AHEAD Pathfinding Workshop: Summary Report

This document summarizes the main points from the workshop inputs and discussions. The agenda and inputs can be found here.

1st session: Integrating renewables into the electricity system and electrification

In framing the first session, moderator Eric Biber suggested that everyone agrees that carbon pricing is the policy endpoint that would effectively address climate change. However, policies that are efficient today may not be achievable today or may not enable greater stringency tomorrow. Policies that are politically feasible today may enable subsequent policy to evolve, but they also may create new barriers to efficient policies.

In the first talk, Jim Bushnell began by commenting on an introductory statement that everyone agrees on carbon pricing as the “policy endpoint” for deep carbonization. It is not clear everyone agrees to it. Rather, the end goal is either the quantity limit of emission, or to equate marginal costs with marginal benefits of greenhouse gas emissions. Whatever the goal is will shape policy choices. The current “California Deep Carbon Reduction Playbook” is to (1) reduce electric sector carbon to
zero, (2) electrify other sectors, and (3) watch while rest of world follows California’s lead. Main challenges for electrification are: (a) Existing policy tools for renewables range from mildly to wildly inefficient. For example the renewable support does not differentiate among the value of incremental solar at different locations. This is getting more and more problematic as marginal cost of additional reductions increase sharply as zero emissions are approached. Average renewable costs are declining, but so are the benefits. (b) Electricity price levels and structures discourage usage and electrification, and there is a growing gap between wholesale and retail prices with the latter in California being twice the average of social marginal cost. This is due to the increasing fixed costs portion of the bill as well as the increasing gap between procurement cost and marginal value. This encourages consumers to leave the retailer and generate their own electricity through solar rooftop which stands in the way of electrification at large. So, how do we encourage electrification? Currently it is paid for through electricity bills, amplifying the dilemma.

In the second talk, Michael Pahle highlighted that there is a striking similarity with the German situation. Activating the demand side is essential both for integrating renewables and electrification, and the main options differ with regard to who controls the switch: the consumer (demand response) or someone else taking the consumer’s constraints into account. Smart meters have been slow to penetrate the market. Industry has been first with smart meters, but the certification for smaller consumers is sluggish not least because of security concerns that need to be addressed. Given the relatively high barriers for demand response and dynamic tariffs in Germany due to ever higher retail rates and the dissipation of local congestion variability through the uniform wholesale price, the country is currently pursuing the path of activating demand through the grid component of the system rather than the energy component. For the purpose of managing grid constraints, new regulation allows retailers to offer rates with reduced grid fees for so called “interruptible load” like EVs and heat pumps. This raises the questions of implications for demand response, the future business and structure and regulation more broadly, which were put up for discussion.

In the third talk, Nina Kelsey began by engaging the question about the endpoint for policy by suggesting the answer is “as little carbon as possible” because it is not a problem that we will have too little. Nina elaborated on how political barriers related to economic interest groups could be overcome, possibly through policy feedbacks. Previous research finds that policy-industry feedback can emerge if initial policies grow green industries that then advocate the sustainability and expansion of policies. But it remains an open issue if similar effects can be observed for voters, i.e. do green policies feed back into public support for more green policies – through jobs etc.? In a recent survey experiment a small but significant effect on beliefs of the economic value of renewable energy was identified, but it did not have any effect on policy support. This
could be due to a weak treatment, but also perhaps there simply is no direct connection between economic interests and policy preferences/voting. This raises the question how public support for green policy can be explained through other factors than economic interests, e.g. elite-led social learning, development of community and personal identity, or changes in narratives, framed in locally relevant ways, and repetition. Maybe it matters whether households have personal ownership of assets. Do rooftop installations strengthen political support? If this is the narrative then there is a coming battle with utilities but also likely an expansion of inefficiency. More broadly, the questions if respective dynamics vary over time and place, and how to move from elite coalitions to mass support when prices get high were put up for discussion.

In a first response, Karen Palmer reflected on current policy development in US states. The integration of renewables raises questions about a broader spatial market and other approaches to ensure essential reliability services, and spatially and temporally differentiated pricing. In light of the inefficiency of current policies as mentioned in the inputs, there seems to be increasing need to make sector-specific policies more technology-neutral. One proposal for a federal 2020 agenda is a clean energy standard, as opposed to a renewable portfolio standard. Senator Bingaman introduced such a bill and work by RFF shows that a clean energy standard can support inter-fuel substitution. The main choices to make are what technologies to include, how to set benchmarks, if to include some form of cost containment, and how to avoid windfalls for exiting generators. The particular choices will determine the path forward.

In a second response, Grady Mathai-Jackson drew lessons from Germany in comparison with the case of California and related them to previous points. To begin with, there is a very strong social sense that Germany’s Energiewende is based on democratization of energy. Early small investors had significant economic gains, which often typically created local-buy-in on the part of rural and more conservative constituencies. Furthermore, regarding the role of capacity markets there is significant divergence between the jurisdictions. Germany is pursuing a so-called “energy market-only” approach to both resource adequacy and flexibility, in which energy and grid prices – or exemptions thereof (see above) – decide on what flexibility and other resources go online. If this turns out well, in a couple of years Germany may offer a really interesting new approach relying increasingly on price signals that California might want to take into account – given its own heavy administrative approach to resource adequacy, where market signals only operate in the background. Another issue is grid expansion, where Germany is exporting a lot to neighboring countries, yet has double the amount of curtailment as California. The state could be headed there if not sufficient flexibility will be provided. Finally, Germany has a much more streamlined and federal approach to energy policy, whereas in California there is a diffusion of authority across agencies which fragments regulation.
In the following discussion, various additional views and comments were provided. A main topic was rate reform and incentivizing demand response. First of all, mandating dynamic or time of use tariffs is something to be wary of – rather consumers should be better educated and shown that there is money to make. This is likely in particular the case in the future, and now is opportunity to get dynamic rates in place so that we have it once it makes a difference. This may also be good opportunity to avoid curtailment and lower integration costs, and hopefully it will turn out that technology costs and demand response are cheap. Relatedly, real-time pricing may be an opt-in for some load such as EVs through separate metering, but that is still a costly option.

Furthermore, it was stated that the big elephant in the room is that electrification in California will require an electricity sector that is about twice as big as the current one. New load has different attributes and also inherent storage capabilities. This raises the question if a new market for flexibility is needed, or if exemptions as in Germany provide sufficient incentives. On that point, concerns were raised that there is typically strong resistance to rate reform and making some exemptions to an altogether “messed up” rate structure can be a dead end. But a dedicated market for flexibility is risky: it may cloud the need to get efficient pricing in place, and may lead to distortions if incentives for aggregation are set wrong. On the other side, there might be network externalities and the need to create acceptance and consumer awareness, which may require such an institution. In that regard it was also mentioned that the complexities of the processes consumers have to go through require consideration. A main factor for the success of the RPS for example may be that consumers just pay the bill. Furthermore, in the short-run price mechanisms may be very difficult to implement because of their transparency. Pointing to the recent problems of implement (higher) carbon prices in France and Australia, it seems essential to identify pathways to more pricing more broadly.

2nd session: Decarbonizing transportation

In framing the second session, moderator Jonas Meckling highlighted that both California and Germany face the challenge that transport emissions are not going down. But they differ in that California has a higher share of overall emissions in transportation, more population growth, and lower public transport, while in Germany the incumbent auto industry is quite important. In consequence, California emerged as a leader in decarbonizing the section while Germany is a laggard. Against that background and considering the differences, main questions are: What policy tools can advance political progress in decarbonization in the transportation sector? And what political coalitions will drive that decarbonization, and how will that vary from CA and DE?
In the first talk, Peter Kasten put Germany’s reputation for pushing back on European car standards into perspective. In the past, strong ties between the auto industry and the government lead the latter to weaken ambitious EU regulation for achieving the 2020 climate targets. It did this by forging a deal with other national governments to facilitate a weaker CO2 emission standard. Yet in 2016, the relevant EU climate policy framework – the Effort Sharing Regulation (ESR) that also covers transportation – was updated and the ambition level of reductions starting in 2021 through 2030 increased considerably. For Germany this implied emissions reduction of 40-42% compared to 1990 in the transportation sector, and a projected emission gap of around 50 Mt in 2030 relative to a baseline. Taking these numbers it was estimated that non-compliance would amount to around 1.75-5 billion EUR in 2030 alone, which made the Ministry of Finance weigh in for tighter standards. Together with the decreasing credibility of the auto industry resulting from the Diesel scandal, this made Germany support a much tighter standard eventually. Another reason this may have happened is that other measures such as energy taxes, road tolls, registration taxes, or company car tax schemes are seen as very unpopular policies. From a sequencing perspective, thus both the new EU regulation and uncovering the industry’s frauds changed the political dynamics so that auto industry can’t just roll over the Ministry of Environment anymore. Instrumental for adopting the new EU regulation in the first place was the cross-sectoral approach of the ESR, because no one would have agreed in isolation to a strict reduction for just transport.

In the second talk, Dan Sperling addressed California’s Low-Carbon Fuel Standard (LCFS)1 and electrifying buses and freight. Regarding the LCFS, there was a lot of up-front political resistance by corn ethanol and oil industry and the policy had few champions. Now it is politically solid because electric utility industry likes it (credits often go back to electric sector), and the natural gas sector likes it (because it gives credits to biogases as they are looking for a pathway to the future and LCFS is a cross-subsidy to biogas). It will probably also move to a rebate for EV buyers will total $2,000 per car (which will get auto industry on board). Even the oil industry’s opposition has reduced as they get credits for CCS upstream and refinery upgrades. Furthermore, an important characteristic of the LCFS is that it is technology forcing, but based on performance standard and also has credit trading. In fact almost all policies in California have credit systems, and distinction between market and regulatory systems are not clear. The reason not to make it purely market-based up front was concern that this would not have enough of an impact. It was intended to be technology forcing, i.e. its goal was to motivate innovation and technology investment. A politically infeasible

carbon price would have been needed to achieve what LCFS is doing in terms of driving innovation. Yet a challenge for the further evolution is that the program is already very complex and partly siloed, and does not yet link fuel credits to vehicle credits.

Regarding electrification, identifying pathways for buses and freight is much more challenging than for light-duty. California will require all buses to be electric by 2040, and all new buses electric by 2028-30 – but a challenge is how to pay respective costs also given that bus systems are highly subsidized and are losing ridership. California has 12,000 buses; China produces 100,000 per year. There is thus a considerable equity issue as California will only subsidize some of it from cap-and-trade revenues, but who bears the rest is an open issue. In freight, a big challenge is that its share is continuously growing – and services like Amazon Prime prevent aggregation so that transportation is scattered all over the place. Main policy questions are whom to regulate and how to effectively reduce emissions? Some action is taken by CARB, e.g., starting mini-ZEV mandates for parts of the industry – especially at ports and delivery trucks. But a problem is that trucks are very different from cars. First, there are a lot of different companies in truck manufacturing, and trucks are used in very different ways. Do you regulate buyers or manufacturers? Furthermore, truck VMT is an issue because of the rise of on-line shopping. To meet increased demand for rapid delivery, having a lot of smaller trucks doing more frequent trips, and more distribution centers all over the place that require more truck traffic. This is a hard problem to solve and there is no solid solution for this right now. Moving to real-time emissions monitoring and regulation in trucks is an option, because NOx pollution from truck use is very specific in place and time, and lots of on-line diagnostic equipment is already on the trucks. This looks like “defeat devices” in reverse. Truck companies may be willing to be responsible for in-use emissions of the truck and can change driving settings to reduce emissions in that location.

In the third talk, Erich Muehlegger addressed two challenges for EV adoption: Upfront costs relative to ICEs, and how regulation/taxes affect relative operational per-mile costs of EVs versus ICEs. Research suggests that upfront costs of EVs will be higher than ICEs probably up through 2030 at least, though the gap is shrinking fast. So subsidies are important in the long-run, but it is an open question how to scale them up for the amount of sales needed to electrify the fleet. Subsidies of more than $3 billion per year are planned to reach 1.5 million EVs by 2025. Further, there is concern about how EV tax credits have disproportionately benefited rich people, in particular given that a mass-market adoption by wide range of income levels is needed. Analysis of the California pilot program (Enhanced Fleet Modernization Program) that was limited to disadvantaged areas with high air pollution and to middle- and low-income households provides some answers. Consumers capture most of the incentive (prices follow subsidies mostly), which increased adoption but also costs of rolling out EVs substantially. Yet operational costs for EV might offset higher
upfront costs, and there is evidence that buyers indeed take into account the long-term operational costs of purchasing the car. Looking at prices of alternative fuels, gas prices are often below marginal social costs while electricity prices are often above, with considerable variance across states. Accordingly, cost savings are too low implying that inefficient pricing poses a barrier to EV adoption.

In a first response, John Boesel commented on the role of carbon pricing and that there is little direct impact on fuel choices, but respective programs provide funds for subsidies and research. In the heavy-duty sector it is essential to look for beachheads where there is a plausible economic case that “make ready” technology is or will be feasible in the near future – e.g., buses, port equipment, delivery trucks. Coordination across markets around the world can further facilitate development. There already exists a range of policy tool including urban exclusion zones, subsidies, LCFS, ZEV mandates, and utility investment in infrastructure. But high carbon-based license fees may be easiest way to motivate consumers to buy EVs. Furthermore, special corporate electricity rates for EVs may also facilitate adoption in commercial fleets.

In a second response, Sean Hecht addressed the political coalition in Southern California for EV heavy-duty transport – observing aggressive advocacy to push local governments on the procurement front and to adopt regulatory strategies. There is an important synergy between GHG reduction goals and EJ advocacy to reduce conventional pollution in low-income communities near freight lines. One example is electric buses which are in ascendance in low-income communities. There is a deep synergy between carbon and conventional pollutants. Further, natural gas utilities want to be able to extend their lifespan by moving into transportation (maybe carbon free if biogas) – which is in tension with electrification proposals. But it is not clear if there is infrastructure and supply for biogas, so EV advocates see this as a dead-end. There is a possibility of indirect source rules from local air districts, associating emissions from electricity generation with vehicles. Regarding the LCFS, it may not be economically efficient, but nonetheless it is effective at forcing technological transformation. It is picking some winners and losers, including major support for biogas. Interestingly, it promotes CCS in oil industry, but it is an expansion of program borders in way that might skew credit markets, which regulators should be aware of.

In a third response, Spence Reeder pointed out the auto industry’s interest to control the demand side of the equation – people who drive – in a more robust way with the aim of creating a stable and more predictable market. In general, the industry wants policies to be technology agnostic because this is more efficient, but it needs political courage to let respective policies like cap-and-trade function. In addition, a handful of manufacturers have made the bet on EVs and are doing consumer education around them. VW has committed $50 billion to this transformation. However, there needs to be policy constructs that affect the structure of demand. EV
subsidies initially were intended to compensate for the risk of early adoption, and the justification for that is diminishing. However, the depreciation cost is absorbed by first buyers which provides another justification for subsidies. Meanwhile, used vehicles are affordable to lower income groups.

In the following discussion, various additional views and comments were provided. One recurrent aspect was making EVs available to disadvantaged communities: it was stated that the bottom half does not buy new vehicle, so that EVs will actually be channeled through higher income brackets. In a similar vein, early adopters co-subsidize technologies. Yet for this group charging outside the house is still too complicated, and packages with the car maker like offered by Tesla excel could facilitate adoption and increase usage. Furthermore, the idea of getting clean energy in disadvantaged communities is a misguided strategy – the focus should be on what actually brings the highest benefits. Relatedly, increasing VMT and Amazon Prime more specifically give benefits to people – this is not per se a problem, but the externalities need to be controlled.

3rd session: Pathways towards efficient and effective integrated carbon policy

In the introductory remarks, moderator Dallas Burtraw observed that under the SO2 trading program, the initial view was that benefits and costs of the program were about balanced; later on, it turns out benefits were 10, 30, and ultimately 100x the costs. Dallas bets by 2024, the social cost of carbon is going to be at least $75/ton; and probably twice that. His fear is that one way or another, we may end up in a wartime economy. Either because climate change gets so bad that we have to act through administrative measures to curtail the problem; or, in a different sense the effects of climate change may become severe and huge problems may arise, e.g. huge migrations and dislocations, that precipitate administrative measures under a wartime economy. If our policy approach in the interim is too inefficient, we get backlash and lose. But if it’s too slow, we don’t solve the problem and we lose.

In the first talk, Michael Pahle began with the observation that Germany – in trying to achieve its climate goals – is at first glance moving away from the first-best policy by having implemented sector-specific climate targets in 2016. It did so in response to the unequal progress and policy effort in different sectors at the time: for instance, subsidies for renewables are 24 billion euros per year in Germany in the electricity sector, and only 1.2 billion overall in the transportation sector. Michael pointed to Grossman and Helpman to illustrate that this may be explained by the failure in “climate coalition” formation in the latter sector. In particular, the politically strong auto industry has so far effectively opposed the implementation of stringent transportation policies. In face of this, a potential way out might include differentiated
carbon prices for different sectors, and specific efforts to address the above organizational failure. This in fact was the motivation of German policy makers to introduce sectoral targets, through which they pinned down the specific responsibility of each sector. More specifically, they thought that such a target would be instrumental to overcome political opposition and set the transformation in motion. If this will indeed turn out to be successful, it will imply that the country had needed to take one step back to make two steps forward. Finally, Michael applied this thinking to the EU Emission Trading Scheme (ETS), raising the question if it would have been better if the industry sector – where firms push back much harder against higher stringency than in other ETS-regulated sectors – had not been included in the EU ETS initially.

In the second talk, Severin Borenstein highlighted that there are two greenhouse gas related market failures: (1) the failure to price the externality, and (2) failure to subsidize positive knowledge spillovers. Yet the second one tends to be the bigger, especially when technology will be provided to poorer countries (for free). The rent extraction function is at the core: the developing world will create negative externality they can’t pay for and we won’t pay for. This implies that innovation should be subsidized and economists usually take the narrower view that this should only be done in the lab, but in fact there are huge knowledge spillovers all the way down the development chain. In policies like the LCFS, people lose sight of the crisp distinction between the two externalities: from the perspective of pricing carbon such policies aren’t particularly good, but they have technology implications. For instance, reducing transportation emissions by getting off of oil will reduce its price. In the past it has become evident that even small reduction in demand can substantially reduce the price (Brandt and Farrell 2007). So the idea that EVs can get to parity in order to get the world to abandon oil requires technologies that can even beat very low oil prices.

This also has implications for cap-and-trade programs. If the price of oil crashes, a much higher price in the carbon market is needed. More generally research shows that price outcomes will be extreme on either end, because BAU emission forecast vary considerably while price response of end-use demand for various energy types is very inelastic. Nevertheless, there are unpredictable pathways that can be discovered if the economic (price) incentives are there. In consequence, price limitations (a price collar) are needed on both ends: When non-policy factors and complementary policies drive GHG emissions way down, this should not eliminate the price-related incentive to reduce emissions and develop new technologies. When non-policy factors drive GHG emissions way up, prices are unlikely to skyrocket without intervention. With such a collar, cap-and-trade actually resembles a carbon tax, the more so the tighter the collar.

Finally, in the context of environmental justice, co-benefits play a role in cost-benefit analysis of climate policies, but they will change with other policies and technology
(e.g. tailpipe emissions or congestion regulations, cleanliness of the grid). The focus on co-benefits thus very likely leads to disappointment because either policy is not aimed at maximizing them, or it undermines the cost-effectiveness of abatement. Here again the crucial question is which market failures shall be fixed: Negative externalities, information failures, or is there just a moral failure to consuming energy?

In a response, Lars Zetterberg discussed the role of carbon pricing for Sweden’s goal to achieve net zero emission by 2045, of which at least 85% of the reduction has to be within Swedish territory. Yet emissions reductions have been slowing in the last few years and even grown in steel, where the EU’s ETS is the primary regulatory instrument. Since ETS allowances have been hovering around 5 euros for the last several years, Sweden needs complementary policies to induce emissions in this sector and reverse the trend, but there are no such policies presently. But if one country does more, it will allow emissions to increase elsewhere in the EU (waterbed effect) pushing ETS prices further down. A recent reform of the ETS will reduce this effect at least temporarily and it can also speed up the coal phase out. But it would probably need a price of around 100 euros per ton to get the desired reductions in cement and steel. Accordingly, the ETS will be an important instrument, but it won’t drive transformation in cement and steel, which requires complementary measures. The ETS can co-exist with complementary policies, but a price floor would be a much better option than the MSR, which is very complicated. Finally, a potential sequencing lesson is that while the ETS per se has not triggered much reduction in industry, it has demonstrated to industry that climate policy is here to stay and made other policy more politically viable. This may work in the other direction as well, with carbon pricing policies becoming less costly after other measures are put in place.

In the following discussion, one prominent aspect was the volatility of prices and the determinants of the upper limit of politically acceptable prices. If there is indeed a very narrow margin within which supply and demand of allowances balance, it should be highlight that this is a policy choice with respect to complementary policies. But conducting the above analysis for the California cap-and-trade program with no complementary policies and higher elasticity showed that the probability of being in the middle is still relatively low. However, in the EU this might be different because of the higher coal-to-gas potential. Yet in the past prices have been very volatile too, but maybe for different reasons.

From an efficiency perspective, price volatility may not be a concern, but from a political perspective price spikes can blow programs up. This is a problem because deep decarbonization requires policies that can send clear signals in perpetuity. From a political perspective, an important question is how to create a policy that is politically solid in the long term? So how do you ensure that a price signal will be sent for as long as it needs to be sent, without blowing up if the price gets high?
Instrumental for that may be changing what people want, and who has power and wants to use that power. In that regard high effective carbon prices in narrow sectors may be a feature and not a bug, because it drives investment that changes interests and builds support for more measures. It was brought up that changing behavior is probably most essential for car owners, who seem to be willing to pay the most for CO2 emissions.

In a similar vein, it was put forth that political ramifications of a high allowance price are not universally fixed, but depend on e.g. the power industries can exert. This suggests that redistributions play an important role, and insulating industries if need be can make policies more politically robust. An objection to the former was that industries seem to fixate on certain costs, even if they’re being compensated. Furthermore, in many US states you have much higher procedural barriers to revenue raising measures relative to regulatory measures. Often supermajorities are required for that, and the fact that Virginia could join RGGI just because the executive branch can decide it unilaterally is a case in point. In addition, an important issue in this context is who gets to decide the design of policies, i.e. agencies (California), voters (Washington), or the legislature (Germany). This leads to very different distributional battles, and in case voters decide, opinion polls suggest that carbon neutrality doesn’t actually mobilize them, while tying it to renewable energy and public values is more effective.

Another aspect was what tools are appropriate to develop technologies and in particular how far market learning mechanisms should be extended. It was argued that this is technology dependent, but there are examples such as rooftop solar and corn ethanol where learning benefits from further support seem limited. The important question is how much learning could still go on, and that has to be a case-by-case judgment that should be rigorously evaluated in the same way as grant applications are in a research environment. This brought up the question about whether there are better ways to spend that money, and how much government support is actually speeding up the learning curve? Relatedly, it was remarked that there is a lot of talking about complementary policies, but not about how they fit in the mix and if they actually act as technology-forcing measures. For instance, if deploying EVs is the goal, is the LCFS actually forcing that? There was consensus that every program should be rigorously analyzed from that perspective. SOx and NOx programs were mentioned as prominent examples, where programs goals were achieved by direct regulation, but arguably at very high costs.

A final issue was how to communicate carbon pricing and to what end. Given the prominence of carbon pricing as a preferred policy instrument, especially among economists, it was stated that the question of whether or how carbon pricing is politically feasible should be taken more seriously. It was further pointed out that the long-lasting academic question of carbon taxes vs. cap-and-trade is now an issue of
the past. However, this was contested by saying that it simply needs a new interpretation. The EU ETS experience suggests that discussing prices – and not quantities – is essential for the level of ambition and willingness to pay, revenues and their use, and effectiveness in terms of being high enough to cause fuel switch.

In summary, it seems both views of the world – that offered by economists and political scientists – are moving toward each other. Economists increasingly recognize the value of complementary measures, while political scientists increasingly agree with the efficiency argument. A general sentiment of the workshop was that we need to take pricing as a goal and ask how it is politically feasible to get there. Where carbon pricing has been implemented, it has been a hard fight every single step of the way. An exclusive focus on carbon pricing fails to show that carbon pricing is contributing to many other outcomes that affect measures of wellbeing such as air quality. The focus of many has been how complementary policies are constraining carbon pricing, rather than how carbon pricing can improve outcomes in many dimensions.