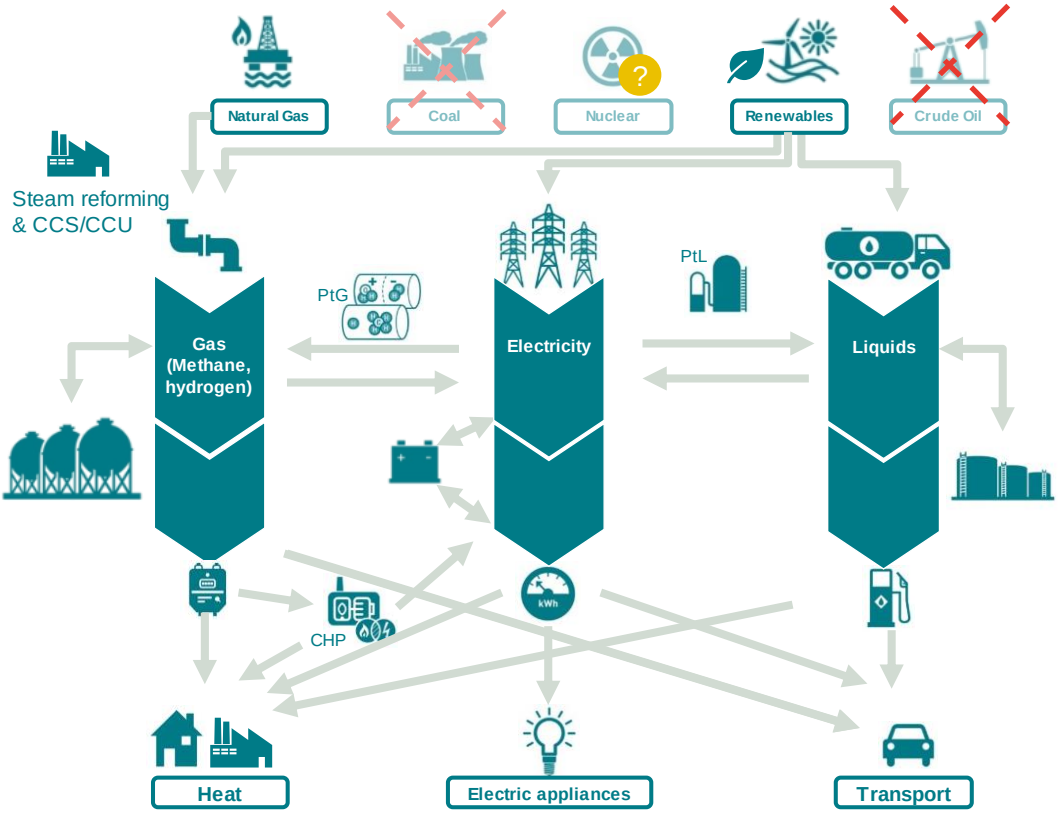
PUTTING THE SMART IN SECTOR INTEGRATION

The Commission is expected to publish its “smart sector integration” strategy next week. The strategy will consider how to ensure that different parts of the energy system link together efficiently, with an emphasis on decarbonising energy used in the buildings and transport sectors. Carbon pricing would feature highly on most economists’ policy prescriptions, and the Commission has indeed already indicated its intention to expand the existing EU Emissions Trading Scheme (ETS). In this article we discuss whether this will be sufficient to deal with the complexity of sector integration, drawing on past experience of electricity market reforms, and consider how the Commission may need to adapt to the challenge.

While significant strides have been made towards decarbonising the power sector, progress in reducing greenhouse gas (GHG) emissions from buildings and transport has been slower. Among the routes being considered by the Commission are:

- Electrification: Greater use of power in transport and in heating and cooling, which could allow for direct use of renewable and low-carbon power.
- Decarbonising gas and liquid fuel consumption: Natural gas and petroleum products can be replaced by renewable and low-carbon alternatives, including synthetic gases and fuels (such as hydrogen) produced using electricity.

Both routes imply a closer linking together of the power sector with heating, cooling and transport than has traditionally been the case (see figure below).



The hope is that such "sector integration" can help reduce the costs of abating GHG (primarily CO_2) emissions in the energy sector, as Europe seeks to achieve increasingly ambitious long-term climate targets.

These cost reductions are driven by optimisation across technologies – for example, converting low-carbon electricity to gas and using it directly in heating if this is cheaper (accounting for wider costs and benefits across the energy system) than electrifying heat. But policy intervention is required to achieve any of this change, so it's important that the intervention ensures investors and consumers have the right incentives, as otherwise the cost reductions won't materialise.

We're already trying to solve a (simpler) version of this problem today by trying to make renewable electricity support technology neutral (so that investment focuses on the cheapest overall technology). In this article, we consider what policymakers need to do to make sure the opportunities from "sector integration" are not lost.

A price for everything…?

The "first best" answer is an economy-wide carbon[1] price. The market can then choose between technologies based on the cost of their emissions. A sufficiently high and credible carbon price[2] will naturally drive out high-emitting technologies, and the market will choose efficiently among (lower-carbon) technologies to replace them.

Actually, a carbon price isn't quite enough. It internalises the carbon externality, but there are other pre-requisites[3] to efficient decarbonisation which are important to bear in mind when thinking about sector integration.

1 In this article, we frequently use "carbon" as shorthand for GHG emissions in general.

2 We explore how the role of carbon pricing might be strengthened in our article on the "Economics of Climate Change" for our 20th anniversary book; https://www.frontier-economics.com/uk/en/news-and-articles/articles/article-i6414-all-hands-to-the-pump/

3 We have described the ideal market-based policy framework for achieving this in further detail, in recent work for the European Federation of Energy Traders (EFET).

- At least initially, there may be important learning and spillover effects from investments in emerging technologies such as low-carbon gas production. If these are not addressed separately, there may be too much focus on mature technologies.
- There may be enduring sources of value from some specific investments – for example, low-carbon gas production may provide important new sources of flexibility to both the power and gas networks. Again, if the respective market designs do not allow this value to be properly captured by investors, the wrong investments will emerge.
- Regulated prices (such as network tariffs in gas and electricity) may distort investment choices, particularly if they seek to recover the sunk costs of energy networks from production or consumption that is price-sensitive.
- Co-ordination requirements of some aspects of the energy transition may limit what market-based instruments can ever achieve (e.g. the market will not be able to ensure conversion of a whole region to a different low-carbon gas, such as hydrogen). In these instances, policymakers will need to ensure that more direct measures are in place to ensure that absence of co-ordination does not act as a barrier. This idea seems to be implicit in the Commission's planned hydrogen strategy.

Having set out these requirements of a first best outcome, we can be clear that we're some way off. While the ETS does create a carbon price, its scope and the abatement ambition built into the scheme have been the subject of much debate.

This Commission seems intent on moving towards broader carbon pricing. Next year, it will bring forward proposals to extend the ETS to cover buildings and road and maritime transport. It is also alive to the risks of carbon leakage, planning a "carbon border adjustment mechanism", and to the risks of distortions from taxes: it has announced an intent to reform the Energy Taxation Directive (ETD), which sets minimum tax rates to be applied by Member States to the use of electricity and fuels.[4]

However, getting to the point where carbon prices are high (and credible) enough to drive investment and operational decisions to meet decarbonisation targets will be challenging. The current framework is no accident: policymakers have several reasons for using alternatives to carbon prices.

Economists like carbon pricing because it leads to efficient outcomes (maximising the size of the economic pie). Policymakers care about the size of the pie and its distribution (how the slices are divided up among different groups in society). Carbon prices create 'winners' and 'losers' which may be difficult for policymakers to swallow. The carbon price required for synthetic gas from renewable electricity to be profitable (compared to natural gas) today could (depending on assumed technology costs) be of the order of EUR 500/tCO_2e. Such a carbon price would represent a significant windfall for those willing to undertake abatement at the current ETS price (EUR 20-25/ tCO_2e), including (potentially) those already in receipt of subsidies that are difficult to adjust (e.g. some existing renewable plants).

And the losers may range from groups who are concentrated and more able to lobby (for example, fossil fuel investors) through to the more dispersed and potentially more vulnerable. Last year's "yellow vest" protests in France demonstrate the political sensitivity attached to energy prices. And in the UK, nearly 10,000 deaths per year can be attributed to cold homes – about the same number of deaths as can be attributed to breast or prostate cancer[5].

Ideally losers might be compensated through using general taxation and/or the welfare system (within countries) or transfers between countries[6]. However, such transfers themselves create winners and losers and therefore come with their own political challenges.

So a lower carbon price, and paying subsidies to technologies that are as a result uneconomic, is often more attractive: there are far fewer winners and losers. While effective carbon pricing should be the end destination, like it or not, subsidies are with us for some time to come. But this means that the

[4] "Communication from the Commission: The European Green Deal", COM/2019/640 final.

[5] E3G and NEA (2018), COLD HOMES AND EXCESS WINTER DEATHS, https://www.e3g.org/docs/E3G_NEA_Cold_homes_and_excess_winter_deaths_2018.02.pdf

[6] To this end, the Commission has proposed a Just Transition Mechanism, including a Just Transition Fund, to assist EU regions currently most dependent on fossil fuels, by aiding them in the energy transition.

subsidy mechanisms should be designed to encourage the efficient investment and operational decisions associated with smart sector integration.

Old lessons, new complications

We have been subsiding renewable electricity for years now, with significant success in terms of capacity deployed. In the process, we've learned a lot about what type of regime gets us closest to an efficient outcome (even if we haven't always acted on what we've learned). To secure efficiencies from sector integration, we're going to have to deploy these and other learnings while thinking across multiple sectors.

Lesson 1

Cross-border technology neutral subsidies (i.e. awarding support based on competition between technologies) are better than localised technology specific ones (once learning and spillover effects are negligible).

While the Commission has been able to encourage technology neutrality for support to renewable electricity, there are frequently separate support schemes across different energy carriers. Taking France as an example, there are support schemes for renewable electricity, renewable heating, renewable heat networks, biomethane injected into the grid, renewable transport fuel and potentially in the future for hydrogen production and nuclear electricity. None of the schemes link up, and so it will only be by coincidence that they are sending efficient signals as to where it is most efficient for the "next" investment in decarbonisation to take place.

The Commission has been less successful in pushing opening of support schemes across borders. Political issues with using customer money to fund projects in other countries have got in the way of the concept of the internal market.

Going forward, we need the logic of technology neutrality to be extended across sectors and energy carriers (and potentially also to energy efficiency measures), ideally with competition based on contribution to the ultimate climate objective (i.e. carbon savings). This is essentially the idea behind the Dutch SDE++ scheme, which is due to launch later this year. It may also be the thinking behind the idea of "Carbon Contracts for Difference" (CfDs) featuring in leaked drafts of the Commission's forthcoming hydrogen strategy.[7] These are intended to provide support in a sectorally neutral way (based on carbon abatement rather than output of a specific type of energy), by covering the difference between the revenue stream required for investments to be economic and revenue levels given the expected ETS price.

Supporting investment based on estimated contributions to abatement will inevitably raise complications, particularly around measurement.

- Common to carbon pricing, a decision is needed on how to assess the emissions of any new installation. Should the focus be on the installation actually generating emissions (the current ETS approach)? Or should all associated emissions be included, including emissions upstream in the production process, regardless of the source? The Commission seems to be leaning towards the latter approach for support for hydrogen but whatever the approach, consistency across sectors is key.
- Our previous work on carbon CfDs shows that determining the benchmark against which to measure emissions saved (i.e. what would have happened absent the new installation) is both critical to ensuring a level playing field and tricky to get precisely right.[8]

[7] https://www.euractiv.com/section/energy-environment/news/leak-eu-puts-onus-on-renewable-hydrogen-in-latest-draft-strategy/

[8] For low-carbon gases, it may be relatively straightforward to assume a counterfactual of natural gas, at least over the medium term. However, the emissions saved by low-carbon electricity will depend on the technology assumed to be displaced. In reality this will vary by time and place, making it difficult to precisely estimate emissions savings. The issues for industrial emissions are potentially even more complex.

Whether via Carbon CfDs or some other policy instrument, it is worth investing the effort in sorting these issues out. For example, to the extent that (initial) differences in the maturity of technologies justify differences in support levels, this could be achieved by competitions in separate groups (within the same scheme), with groups being merged over time. And any cross-border opening of support schemes need not be 100% from the start. However, the risk of the current approach (starting with completely separate structures for each sector, defined on national lines) is that the resulting development of vested interests makes a later shift to a more internationally- and technologically-open approach (and realising the value of sector integration) much more difficult.

Lesson 2

If new installations face (non-cost reflective) differences in taxes or in tariffs (e.g. to connect to and use energy networks), then no amount of competition will result in the right investments.

In power markets, we've seen the importance of getting network charging structures right, to avoid distorting competition. This challenge also applies to sector integration, though is of an order of magnitude greater. Authorities need to ensure that developers are incentivised to produce (or consume) not just at the right time and place within a given system, but also on the right network and (increasingly) on the right level of the network (transmission or distribution).

Tax also matters. A review of the requirements of the ETD quickly reveals that countries need not place any tax the use of gas for domestic heating (currently, ten member states take advantage of this loophole). On one level this is unsurprising, since policies that raise the price of heating homes are typically deeply unattractive from a political viewpoint. But in addition to facing a carbon price via the ETS (which gas consumed in households does not), electricity frequently faces additional charges. In Spain, electricity charges include a tax on final consumption, a tax on electricity generator revenues and a levy to recover the costs of renewable subsidies (see "Lesson 3"). If we want consumers to make efficient choices regarding whether and when to replace fossil gas heating systems with electric heat pumps or low carbon gas alternatives, technologies will need to be on a level playing field.

Energy taxes, regulated tariffs and levies are always politically sensitive, and change will create winners and losers. But given where we start from, not changing also has a cost. We need to focus more on making sure that where people are going to be making decisions based on price, administratively set prices are helping rather than hindering.

Lesson 3

Following on from Lesson 2, if we are not careful about how we recover the costs of subsidies, this will in itself cause people to change their behaviour inefficiently.

For example, households in Germany only pay the "EEG levy" (used primarily to recover the costs of supporting renewable electricity) on "net" metered electricity consumption from the grid, i.e. consumption less any exports to the grid.[9] This, combined with the high level of the EEG levy, has arguably resulted in greater deployment of power generation "behind the meter" (for example, rooftop solar PV installations), to reduce exposure to the levy, than would have been cost-effective from a societal perspective.

Sector integration will create similar challenges across a wider set of customer decisions if we stick to our silo-driven approach to recovering the cost of subsidies (for example, the burden of subsidies to renewable electricity producers have typically fallen on electricity customers).

[9] Larger consumers, on the other hand, pay the levy on "gross" electricity consumption.

The logic of such an approach will increasingly be called into question. Should electricity customers pay for a renewable power plant that is used to make low-carbon gas? And who should pay for a biomass plant with Carbon Capture and Storage (CCS) which is producing electricity but is also removing carbon from the atmosphere? And what about for a Direct Air Capture with Carbon Storage plant[10] which is doing nothing but removing carbon?

Political factors have sometimes forced governments to move part of this burden onto taxpayers. This has happened in Denmark for its energy public service obligation costs, in the UK for the costs of supporting renewable heat, and will soon – at least in part – happen in Germany (as it looks to cap the EEG levy). This solution may risk greater politicisation of the subsidy process. It might be better to adopt a different approach to levies, recovering costs not in silos but across energy carriers, in a way which balances:

- efficiency, avoiding charging uses and users that are price sensitive (both at the personal level, and also in relation to industries which face international competition);
- fairness, avoiding charging in a way which worsens the position of the vulnerable in society; and
- practicality, avoiding approaches which are complex and costly to administer.

Back to the future

The overall costs of the energy transition should be brought down if the Commission is successful in its efforts to streamline and strengthen the role of carbon pricing. But this will not be sufficient, on its own, to achieve efficient decarbonisation. There are three important lessons from the past which the Commission should think carefully about when thinking about policies to support sector integration.

First, we should stop thinking about support schemes in isolation. At some point, pushing more and more decarbonisation in electricity will not make sense, because there will be lower hanging fruit in other sectors. We need to start to design schemes which put technologies from different sectors (and, ideally, from different jurisdictions) on a level playing field and choose what to invest in based on an estimate of the cost per tonne of carbon abated (rather than the price of energy produced).

While the Commission has been able to approve State aid for CHP (including coal-fired) on energy efficiency grounds, it has not been clear that there is an “objective of common interest” for schemes with the simple aim of reducing carbon emissions. The Commission has recently broken precedent with the approval of aid for closure of coal-fired power plants in the Netherlands; it should clarify that Member States can come forward with (well-designed) support schemes for decarbonisation. And as the example of trans-boundary energy pipelines and wires shows, EU funding and cost allocation rules may help grease the wheels of making cross-border investment a reality.

Second, while promoting competition between technologies and across sectors, we have to make sure that taxes and tariffs don’t distort the outcomes. Given member states’ different starting points, and the complexity of ensuring “cost-reflective” charges, a hard and fast “one size fits all” approach is unlikely to be feasible or desirable. While some level of EU-level guidance or harmonisation is likely to be helpful, there may be merit in a combination of some rules of thumb, combined with a more flexible, case-based approach to ensuring that distortions to competition between low-carbon technologies are avoided. This is similar in some ways to the approach taken on electricity transmission charges paid by generators, but needs to extend more widely.

Third, we need to start to think more carefully about how we recover support costs. EU rules (notably on State aid) need to adapt to allow for the possibility that costs could be spread across different energy carriers. They also could benefit from a more coherent treatment of different types of levies. But given the points on fairness and practicality noted above, they should leave scope for member states to make the difficult trade-offs that will inevitably arise.

[10] Such GHG removal technologies are likely to be key to enabling the EU to meet the proposed 2050 “net zero” GHG emissions goal.