires a sensitivity to their mutual interdependencies and relation to facts on the ground; and the prioritisation of these principles is subject to practical and political disagreement. Good policy appraisal, therefore, involves not only evaluative principles and due regard to evidence, but also the exercise of political judgement, which I define here as an aptitude for 'the art of the possible'. How might we improve this quality of judgement?

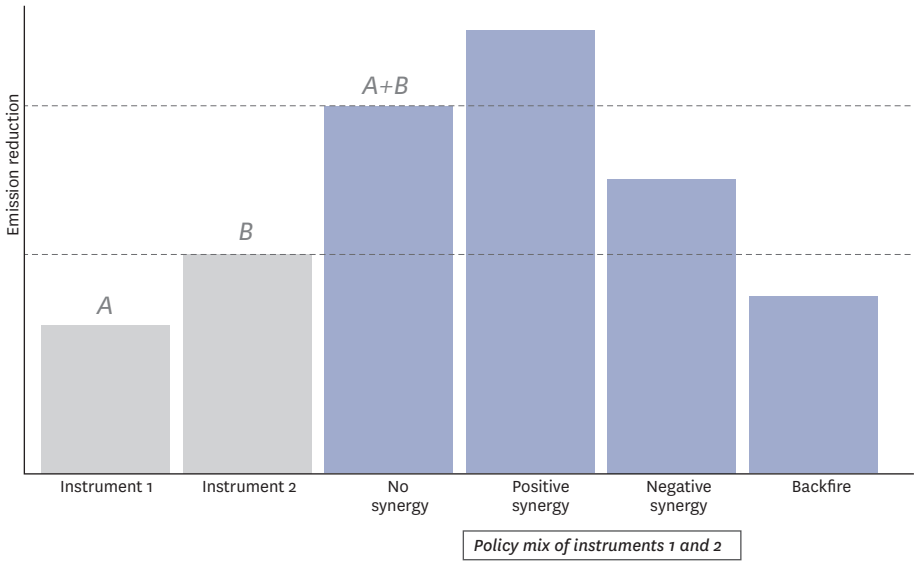
Table 1: Selected principles for policy appraisal

Principle for policy appraisal	Description
Effectiveness	Extent to which policy meets its proposed objective or realises a positive outcome.
Efficiency	Extent to which policy achieves the highest amount of output by using the least amount of inputs – whether as financial cost, time, energy or materials.
Social acceptability	Extent to which policy is regarded as legitimate by relevant publics and gains broad-based acceptance.
Political feasibility	Extent to which policy is likely to be adopted, implemented and maintained over time, given existing political conditions and constraints.
Ease of implementation	Extent to which policy is technically able to be implemented, with relatively manageable transaction costs.
Distributional impacts	Extent to which policy has unequal or inequitable impacts, and the perceived (un)fairness of the policy instrument in its distribution of costs and benefits.
Spillovers	Extent to which policy has positive or negative effects on policy goals which are not the primary goal of the policy (e.g. co-benefits of decarbonisation for public health by reduced air pollution)
Macroeconomic effects	Extent to which policy produces macroeconomic effects, such as competitiveness, change to GDP, employment, exports and imports, industry creation, and other changes in the costs and benefits to parties.
Adaptability	Extent to which policy can be modified or adjusted over time in response to changing circumstances.
Policy harmonisation	Extent to which policy interacts positively, negatively or neutrally with other policies, both within a policy portfolio, but also in relation to wider policy settings (e.g. taxation, urban development).
Tipping points	Extent to which policy is likely to trigger social tipping points – such as technology diffusion or behaviour change – that causes irreversible and self-reinforcing change.

First, it must be recognised that each of these evaluative principles can be interpreted in diverse ways. Distributional impacts, for instance, summons up longstanding debates in ethics over the meaning of equality, equity and fairness. But even apparently technical principles, such as efficiency, have a variety of meanings which need to be carefully delineated. For instance, economic efficiency is often conceived statically as the relative cost of inputs and outputs at a single point in time. Marginal abatement cost curves (MACCs) are often interpreted by decision makers in this way, which encourages the view that only least-cost options should be considered first, with more expensive options left until a later date. However, 'as it is well known, a static notion of cost efficiency can lead to inefficient policies whenever dynamic effects are in place' (Fabra and Reguant, 2024). For instance, if investing in an expensive option reduces its costs – which is precisely what has occurred with clean technologies like solar PV, wind turbines, batteries, EVs (Bond, Butler-Sloss and Walter, 2024) – then this will realise cost savings over the long run that outweigh the initial costs (Vogt-Schilb, Meunier and Hallegatte, 2018; Grubb et al., 2021). To accept this point is not to reject the importance of efficiency, it is rather to shift from one conception of efficiency to another, from *static* to *dynamic* efficiency, the latter of which is appropriate to the circumstances of transition and transformation (Huerta de Soto, 2008). This further highlights the importance of time as a dimension in the policy mix, in particular the opportunities for policy sequencing, knowing when to begin and end a policy, and how to stage policies so that one might amplify another (Pahle et al., 2018).

Second, each evaluative principle, while oriented towards an ideal, must be applied with due regard to the non-ideal circumstances in which the policy will actually be implemented. The notion that emissions pricing alone is justified on the basis of economic efficiency, for example, rests upon several heroic assumptions that do not pertain in the real world, such as perfectly operating markets, full compliance by market participants, the quantifiability of future climate impacts, and the absence of near-term targets. Nevertheless, some prominent commentators and even some decision makers appeal to this 'first-best' ideal by arguing that, because emissions pricing delivers the most efficient response to climate change, complementary policies can only but contribute to inefficiency. In the real world, however, the superior efficiency of emissions pricing relative to other policies is far from obvious. As Borenstein and Kellogg (2023) have shown, in the circumstances of imperfect energy markets and near-term gross emissions targets, the difference in the economic

Figure 2: Potential outcomes of policy instrument interactions



Source: adapted from Drews, Exadaktylos and van den Bergh, 2020

efficiency of subsidies or emissions pricing is negligible. In short: 'It is a fundamental mistake to begin the analysis of climate change under the premise that, but for the mispricing of emissions, the economy is efficient' (Stern and Stiglitz, 2021).

Third, it is important to consider these evaluative principles in relation to one another, not in isolation. For example, the most efficient option *in principle* might not *in fact* be politically feasible – and, as such, its claim to efficiency is unrealisable. The same goes for effectiveness: a supply-side policy which directly restricts emissions-intensive consumption, such as a ban on fossil fuel imports, will not be effective at all if it induces a backlash so severe that it cannot be implemented or sustained. The virtues of efficiency and effectiveness must be reconciled with the principle of political feasibility. If reconciliation is not possible, then it is churlish to continue to insist upon the ideal option, not least because it crowds out feasible alternatives. A least-cost policy that cannot be implemented is not a triumph for fiscal prudence; it is a failure. However, a policy with a higher abatement cost might be worth the investment if it avoids resistance and ensures durability.

The lesson here is not that one or other principle is superior; rather that judicious policy design will involve a synergistic combination of principles. By way of example, a major cross-country survey by OECD economists found that public support for climate policy is dependent on three key factors: the perceived effectiveness of the policies in reducing emissions, their perceived distributional impacts on lower-income households, and their own household's gains and losses (Dechezleprêtre et al., 2022). In other words, social acceptability – which is a contributing factor to political feasibility – is underpinned by the effectiveness, efficiency, distributional impacts and macroeconomic effects of the policy mix. In turn, this social acceptability enhances the capacity of policymakers to tighten the stringency of those attributes.

Policy harmonisation

The assumption of an instrument mix should not be taken as a *carte blanche*, as an excuse to implement any and every policy idea as if each were necessarily additive. Rather, the challenge is to develop a strategic portfolio of instruments which is defensible as an interrelated package.

As Figure 2 shows, there are a range of possible interactions among overlapping policies. If there is no synergy, the policies are additive – that is, the combined impact is simply the sum of its parts. If there is a positive synergy, the combined impact is greater than the sum of its parts. If there is a negative synergy, it is less than the sum of its parts and, in extreme cases, results in backfire where the combined impact is less than the impact of the best-performing instrument. Policymakers are well advised to anticipate and avoid backfires, to tread carefully with negative synergies, and to pursue policy combinations with no or positive synergies (van den Bergh et al., 2021).

The deliberate pursuit of positive synergies is a plausible goal, as demonstrated by an innovative 2024 study which applies machine learning to a global, systematic ex-post evaluation of 1,500 climate policies in 41 countries between 1998 and 2022 (Stechemesser et al., 2024). It finds 63 instances of emissions breaks, where a country's historical emissions diverge significantly from the counterfactual. By assessing policy interventions associated with each emissions break, the research found that 'effect sizes are larger if a policy instrument is part of a mix rather than implemented alone', which suggests that many policy instruments are complementary or even reinforcing in policy mixes. Emissions pricing is especially important as a complement to other policies.

One way that positive synergies occur is where two (or more) policies trigger self-reinforcing feedbacks which create irreversible momentum for a new behaviour or technology. A combination of adoption subsidies and emissions pricing, for instance, can accelerate the deployment of clean technologies and therefore build economies of scale and cost efficiencies, which in turn improves its cost-competitiveness and its deployment in market economies. These so-called 'learning curves' or 'experience curves' are behind the dramatic diffusion of mass-manufactured technologies – including solar panels, batteries and electric vehicles – which abruptly shift from niche to mainstream over relatively short periods of time (Grubb et al., 2021; Sharpe, 2023; Bond, Butler-Sloss and Walter, 2024).

An example of a negative synergy is the waterbed effect in a cap-and-trade scheme. In theory, any additional policy will only free up allowances that other polluters will use, thus negating any emissions reductions that the additional policy delivered. If the cap-and-trade scheme is watertight, the negative synergy will, in theory, be on the boundary of backfire. Yet we need to differentiate between ideal and non-ideal circumstances. The NZ ETS is not watertight. It has, at best, a leaky cap that permits a substantial flow of forestry removals. Furthermore, New Zealand companies have diverse motives to reduce emissions, above and beyond

compliance (Nikula, 2022), which means that they may not avail themselves of all opportunities to pollute. These motives include company-level targets, brand alignment, employee retention, competitive advantage, market access, and the spectre of carbon border adjustment taxes. This results in an accumulation of surplus units in the stockpile, which might be released to permit emissions in future that complicate the meeting of targets by permitting an excess of future emissions..

Even worse, an ETS can produce perverse incentives that discourage ambition. For example, technology breakthroughs can create emissions reductions at unexpected volumes that run ahead of the cap, contributing to oversupply and depressing the price. For this reason, some experts argue for carbon taxes instead (Sharpe, 2023). However, the waterbed effect can be mitigated by policy: for example, the EU ETS has temporarily achieved this with its Market Stability Reserve (Perino, Ritz and van Benthem, 2022). Tightening the cap to lock in ambitious emissions reductions can deliver an outcome closer to no synergy, although accurately quantifying the real emissions reductions is not without its challenges (Pahle and Edenhofer, 2021).

This is where credibility is key. If governments lack the fortitude to manage the NZ ETS with due stringency, then this is potentially a reason to complement it, or even replace it, with other policy tools. Recent analysis has shown that, in the EU ETS, policy credibility has a substantial effect on price, beyond basic dynamics of supply and demand. It forces market participants to be far-sighted, to take long-term targets seriously, whereas policy decisions that betray a lack of credibility encourage market participants to be more myopic, to prioritise short-term gain and management of risks (Sitarz et al., 2024). Many readers will also recognise that dynamic in the NZ ETS, in its sensitivity to political announcements. In sum, it is not merely about the tool, but about the willingness to use it well, the commitment of a government to apply it with stringency and to address inconsistencies when they arise.

Two economic paradigms

Another dimension of the policy mix is the paradigms that policymakers draw upon to interpret problems and solutions. A paradigm is a set of overarching and interconnected assumptions about the nature of reality (Kuhn, 1962). The concept of market failure is an expression of a distinctive economic paradigm. It is defined as a situation where, due to a market imperfection, the market alone cannot achieve an optimal allocation of economic resources. This justifies interventions that restore optimal allocation, but cautions against further interventions, lest they produce a distortion. It reflects a view of the economy as an equilibrium which needs to be restored or fixed by judicious interventions.

> … our economy is presently optimised for fossil fuels, which is an equilibrium we cannot afford to keep returning to.

The logic of market fixing might appear to favour a narrow policy mix. However, given how pervasive market imperfections really are, this is far from obviously the case. Market failure can actually be used to justify a wide range of interventions – from direct support for innovation and technology, to internalising externalities, to infrastructure investment, to addressing information deficits and bounded rationality (Climate Change Commission, 2021, p.213). Furthermore, when emissions are being priced suboptimally, then the scope for complementary policy is potentially rather wide. As the energy economist Jesse Jenkins (2014) notes, suboptimal pricing creates an 'opportunity space' for other policies to deliver the response that optimal pricing would have done. In this context, determining what is a genuine market failure – and what is not – is unlikely to be free from subjective opinion, or political preference.

Market failure is also, more importantly, ill-suited to the task at hand. As the name suggests, it takes as its starting point the assumption that markets would be optimal if not for discrete, identifiable market imperfections. However, our economy is presently optimised for fossil fuels, which is an equilibrium we cannot afford to keep returning to. The objective of climate mitigation policy for the energy system is to destabilise this equilibrium, to supplant the current system with another that relies on renewable energy generation and the electrification of end use. Transformative change is also needed in other sectors, including our response to the impacts of climate change itself.

The UK Treasury's *Green Book* for policy appraisal defines transformative change as 'a radical permanent qualitative change in the subject being transformed, so that the subject when transformed has very different properties and behaves or operates in a different way' (HM Treasury, 2022). This pertains to situations where:

- policy is being developed for an operational environment that is undergoing transformative change (e.g., climate adaptation);
- transformative change is the objective of policy (e.g., electrification of the energy system);
- transformative change is a consequence or side-effect of policy that is pursuing another primary objective (e.g., major land use change as a consequence of meeting net-zero targets).

In such circumstances, the *Green Book* warns that marginalist analysis alone, such as standard forms of cost–benefit analysis, is not sufficient for policy appraisal. Cost–benefit analysis has a well-known status quo bias, which becomes increasingly problematic over long time frames and greater uncertainty: 'simple extrapolation from past experience will fail to foresee the way that a system may behave after it has been transformed or once the process of change has started' (ibid.). In such circumstances, we need to consider the wider set of analytical tools available,

which might include real options analysis, portfolio analysis, robust decision making, scenario analysis and risk-opportunity analysis (Pells, 2023).

More than that, we need to shift paradigms. As noted earlier, direct support for RD&D is conceived as fixing a market failure, insofar as it compensates businesses for technology spillovers that they cannot entirely capture (Jaffe Newell and Stavins, 2005). But RD&D can also be conceived as *market shaping*, as corralling the forces of innovation and investment towards specific goals, such as the strategic pursuit of green economic opportunities. This involves a different mental model of the economy, not as an equilibrium, but arguably as an ecosystem that evolves and changes over time. This is also associated with a shift in economic disciplines – from orthodox neoclassical economics to evolutionary economics, complexity economics, systems thinking and transitions theory.

Climate policy expert Simon Sharpe (2023) notes that, once we take this view, 'we see that just like an ecosystem, [the economy] has many possible dynamic states. It can grow, crash, oscillate, bounce, and lurch. It is rarely, if ever, in a perfect state of balance of equilibrium' (Sharpe, 2023, p.110). These are the dynamic conditions which policymakers must operate in, not only to anticipate and navigate economic disruptions, but also to purposefully mobilise the disruptive power of innovation and markets to achieve the goals of public policy.

In Table 1 I included tipping points as a criterion for designing policy mixes. Rather than aim for changes at the margin of existing systems, this involves the strategic pursuit of non-marginal, non-linear change, such as the scaling up of new products or business models, or major transitions in industry or land use. This paradigm, in turn, influences the strategic design of the policy mix. The goal is a well-sequenced combination of instruments that intentionally push new technologies and behaviours to a point where reinforcing feedbacks take hold, precipitating a larger, irreversible change.

The extraordinary rise of solar PV is a good example. In 2010, electricity from solar PV was 710% more expensive than the cheapest fossil electricity, but by 2022 it was 29% less expensive against the same benchmark (IRENA, 2023). As a fact of history, this did not occur spontaneously, but rather as a consequence of intentional policy mixes and international coordination. In Germany in the 1990s, feed-in tariffs for renewable energy were introduced, later augmented by renewables targets and the industrial strategy known as *Energiewende*. By supporting solar technologies when they were uneconomic, innovation processes could be sustained, driving down technology costs and improving efficiency. This further enabled the development of Chinese manufacturing, initially to meet offshore demand from Germany especially, and subsequently to meet China's own renewable energy ambitions (Grubb et al., 2021). As a consequence, the cost of electricity from solar generation declined dramatically. It is an extraordinary demonstration of dynamic efficiency, where investments at a high abatement cost in the past sowed the seeds for low abatement costs in the present, along with energy cost savings and other co-benefits (e.g., avoided air pollution) that accrue to all future generations. Globally, the substitution of fossil energy with cheaper renewable energy will deliver net savings of many trillions of dollars – even without accounting for climate damages or co-benefits of climate policy (Way et al., 2022).

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At the country level, Rewiring Aotearoa has estimated that, by electrifying households and private vehicles with technologies that are already commercially available, New Zealand could avoid fossil fuel expenditure of over $10 billion per year by the late 2030s (Griffith et al., 2024). The costs of upfront policy support – whether delivered by subsidies or regulations – need to be assessed in this context.

This pragmatic logic – of policy interactions, of policy sequencing – is not absent from New Zealand's policy domain. It is evident in the current government's approach to agricultural emissions: 'Tools first, then price: Reducing agricultural emissions depends on farmers having access to the right technologies and tools which allows a price response' (New Zealand National Party, 2023). Setting aside the needlessly long delay on pricing until 2030 – plus the injury this does to the credibility of the policy mix – this is at least a defensible intervention logic which might be applied to other sectors as well as agriculture.

Success, however, depends on making choices about technologies and tools, at least at the portfolio level. Again, one paradigm is more amenable to directing innovation than the other:

> Equilibrium economics tells us that we should aim to be technology-neutral. We should set policies that determine the required outcome, and then leave the market to decide the technologies to which resources should be allocated … however, in the ecosystem economy, no action is neutral. Any intervention will affect its evolution, advantaging some of its incumbents and disadvantaging others. (Sharpe, 2023, p.135)

To put the point more sharply, the myth of technology neutrality often functions as *de facto* support for business-as-usual, a refusal to address the market barriers, infrastructure shortfalls, well-formed habits and other arbitrary disadvantages that prevent niche technologies from scaling up. It is sometimes suggested that New Zealand, as a small, technology-taking country, lacks the scale and capacity to drive innovation. Yet we can see how concerted public–private coordination has created an unlikely space industry in New

Zealand. Another small island country, Singapore, uses living laboratories and multi-stakeholder partnerships to purposefully foster climate innovation as part of its mitigation strategy, to steer markets towards addressing challenges.

The critical shift is one of outlook. As Sharpe describes the policymaker's role: 'We are not mechanics, fixing the machine when it fails. We are something more like gardeners, tending and shaping the ecosystem so that it grows in ways that we find beneficial' (ibid., p.111).

Conclusion

New Zealand's policy mix for climate mitigation is now more than three decades in the making. It has brought us to where we are: a levelling-off of gross emissions and a relative decoupling from GDP growth. But this is still a long way from the structural declines in gross emissions that will credibly fulfil our international commitments and support our businesses to align with hardening market expectations for emissions reductions throughout global supply chains. We can try to fix our policy mix, but if we restrict ourselves to the same paradigm that got us lost, we might find ourselves off course again. Too often, our policy processes are taking a narrow approach to policy appraisal, evaluating instruments in isolation instead of interaction, and delivering idealised solutions for non-ideal circumstances.

This is advice that will keep us lost: 'Please, sir, how do I get to Dublin from here?' 'Well, as the crow flies, you'd go directly in a straight line from here to Dublin.' 'But, sir, the roads are crooked and the obstacles are many. People are telling me that the River Liffey is in flood …'. 'Well, I'd still insist upon the way of the crow. Anything else would be inefficient.' We need to do better, to use analytical tools that are well suited to what we are trying to achieve. The framework of the policy mix helps us to understand not only what we are doing, but also how we might do better.

1 For example, 'governments must have policy instruments equal in number to the objectives' (Reinert et al., 2009).

2 For example, the fourth National government introduced minimum energy performance standards in 1996 by quantifying the avoided emissions and observing that the policy would 'help New Zealand in terms of our international commitments on climate change' (Kidd, 1996).

3 I would like to thank the anonymous reviewer for many useful suggestions, including a prompt to sharpen this point.

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