



Regulatory approaches and tools to meet the decarbonization challenge

Conference report

Université Paris Dauphine-PSL, 16th April 2021



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Regulatory approaches and tools to meet the decarbonization challenge

Introduction

Éric Brousseau

Scientific Director of the Governance and Regulation Chair and of the Club of Regulators

Dominique Jamme

Moderator of the conference, Managing Director, Commission de Régulation de l'Énergie (CRE), France, and President of the Club of Regulators

Decarbonization requires major investments by operators in regulated industries, which need to reshape infrastructures to adapt them to different technologies and evolving users needs. This conference will be aimed at discussing how various regulators from different countries can facilitate funding for these investments, while guaranteeing efficiency of choices and a fair distribution of costs and benefits among the various stakeholders.

Among the challenges faced by regulators are: the writing-off of past investments or, in case of conversion to any alternative role, the pricing of the new services ; the coordination of regulatory policies across industries requested by sector coupling ; the conflicting objective of guaranteeing moderate price evolution to the users and the guarantee of funding the investments allowing decentralization of energy and mobility systems ; the necessity to incite users to adopt more responsible behaviours ; the uncertainty characterizing these major transformations due to the incomplete knowledge about the economics of alternative technological scenarios and about the social acceptance, etc.

The conference will be introduced by two keynotes speeches aimed at highlighting the stakes and the constraints faced by regulators and industry operators. The strategies implemented by several regulators in various network industries in different regions will then be presented.

Keynote speeches

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Simone Borghesi, Director of the Florence School of Regulation-Climate, European University Institute

The EU ETS at the crossroads: LIFE and challenges of a decarbonization instrument

Past and present of the EU ETS

The EU ETS is a carbon-pricing mechanism that sets a price on greenhouse gas emissions to cost-effectively control and possibly eliminate emissions in the future. More precisely, it is a carbon trading mechanism in which the government sets the cap on total emission allowances, letting the interplay of supply and demand determine the price. Increasingly stringent over time, it is considered the cornerstone of the EU climate policy, covering more than 10 000 heavy-using installations, and around 14% of the European greenhouse gas emissions.

It can also be said to be a living creature: it grows, learns, teaches, and even sometimes marries (with its Swiss counterpart) and divorces (from the UK, as a result of Brexit). Born in 2005 as the first transboundary carbon trading system on the world's largest carbon market, it began growing immediately, adding petrochemicals, aluminium, ammonia, and additional gases to its mix and, throughout its life, has been on a continuous learning journey, as attested to by the large number of reforms and directives of which it has been the focus.

Having remained a lone beacon in the landscape, potentially joined only this year by a Chinese equivalent, it has consistently "pitched" to other ETSs contemplated or actually developed around the world, from the Middle East to California, Mexico, South Korea or New Zealand. In total, ETSs cover 40% of greenhouse gas emissions today. As the subsequent aim is to harmonise and align these various mechanisms, EU policymakers are working to build international cooperation with the other carbon markets, with the active participation of regulators.

Future, open issues and challenges

The extension to new sectors

The European Commission plans to extend the EU ETS to other sectors, to begin addressing the 60% emissions yet uncovered. The maritime sector, in particular, appears a good candidate: while a relatively low transmitter today, it is projected to grow by up to 50% between now and 2050.

Heated debate continues as to whether building and road transport should also

be included. Caution is required, considering the remarkable impact such a decision would have on low-income households and commuters, more vulnerable to price increases in this sector. A substantial share of the revenues raised through EU ETS auctions should be redistributed to mitigate such knock-on effects. Another possible solution consists of setting up a separate EU ETS for building and transport during a transition phase. The rules instituted by Germany for its fuel combustion ETS could serve as a reference point in this regard.

Possible reform of the Market Stability Reserve

The Market Stability Reserve is an automatic adjustment mechanism designed to remedy any oversupply of allowances. When oversupply exceeds a given threshold level, the Commission withdraws allowances from the market, to support prices; when oversupply falls below a threshold, it reinjects those allowances.

Can such a mechanism shelter the EU ETS from the side effects of other policies, or unanticipated shocks, such as the one we are currently experiencing? Though recent events appear to offer a positive response to this question, doubts remain as to whether it will be sufficient to ensure the stability of the higher prices we need to achieve climate neutrality, in the face of multiple disruptions, especially as the adjustments produce effects no earlier than one year down the line from the shock.

The current mechanism should most likely be reinforced and anticipated, as this would ensure market stability, improve regulatory certainty, and strengthen the signal to the market. This is particularly important, given the crucial role of expectations on carbon markets: prices increased when Covid broke out, even before the Market Stability Reserve could go into force, and did not fall as much as expected during lockdown, because of the anticipated higher ambition targets, and announced policies from the Commission.

The issue of carbon leakage

Any unilateral policy can trigger carbon leakage, namely, the delocalisation of polluting activities. While there appears to be reassuringly little evidence of carbon leakage, it is important to keep in mind that prices have been relatively low. When the latter are increased in order to achieve climate neutrality by 2050, we will need to find ways to safeguard international competitiveness.

Three possible routes emerge:

- The provision of free allowances to sectors at risk of carbon leakage has been found to reduce incentive for innovation. The EU is thus inclined to phase these out in favour of border carbon adjustments, but will have to design the latter in such a way that trade wars and retaliation policies are averted.

- For this purpose, it should engage international partners in a clear, frank conversation and negotiation, and allow exemptions for those partners who show environmental performance comparable to that of Europe, and introduce

this process gradually, starting from single sectors, possibly extending the scope.

- Lastly, by linking ETSs, it can foster price convergence, leading eventually to a single common price that would do away with any incentive to flee and thus preclude carbon leakage. However, linking requires time, in particular to build up the high level of trust on which it must rest.

Regulatory modifications ahead

All policies, whether past or future, will definitely imply trade-offs and bring about “winners” and “losers” across sectors and the population. The greater stringency sought by the EU at present through the European Green Deal is leading to higher carbon prices, which discourage emissions but also have regressive effects on lower-income countries and populations. We should not forget that higher carbon prices can also create higher incentive to innovate, behavioural changes and larger auction revenues. The use of the latter will play a central part in mitigating losses and fund the low-carbon innovation and modernisation needed in Europe.

The EU ETS has great potentialities to help decarbonisation, provided that it is neither seen as a silver bullet, nor left untouched. Further accompanying regulatory measures will be needed.

Patrice Geoffron, Director, Energy-Climate Center, and Director, Center for geopolitics of energy and raw materials, Paris Dauphine-PSL University

Regulatory approaches and tools to meet the decarbonisation challenges: introductory observations

1. The so-called low-carbon transition is more than an “energy” challenge.

It is essential to recall of all, a historical fact: there exists a classical and positive long-term relationship between CO₂ emissions and GDP growth at the world level.

Considering the remaining carbon “budget” – i.e., the CO₂ that can still be emitted up to 2050 without sending the temperature increase beyond 2° at the end of the century – we would have to reduce our generation of emissions to the same level as it was in 1950 (5 Gtonnes of CO₂). But, between 1950 and 2050, the world population will have been multiplied by a factor greater than 3, and GDP by a factor of 10. This world is a terra incognita from the macro-economic point of view, since as there has never been a period of decoupling, at the global level, between growth and CO₂ emissions. Nevertheless, Europe, which is already on this path, knows that the change of model is complex and requires time.

It will require a very innovative approach to regulatory activity, and extensive and close cooperation between sector regulators. And increasing interaction with the financial regulator, to address stranded assets, may also be needed. The leverage from CO2 abatement will require us to activate other technologies than those in the energy area. The potential impact of ICTs compared with that level of emission needs to be stressed.

2. The need for multiple sector coupling effort

Sector coupling between gas and electricity, especially in Europe, will be of key importance in the years to come, offering a way to store the surplus of renewable energy in the gas network as well as a means of providing services and creating economic value with the gas network. But this issue is only one of many examples of the efforts required in terms of sector coupling.

For example, the electricity consumption and carbon footprint of data centres in some parts of Europe has stirred concern in recent months. In Ireland as in Denmark, 20 to 30% of all electricity demand will come from these centres in 2030, because of these nations' policies designed to attract them and put to use the large power supply they boast. As data centres will be the fastest growing electro-intensive industry in the next decade, answers must be found now if the dual digital and energy transition is to succeed.

It will be a complex task to integrate these data centres into the local landscape while also managing demand-response, building market flexibility, establishing connections with heat networks, guaranteeing the ability to connect to fibre networks, which implies unprecedented efforts of sector coupling.

3. The co-benefits of climate action

In defining and fine-tuning regulation, it is important not to overlook the co-benefits of the climate action, for example in terms of air quality. And, unfortunately, once the public health crisis has passed, this issue will be even more important in public debate in Europe.

Just to give an idea of what is at stake, let's point out that OECD work on the cost of air pollution in Europe demonstrates that lowering air pollution since 2000 has contributed to GDP growth and is behind 15% of GDP growth in this period.

Thus, while the payback from CO2 prices (in terms of abatement) is essential, attention also needs to be paid to other benefits of climate-related action.

This dimension is essential in so far as it can convince that the reduction of global externalities (greenhouse gases) also produces local benefits, and thus improve the acceptability of measures to combat climate change.

Discussion

A participant

You thus propose more and more a move towards a price mechanism, rather than a quantity mechanism.

Simone Borghesi

I propose a quantity-based price-control mechanism (PCM) as in the other main ETSs. While I understand it can be undesirable to change the EU ETS now that it is working fairly well, such a change already being unfeasible in the 2021 review given the large number of issues at stake, we should start thinking now about possible changes to be implemented in the medium to long run.

A participant

What is the EU's strategy for countries that do not care much yet about such emissions, especially considering that climate neutrality is a public good?

Simone Borghesi

The idea underlying the proposed Carbon Border Adjustment Mechanism is to create a level playing field and spur other countries to improve their environmental performance. This will have to be a gradual process and one integrated by financial support to those less developed countries that are more vulnerable to climate change and currently lack financial resources to start a green economic recovery.

We will need to be very careful in our implementation methods, to prevent this mechanism from being perceived as a protectionist measure, even as we try to safeguard the interests of our industry in the face of almost unregulated jurisdictions.

1st roundtable: Energy sector overview

Annegret Groebel, President, Council of European Energy Regulators (CEER), UE

Energy regulation to promote the energy transition

Dynamic regulation

While regulation continues to be based on the natural monopolies of transport and distribution networks, it also entails numerous new responsibilities – in the wake of market liberalisation, as a result of the increased use of renewables, already part of the energy transition, and with the arrival of new technologies, in particular digitalisation.

It is our role to integrate this growing share of renewables not only into the grids, but also the markets, specifically by making the energy system as a whole more flexible, since renewable energies are more volatile. We will be able to achieve this by making greater use of digital technologies, integrating them into our regulation. An approach based solely on the traditional utilities infrastructure would neither offer the holistic vision nor provide for the interconnection between system layers which characterise today's energy playing field.

We refer to this approach as dynamic or adaptive regulation, in that we strive to make regulation more flexible, to address existing and developing needs in the system, all the while still regulating networks as natural monopolies, thus with continued consideration for such fundamental principles as predictability.

We aim to build smart regulatory oversight, with a market-based whole-system consumer-centric approach that fosters the necessary innovation.

In this model, consumers are the focal point, and must be both protected and empowered to make use of the demand-side flexibility and buy into the system. For this to happen, we will need to define ex-ante the role of all players, in particular consumers.

An illustration through tariffs

Decarbonisation is sought "at least cost", i.e., the regulation should contribute to the renewables and other measures for the energy transition at a cost that is efficient to the system and does not overburden users or consumers.

To illustrate the way in which regulation needs to change today, I will focus briefly on network tariffs at the distribution level. Regulation must be designed to ensure that the distributed energy resources are well-integrated into the grid and the market and send the right signals for greater flexibility. This can imply further differentiation of tariff structures, for instance, through dynamic price contracts,

varying by location or premised on the principle of interruptibility. Without this differentiation, demand-side management will not come about, as consumers will not see the purpose of engaging.

When integrating or introducing these new tariffs, regulators will in particular need to take into account storage facilities, due to the whole-system approach and to ensure that flexibility solutions and infrastructure investment are fostered where needed, both in distribution and transmission.

CEER papers and Strategy

In three recent White Papers, the CEER has focused more specifically on renewable gases and end-hydrogen, describing: when and how to regulate hydrogen networks; the regulatory treatment of power to gas; and long-term storage.

It also recently published a short paper on dynamic regulation, which identifies in particular two sorts of tools for innovation available to regulatory regulators:

- incentive regulation, to stimulate efficient investment as well as efficient network operation;
- and more experimental forms of regulation such as regulatory sandboxes, pilot projects and pilot regulations.

Exchange and communication between regulators must be encouraged in the context of the latter, so that all can benefit from lessons learned, whatever their stage in the innovation process.

In CEER's Draft Energy Transition Strategy 2022 - 2025 three regulatory dimensions are defined with a view to achieving the energy transition and contributing to a carbon-neutral society and economy – enabling energy system integration, placing consumers at the centre of energy markets with consumer-centric dynamic regulation, and ensuring open, well-functioning and resilient markets nationally and in Europe – have been further cast into six core areas:

- consumer-centric design;
- empowering consumers for the energy transition;
- energy systems integration;
- well-functioning markets;
- sustainable and efficient infrastructure;
- decentralised and local energy; and flexibility.

The CEER Energy Transition Strategy will run from 2022 to 2025.

The main trend influencing our increasingly varying work as energy regulators is climate change, and the policies and actions needed to achieve a carbon-neutral

society and economy. The centrepiece of the new CEER strategy is the consumer-centric dynamic regulation that incorporates the ASPIRE principles of the 2030 BEUC/CEER vision.

Fast-moving markets and new technologies require us to adapt our regulation in a way that balances the tension between achieving regulatory goals without discouraging innovation.

Martin Cave, Chair, Office for Gas and Electricity Markets (Ofgem), UK

The view from Ofgem

The decarbonization problem with which regulators are now faced is one of the most difficult I have come across for at least three reasons:

- it affects every component of the value chain, from electricity generation to measures to influence behaviours or provide digital support to consumers;
- it is an enduring process combining long-term and intermediate-term strategies for different sectors, some of which still remain to be fully identified;
- it may involve new governance arrangements across legislation policy and regulation.

In the UK, our regulatory endeavours have been greatly helped by the recent release in of publications from other bodies, including the work of the Parliament's Committee on Climate Change, the Government's short-term Ten-Point Plan and its much longer-term White Paper.

Our objective, set by Parliament, is clear: to protect the interest of current and future consumers of energy, especially vulnerable ones. Future consumers in particular have a very powerful incentive to decarbonise. Ofgem as a whole are fully committed to this objective and desire that our Office play a key driving role.

As an organisation, we are progressing in our decarbonisation ambition, but are still only at the start of our process.

We recently published a document that set out five strategic change programmes, which exist alongside our usual regulatory functions.

1. The first revolves around investing in low-carbon infrastructures at all points in the value chain, including by strengthening networks to connect more renewables, potentially new regulatory regimes for nuclear and carbon-capture storage, respectively, and trials to assess the potential role of hydrogen.
2. We have also developed a programme in full-chain flexibility, for example

enabling new forms of flexibility such as storage and flexible charging of electric vehicles.

3. We want to take advantage of innovative new retail products while stepping up our consumer protections to ensure safeguards both to those actually engaging in the markets and those who do not.

4. Alongside the Net Zero transition, we see growing opportunities relating to digitalisation.

5. Lastly, as the energy sector goes through this major transition, we need to ensure that energy system governance is fit-for-purpose, including the role which Ofgem plays.

The timetable has most recently made it necessary for us to introduce a new price control for electricity transmission and gas transmission networks, as well as for gas distribution. We have taken this opportunity to insert new features into our network regulatory system, to facilitate decarbonisation.

In our Final Determinations on the electricity transmission and gas sectors, published in late 2020, we announced a very substantial €35 billion programme of up-front investment for a greener and fairer energy system. We also allocated, for the first time, a further €12 billion in investments that could be unlocked by our uncertainty mechanisms or re-openers, to support the Net Zero target. Further, we have made €750 million available by our Strategic Investment Fund under the Network Innovation Allowance, which can be used toward funding trials on hydrogen gas networks. Lastly, in a controversial move still under appeal, we decided to reduce the amount of pay to shareholders to come closer to market levels.

Glasgow will host the COP-26 conference in November 2021, chairing it with our Italian colleagues. Ofgem is keen to work very closely with other regulators and organisations to maximise this opportunity.

Elisa Kahl, Senior Economist, Authority for Consumers and Markets (ACM), Netherlands

The Dutch case

The historical reliance on gas

The Netherlands, widely known as a country largely reliant on gas, first discovered the energy source in tremendous quantities in 1959, in Groningen. Networks were built across the nation in the subsequent decade and, by 1973, most households were connected to the grid and depended on it for their heat. Today, decarbonisation implies moving away from gas and from the extensive,

tightly-meshed network that serves the country comprehensively as well as extends into neighbouring countries. Its distinctive use of parallel pipelines, respectively carrying low- and high-calorific gas now appears an asset, as one of the two could be disconnected and given over to hydrogen.

The Dutch regulation system operates according to the incentive method, whereby the income level is set for five years based on expected efficient costs, and rarely adjusted if at all during that period. This approach, in which costs are set based on past trends, creates a further challenge in an energy landscape set to change inside out.

Will those past data on costs and capacity still be useable to estimate future costs and volumes? With gas use set to decrease, we risk overestimating costs and booked capacity, while with electricity usage, which will increase, the reverse applies.

Monique Coenraad, Senior Economist, Authority for Consumers and Markets (ACM), Netherlands

Scenario-building for the new regulation

In anticipation of the next regulation period starting in 2022, a priority project has been conducted to rethink gas regulation for DSOs, to: explore the impact of the energy transition on gas network regulation, in particular the potential for stranded assets and increasing tariffs; and determine which measures could or should be taken to make the regulation “future-proof”.

This effort was conducted using: a qualitative analysis based on the literature and experiences abroad; quantitative analysis looking at the future scenarios developed; cooperation with DSOs and TSO, drawing on their knowledge and data sources; and sessions with stakeholders.

Three scenarios were developed on future Dutch gas demand up to 2050, all compatible with the aims of the Paris Climate Agreement, and all making use of the full range of energy sources available.

- Scenario 1, based on Solar PV, Wind and Heat networks, focuses on electrification and enables a 49% reduction in gas use
- Scenario 2 uses Green Gas as the main energy source, resulting in a 45% decrease in gas use
- Scenario 3 is centred around hydrogen, and would enable a 36% drop in gas use

The decline in use of gas would result in a reduction in the related network capacity requirements, affecting capacity booking costs accordingly. Network operators would need to make investments to facilitate green gas and hydrogen,

while also bearing the cost of removing gas connections and entire parts of their network.

If the current regulation proceeds as planned, we can thus expect to see increasing gas network tariffs and cost-reflective network tariffs.

We would see a decline in required capacity, but no sector-wide stranded assets, whether for DSOs or TSOs. The investments needed to facilitate green gas and hydrogen TSO under Scenarios 1 and 2 are similar in magnitude, as both rely on gas to fulfil peak demand, while those for Scenario 3 are three to four times higher. In contrast, the costs of removing gas connections and parts of the gas network are much lower in Scenario 3.

As to gas network tariffs, they would increase by a factor of 1.3 (Scenario 3) to 2.8 (Scenario 1) by 2050 with DSOs, the approach making the least use of the network resulting in the highest increase. From the regulators' perspective, this situation is not seen as problematic, provided it is based on efficient cost. The situation is similar with TSOs, though the differential between the three scenarios is smaller.

Cost-reflective tariffs are intended to take into account and compensate for the reality that those remaining on the network will bear the cost of removing the gas networks and capital expenditure which can no longer be charged to those who have left.

[A conservative yet forward-moving approach](#)

While a decline can be expected in gas network capacity, the network itself will continue to be used to some extent, thus no sector-wide stranded assets. Tariffs will increase in the short and medium term, a shift acceptable to regulators in that the EU regulation specifically states that tariffs should be based on efficient costs, but an issue for policy-makers concerned about the broader cost of the energy transition. Lastly, to prevent the remaining network users from bearing an undue proportion of the cost burden, regulation should be adapted on capital-cost assumptions over time.

To adapt the regulation of gas TSOs and DSOs, in the face of considerable uncertainties on timescale and energy mix, we decided to act conservatively, with the aim of smoothing out the capital costs to match network utilisation. We considered TSOs and DSOs separately due to the structure of our system. Three major changes were initiated:

1. We moved from real to nominal WACC, no longer indexing the RAB, such that users pay for inflation immediately rather than over the investments' lifetime.
2. Divestments will be removed from the asset base immediately, hence costs are no longer remunerated by future users.
3. Lastly and most significantly, we changed from the linear depreciation

method to a digressive depreciation method, depreciating assets earlier in their lives, when the number of asset users is higher. The acceleration factor for this depreciation was based on the average of the three scenarios, matching depreciation with use of the network. It can be adjusted for each new regulatory period: a slow start is preferable, but above all, the change must be initiated early enough to take advantage of greater impact available during this time. For TSOs, it amounts to 1.3 and for DSOs to 1.2. To prevent cross-subsidisation between users of the gas network and hydrogen network respectively, we excluded assets redeployed for hydrogen from digressive depreciation.

Discussion

A participant

Since the energy sector is increasingly relying on digital technologies, it seems important that energy regulators and telecom/ICT regulators keep the dialogue open, to ensure coherent regulatory frameworks on both sides and ultimately, better market and consumer outcomes.

Annegret Groebel

I fully agree. We have an initiative (PEER) to work across sector regulators to ensure energy and digitalisation go together and work for the benefit of consumers.

A participant

At ITU, we have been working on the concept of collaborative regulation which, in essence, advocates for wider and deeper collaboration between all sector and cross-sector regulators where digital technologies have been integrated.

Dominique Jamme

Is the continued use of gas for at least 50% of your needs compatible with national-level commitments to Net Zero by 2050?

Monique Coenraad

All the scenarios are compatible with that aim, as we took into account carbon capture and storage as a method for reaching zero.

A participant

What role do you think regional/international standards can play to support regulatory efforts in this area?

Annegret Groebel

Regional/international standards are very important, e.g. there should be a definition/taxonomy of «green gases» or «colours of hydrogen» etc. to have a

consistent approach across jurisdictions as otherwise a CO2 cross-border tax would not work.

Dominique Jamme

How can we prevent the transformation from weighing too heavily on consumers?

Annegret Groebel

I agree with the emphasis on the importance of accepting efficient costs as well as envisioning this process as gradual, such that the costs are spread across generations as shown in the ACM presentation. As those of the future will profit even more if climate change is halted and carbon neutrality is achieved, it is also appropriate that they contribute as well.

The current benefits of the dramatic drop in wholesale prices have not yet been passed on to the retail level, such that consumers are not feeling the benefit of the greater use of renewables that are becoming more and more competitive. A mechanism will be needed to structurally ensure this pass-through, probably relying in part on greater competition.

The subsidies for renewables need to be made efficient as well, possibly through auctioning and tendering mechanisms to be rolled out according to the new Clean Energy Package framework. We should not create the impression of a zero-sum game. There are efficient costs and we should use all the instruments mentioned to ensure that consumers pay only a fair amount of this transition.

Elisa Kahl

At least with gas, the alternatives are much more expensive than continuing with the current connection. Thus, by acting on gas tariffs, it might be possible to lure consumers to heat pumps or encourage them to isolate their homes.

A participant

Passing on lower wholesale prices to customers might encourage higher consumption, which would then go against decarbonisation.

A participant

Do you consider that performance instruments will play a substantial role in the future regulation of network operators' activities, e.g. to support flexibility (more emphasis on targeted opex)?

Martin Cave

We do use performance instruments: for TSOs, we conduct cost benchmarking to determine how much of the costs are efficient. I do think the nature of performance instrument can change to keep up with developments in the network.

2nd roundtable: Multi-sectors overview

Wei-Shiuen Ng, Advisor on Sustainable Transport and Global Outreach, International Transport Forum (ITF), OECD

Decarbonizing Transport: Trends and Regulation

The International Transport Forum is an inter-governmental organisation administratively integrated into the OECD, but politically independent. Its membership extends far beyond that of the OECD's, and includes many emerging economies, such that it addresses a wide range of priorities, including the context of its work on decarbonising transport.

Rising demand, insufficient ambitions

It has been widely-recognised that the transport sector is not on track to achieve the climate goals identified. Even the larger-scale policies are still not building towards net-zero. Only 10% of the nationally-determined contributions have set a target on reducing CO₂ from transport, when transport-related CO₂ emissions could grow by over 60% by 2050. The ITF's modelling framework highlights, beyond the need for more ambitious policies, the importance of disruptive innovation.

While the contribution of urban passenger transport to CO₂ emissions will decrease in decades to come, that of non-urban passenger transport will grow. The trend for freight, also slated to make an increasing contribution, could be turned around by ambitious mitigation measures. The majority of emission reductions will come from road and maritime freight transport.

It is estimated that passenger transport demand will triple by 2050. One-third of global passenger kilometres will be generated by China and India, while those from OECD countries will fall from 43% to 24% of the total. Non-urban road transport will be the predominant mode by 2050. In non-OECD countries, public transport will cover a larger proportion of urban passenger demand. Shared mobility will prove to be one of the fastest-growing modes, while private car use, still dominant, will decline. These shifts will necessarily induce changes in the regulations currently in place.

Facilitating decarbonization

Among the current policy scenarios studied, the ITF classified as "high-ambition" those taking aim at: car access, pricing, mass transit, transport integration, urban density, carbon pricing, trade of coal and oil, logistics efficiency, and efficiency and EVs.

The Decarbonising Transport Initiative was developed by the ITF in 2016 in the wake of the Paris Agreement to:

- build a catalogue of effective CO2 mitigation measures;
- provide a targeted analytical assistance to countries and partners to identify climate actions that work;
- gather and share evidence of best practices capable of speeding up the transition to carbon-neutral mobility;
- shape the climate change debate by building a global policy dialogue and by bringing the transport perspective to the table.

The catalogue of measures has been developed into an interactive tool making clear the multiple objectives that must be achieved across different sectors to decarbonise transport. The measures fall within five main categories:

- mode shift and demand management;
- improved design, operations and efficiency;
- low- or zero-emission vehicles and fuels;
- integration across sectors;
- up-scaling and innovation.

The tool is based on an extensive literature review, and intended to facilitate dialogue on decarbonising transport across stakeholder groups.

Transport policy must anticipate disruptions that originate outside the sector. Better planning tools are needed to improve adaptability to uncertainties. Transport systems will benefit from policy frameworks that foster innovation, while also enabling a shift from static regulation to frequent regulatory reviews.

John Evans, Director of Strategy and Economics, Commission for Communications Regulation (ComReg), Ireland

Connectivity and decarbonization

Decarbonization is a relatively new field for telecommunications regulators. The sector's significance with regard to sustainability has become more apparent in recent times, with the growth of the digital economy and the increasing spotlight on the role of data centres, the proliferation of short life-cycle products, and of course the technologies enabling and even crucially underpinning our lives in the ongoing Covid crisis.

ComReg's work: CFI and key takeaways

In 2019, ComReg initiated a workstream to explore the connection between the sector and climate change, asking two questions:

- what role does the electronic communications sector have to play as an enabling contributor?
- What role does the electronic communications sector have to play directly?

The consultation process put us in contact with new stakeholder populations, including academia, institutions in art and culture, etc. Several parties made written submissions, viewable on our website.

In terms of enablement, the respondents generally agreed with our take on the key sectors in decarbonisation – electricity, transport, agriculture and industry – as well as on the role of connectivity. They pointed in particular to the continued roll-out of very high capacity networks and the place of the IoT, for example, as an enabler of sustainable precision farming.

At the same time, telecoms operators were keen to emphasise the benefits which their connectivity enables, putting forward widely varying estimates to back up their assertions.

When it comes to making direct impacts, many operators are taking steps to measure their emissions, and have widely identified the electricity they use to power their networks as the leading source of their emissions generated. Operators are also, by and large, setting targets to reduce emissions, and those making technology investments to improve efficiency (e.g. the deployment of machine learning algorithms to enhance spectrum efficiency) see this as a way of reducing associated emissions.

Respondents see fibre rollout as delivering significant energy efficiencies, as compared to copper networks. Access networks were identified as a key driver of energy consumption.

[BEREC undertakings and outlook](#)

BEREC, the Body of European Regulators for Electronic Communications, made a strategic commitment to work on sustainability, under an agenda defined for 2021-2025.

Its expert networking group on sustainability (2019) and ad hoc working group on sustainability (2020) contributed to its development, in a broader drive to tell the complicated story of this sector and the aim of sustainability. In particular, they helped elucidate questions around: networks as consumers of capex and opex; devices and the circular economy; and the enablement of the wider digital economy. ICTs contribute 4% to global CO2 emissions, of which one-quarter come from networks.

Thus far, it has held two workshops on sustainability, launched a broad study on the environmental impact of telecommunications networks including a literature review and particularly enriching bilateral meetings, and presented initial findings at the 9th BEREC Stakeholder Forum. Already, it is being called upon by the European Commission for information on sustainability in preparation for BCRD revision.

BEREC now looks forward to the outcome of the study on the environmental impact of telecommunications networks. It plans to further develop its knowledge on sustainability issues, continue its ongoing studies, and establish relationships with key stakeholders.

New projects are being considered as well for the 2022 Work Plan.

Nisarg Hirani, General Manager for Transformation, Scottish Water, UK

A new outlook for a changing world

My perspective will be that of an engineer with yet few definitive answers to offer at this early stage in decarbonisation and the transformation programme.

When Scottish Water was formed in 2002, from the merger of three water companies, it was charging some of the highest tariffs in the UK, while posting one of the lowest performance rates. Eighteen years down the line, it has turned that picture around and is now one of the lowest-charging and best-performing entities of its kind, moreover, enjoying great trust from its customers. Its carbon footprint from operations has been reduced by about 45% over this period.

Despite this clear success, achieved by the regulatory task lists and sheer determination to outperform by SW over the regulatory period. The agency, or I would argue the industry can be criticised at times for its short-term focus in the face of a fast-changing world. A second journey for transformation has thus begun, with decarbonisation at its heart: we are committed to achieving Net Zero by 2040, five years ahead of the national target.

This ambition needs to be achieved within the context of other challenges:

- ageing historical assets requiring upgrades, each upgrade increases the carbon footprint;
- a seismic shift in customer expectations, which now judge water companies by the standards of modern-day businesses;
- continually reducing ability of customers to pay, further shrunk by the pandemic;
- and the lightning speed of digitisation.

As a systemic problem requires a systemic solution, Scottish Water will now operate in a long-term ethical business regulation and driven by ethical business practices. We can no longer hide behind a regulatory task list or budget to explain our performance to users; rather be driven by a long-term purpose to support a flourishing Scotland and a clear strategy.

Among number of changes, we will have to make to operate this way are:

- the ability to analyse and prioritise demand, but also explain our resulting decisions to customers and stakeholders, less and less willing to trust blindly;
- an effective shift from a focus solely on lowest whole-life cost to one that includes non-financial benefits and costs, to give rise to the highest-value solution.

These being new capabilities, some of their components will need to be invented as we move along. We will also need to unlearn our past ways of working, and fundamentally redefine the way we conceive of success as engineers and as an industry. We want to create a world in which customers' views weigh as much as our own – those of today as well as those of the future – a must for maintaining our social license to operate.

The world in which our only challenge was execution is a thing of the past. We are entering a new realm, in which many of the solutions have yet to be found, then executed.

Discussion

Dominique Jamme

The only way of fostering the attainment of non-financial goals remains financial incentives, at least in my experience. What do you think of these or, in contrast, coercive measures (bans on flights coverable by train in less than 2.5 hours in France)?

Nisarg Hirani

As the thinking on carbon is advancing rapidly, it is easier to monetise targets on that indicator, and much more difficult to do so on community benefit, not to mention biodiversity.

Wei-Shiuen Ng

Modes of transport should be considered from a broader perspective, taking into account their purpose, the time of day, etc., to increase efficiency in the sector and encourage multi-modal transport.





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