Choosing Efficient Combinations of Policy Instruments for Low-carbon development and Innovation to Achieve Europe's 2050 climate targets

Country report: France

WP 1 – Taking stock of the current instrument mix

Contribution to Deliverable 1.2: Review of the existing instrument mix at EU level and in selected Member States

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0 Executive summary

The goal of this country report is to provide an overview of main instruments for CO_2 pricing, energy consumption reduction and renewable energy promotion in France, including the main interactions between instruments and a first qualitative assessment of the optimality of these policy landscapes and the instrument mix as a whole.

In France, the instruments at work for mitigation and carbon pricing are mainly defined at the EU level. Except some tentative attempts in the industry and agriculture sector (with some domestic credit projects), the price on carbon comes from the EU-ETS. While quite efficient (if high enough), the pricing of carbon is subject to indirect interactions with the energy efficiency and the renewable instruments, channelled through the electricity market by power consumption reductions, which in turn affect the emission allowances demand. A carbon tax has been proposed several times, and is expected to be proposed again, but it suffers from a lack of acceptability, as any major tax reform. Debates focus on ideological issues, or whether every carbon emission should be equally taxed or not. Considering no comprehensive policy exists in France for non-carbon dioxide greenhouse gases, most actions are due to the EU-ETS. Agriculture (2/3 of non CO_2 GHG in France) is mostly left untouched, and only a few domestic credit measures target industrial gases.

The energy efficiency landscape is comprised of comprehensive performance standards, along with voluntary instruments such as tax rebates or preferential loans for individuals giving incentives to invest beyond this standard, and a flexible obligation scheme for energy retailers. The landscape is fairly cost-effective, with a standard setting a clear reference and a market-based scheme designed to promote the cheapest technology first. Additional instruments help overcome some specific market failures and investment hurdles in the household sector. Alongside those instruments, the bonus and penalty system on the purchase of new passenger cars provides an incentive for the efficiency of cars. It appears that it is quite effective on a per-vehicle basis from a static and a dynamic point of view. It provides however no incentive to reduce the use of cars, and falls somewhat short regarding environmental effectiveness.

The policy landscape for renewable promotion is dominated by the feed-in tariff (FiT), channelling the biggest part of public funding. FiT are efficient in the sense that they equalize the marginal costs of all sources, for a given renewable technology. From a dynamic point of view, there is a clear incentive to improve existing technologies and introduce new and more efficient ones. The adjusting of the scheme however is problematic, leading to some windfall profits for some investors in the past. There is also a quota for biofuel and tenders for large-scale renewable installations, but they have a considerably smaller financial impact. The economic efficiency of the quota is questionable, since the biofuel quota promotes only renewables from one source, and not the cheapest. Moreover, the benefit of biofuels in terms of climate change mitigation is questionable since indirect land-use change is ignored. Considering tenders, in theory they should be quite effective, but no assessment has been made, and they suffer from acceptability problems on the local scale.

1 Description of policy landscapes

1.1 Classification of the instruments previously selected into policy landscapes

The objective of this report (and report series) is to perform an initial 'stock-take' of the climate policy instrument mix at the EU-Level and a representative group of Member States – the United Kingdom, Germany, France, Spain, Italy, the Netherlands, Poland and the Czech Republic. An initial list of up to 50 instruments from each country and EU-level was created, from which up to 15 key instruments for each state covering a broad selection of the economy, instrument type and objectives were selected for further analysis. Please refer to the Taxonomy of Instruments, developed under Task 1.1 of CECILIA 2050, for a full description of instrument classification. For each report, the selected instruments were categorised into policy 'landscapes', described below.

(1) **Carbon Pricing**: this includes policies that price CO2 emissions or otherwise change the relative prices of fuel use, depending on the carbon intensities of fuels. Apart from the obvious candidates (carbon taxes and emissions trading) this would also include the reform or removal of fossil fuel subsidies;

(2) **Energy Efficiency and Energy Consumption**: this includes measures targeted at either increasing the efficiency of the energy sector, including power generation / combustion processes, transmission of energy (heat, electricity) and end-use efficiency, or at reducing overall energy consumption (demand-side management, energy saving, sufficiency);

(3) **Promotion of Renewable Sources of Energy**: this includes policies aimed at increasing the share of energy from renewable sources (solar, wind, hydro, biomass, geothermal);

(4) **Non-Carbon Dioxide Greenhouse Gases**: this covers policies geared at reducing non-CO2 greenhouse gas emissions, typically from sectors other than the energy sector. It may include emissions like methane emissions from landfills or animal husbandry, N2O emissions from agriculture, or greenhouse gas emissions from chemical industries (SF6, NF3, HFC etc.)

The list of instruments for France, along with their landscape classifications may be seen in Table 1, below. This report describes each instrument based on a set of tabulated information found in Annex 1, and an attempt at assessing their individual 'optimality', based on the concept developed for use in the CECILIA 2050 project also developed in Task 1.1, is provided. Descriptions of interactions between instruments within each landscape are also provided, based on tables found in Annex 2. The categories and methods of interaction are based on best practice in instrument interaction assessment, and are completed in pairs against a single key instrument, or when important interactions between non-key instruments are present.

The resulting optimality of each landscape based on instruments and their interaction are then assessed, followed by interactions between each landscape and, finally, an analysis of the optimality of the climate policy mix as a whole in each country and at the EU-level is provided.

Carbon pricing instruments are not highly developed in France, with only domestic credits valuing carbon besides the EU-ETS for now (a carbon tax is expected to be proposed again in 2014-2015). Promotion of renewables is mainly achieved by feed-in tariffs, tenders and a biofuel quota in the transportation sector. The energy efficiency landscape is the most developed with six dedicated major instruments. Non-Carbon Dioxide GHGs pricing is quasi non-existent, except on the margin through domestic credits. Table 1 presents the list of instruments discussed in the report for each landscape.

Table 1: List of instruments detailed in the report for each policy landscape

	Policy Landscapes			
Policy Instrument	**Carbon Pricing**	**Energy Efficiency and Energy Consumption**	**Promotion of Renewable Sources of Energy**	**Non-Carbon Dioxide GHGs**
Carbon Tax	✓	✓	✓	
Domestic credits	✓			✓
Feed-in tariffs			✓	
Tenders			✓	
Biofuel quota			✓	
Energy efficiency certificates		✓		
Building code regulations 2012		✓		
Building code regulations for existing buildings		✓		
Sustainable Development Tax Credit		✓	✓	
Zero-rated eco-loan		✓	✓	
Bonus-Malus: vehicle (feebate)		✓		

1.2 Detailed description of instruments within each policy landscape

1.2.1 Carbon Pricing

Carbon Tax

Aiming at giving a price incentive to reduce carbon emissions, the carbon tax has been proposed and rejected several times in France because of equity issues. In 2000, the "Constitutional Council" (the court which checks the compatibility of new laws with the Constitution) rejected a proposal, which would have taxed CO_2 emissions and energy

consumption by firms. It argued that this tax infringed the principle of equal taxation, because large emitters would have benefited from substantial rebates. After a promise made during the elections, the French president Nicolas Sarkozy proposed in 2009 a "Contribution climat-énergie", where emitters (both households and firms) were to be taxed. Revenues raised from households would have been distributed back as lump-sum transfers to households, while revenues raised from firms would have been used to reduce pre-existing taxes. Emitters already covered by the EU-ETS were to be exempted. Due to this exemption, and others (such as emission from farmers), the Constitutional Council censored again the carbon tax. Shortly after, the right-wing government decided not to table a new proposal.

The Constitutional Council never opposed the principle of the tax, but only the rebates given mostly to some energy-intensive industries. The recent public debt crisis leads various actors to expect a new carbon tax project in 2014-2015, following the current "national debate on energy transition" initiated by the current left-wing government. The previous tax proposal is detailed in great length in the 2009 project finance law for 2010 (Combet 2013).

The objective is to mitigate emissions from sources not already covered by similar mechanisms, such as the EU-ETS. Such sources include entities such as households, the service sector and light industry emitters and mostly emissions from transportation and heating. Being a tax and redistributed as a lump-sum tax rebate to households, it would be passed on through the annual finance law, enforced by fiscal authorities, and subject to the fiscal law. Various exemptions have to be expected, to protect fragile industries and powerful lobbies, as has been observed in the previous attempts (high emitters with high exposure to international competition, or agriculture for instance). The additional cost to firms from this tax is likely to be passed on to consumers. The level of this future tax is most uncertain. A 2009 stakeholder and expert group led by the “Conseil d’analyse stratégique” (a public body in charge of expertise and stakeholder dialogue) set the optimal level of the carbon tax (the social cost of carbon) at €32/tCO_2 in 2010, and rising to €100 in 2030 and €200 in 2050 (Quinet 2008). The expected abatement among the covered sectors was 7.5% after a few years and 14% in 2020 (Ademe, 2009). After political compromises, the French president set the initial level of the projected tax at €17/CO_2 in 2009.

By equalizing the marginal costs of the various abatement options across almost all sectors[1], the carbon tax allows maximum cost effectiveness. To this extent, exempting actors already covered by another equivalent scheme (e.g. the EU-ETS) makes sense, lest imposing a double burden on those actors, but exempting other actors would reduce the global effectiveness of the instrument, leaving untapped potential savings. From an environmental point of view, the level of abatement achieved is not guaranteed, and depends on the level of the tax, which will be the result of a political negotiation. While very easy to administer and monitor, a tax is always most difficult to set up, and its political feasibility is questionable in a context of economic crisis and relatively high energy prices. A possible way would be to pass it along with a larger reform of the fiscal system, to benefit from possible double dividends.

[1] Some partial or total exemptions were part of the previous tax proposal, for farmers and fishermen in particular.

Domestic Credits

The domestic credits are issued as a result of Joint Implementation (JI) projects. JI is one of the flexibility mechanisms set out in the Kyoto Protocol (article 6) to help mitigate carbon emissions in Annex-I countries. The domestic credits were implemented in 2006, in order to curb emissions in sectors not covered by the EU-ETS, such as agriculture, transport, tertiary, etc. As all JI projects, they have to meet the specified criteria: additionality and proven emission reductions. The ERUs (emission reduction units) are issued by France, and used in various European countries as well as Japan. France had validated 20 projects in January 2013, accounting for several Mt CO_2 equivalent in expected emission reductions although the exact numbers are not known yet (UNFCCC, 2013).

No large-scale assessment of this instrument has been made in France, but since the European Climate Change Committee voted in December 2012 a ban on ERUs from countries that have not signed up for a second commitment period under the Kyoto protocol, the prices of ERUs crashed by more than 89% to a low €0.23. This casts doubts over the viability of such a scheme in the long run. The efficiency of this instrument is linked to that of the EU-ETS. If prices recover, being a flexibility mechanism, it would allow increasing the global economic efficiency and environmental effectiveness of the EU-ETS, since it taps into sectors not covered by the EU-ETS. Its voluntary nature makes it easy to be accepted by all actors. The only difficult point lays in the administration of such an instrument, which is quite cumbersome since every project must be approved and monitored.

1.2.2 Promotion of Renewable Sources of Energy

Feed-in Tariffs (FiTs)

The feed-in tariffs give an incentive to produce electricity from renewable sources. The aim of this instrument is to promote efficient renewable energy production technologies, in order to reach the objective set in the Renewable Energy (RE) directive for France (23% of primary energy from renewables in 2020, 26% in the electricity sector, compared to a share of approx. 16% of renewables in the electricity production in 2012). Through this increased renewable production, additional benefits in terms of reduced energy dependency and carbon emission reduction are expected (although the environmental efficiency of the scheme depends on the type of electricity production that is replaced by renewables, but no study exist for now on this subject). The generation of electricity from renewable energy sources is promoted through a feed-in tariff scheme since the transcription of the 2001 European Directive on renewables. Electricity suppliers (mainly EDF and local distribution companies) and distribution grid operators (RTE, Réseau de Transport de l'électricité) have an obligation to buy the electricity from renewable sources at a fixed price (the tariff), and to export it to the grid. The energy regulation entity (CRE, Commission de Régulation de l'Energie) is responsible for monitoring the scheme.

The scheme subsidizes the production from all small-scale renewable technologies (less than 12 MW installed) wind, solar PV, geothermal, biogas, biomass, small hydropower. The level of the tariff depends on the technology type, on the area where it is installed and on the size of the installation, with higher subsidies for smaller installations. For example, windmills installed after November 2008 benefit from 15 years contracts with a rate fixed at 8.2c€/kWh for 10

years, then between 2.8 and 8.2c€/kWh for 5 years depending on the site. Marine technologies benefit from 20 year contracts with a rate fixed at 15c€/kWh,

It also depends for PV on the type of building and on the degree of "integration" of the PV panel to the building, and, for wind, on the average wind speed in the chosen location. The tariff is guaranteed for a given period (15 or 20 years), and is financed through an earmarked tax on electricity consumption (the CSPE or social contribution to electricity consumption). This earmarked tax has been substantially increased in the last years (from 7.5 €/MWh in 2011 to 10.5 €/MWh in 2012), partly to account for the boom in PV installations (+3 GW since 2011, 2.4 GW still waiting to be connected to the grid) and the cost of connections to the grid (which it covers too). The total charges represented 5.2 bn€ in 2012, 52% of which to finance the FiT (mainly wind: 11.5% of total and solar: 32.3% of total). The total earmarked tax that would be necessary to cover those charges amounts to 13.7 € per MWh electricity produced. The difference with the actual tax feeds the deficit for the next years.

The scheme was substantially modified in 2009, in order to take into account the decreasing production costs of fast evolving technologies such as solar PV and reduce the levels of the tariffs. In 2011 another major change was introduced to let PV tariffs decrease annually, and a maximum possible installed capacity per year (the cap is given by the peak capacity installed multiplied by 1,500 hours of full load). If the cap is reached, all further installation or plants installed will be subject to a lower tariff (€ct. 5 per kWh). Every quarter, reduction coefficients are applied to the tariff, adjusted to the number of grid connection requests adopted in the previous quarter. The tariff changes for installations bigger than 100 kWp, while bigger installations are expected to be incentivized through tenders (see below). The feed-in tariffs are a major element of the policy landscape and should stay in place at least until the 2020 targets for renewables are reached. The level of the tariffs is however subject to changes to follow the technological progress.

FiT are efficient in the sense that they equalize the marginal costs of all renewable sources for each technology. They are however different from one technology to another. The most profitable sites are equipped first and operators have an incentive to maximize production (e.g. by avoiding shades on PV panels). From a dynamic point of view, there is a clear incentive to improve existing technologies and introduce new and more efficient ones. Any major breakthrough (e.g. a new type of solar) with high initial costs and high progress potential would need a tariff on its own however. The previous paragraph highlights the redistribution issues that this instrument faces. Political inertia has made it difficult for regulators to adapt the level of the tariff fast enough for the technologies with the highest technical progress. This has led to big windfall profits for investors in the periods where the tariff was still high and the costs had decreased sharply.

The main obstacles for the development of new renewable systems are the grid connection procedure, which are very lengthy compared to other European countries, and administrative hurdles. On-shore wind projects can only be installed in special development zones (zone de développement de l'éolien, ZDE), consist of at least 5 mills and be at least 500m from any inhabited building, with the obligation to make an impact assessment and have financial guarantees for the dismantling. For solar projects bigger than 4.5MW, a special exploitation permit has to be issued, and projects bigger than 250 kW need a special certification to benefit from the FiT. Then investors have to apply to the transmission grid operator for a connection,

with further delays. As a consequence, the amount of new wind capacity has decreased in 2012 (from approx. 1 GW new capacity in 2009 and 2010 to approx. 800 MW in 2011 and 750 MW in 2012) and the 23% target for renewables will not be reached unless these hurdles are reduced and/or new policies introduced.

Tenders

The French government invites tenders for the construction of large-scale renewable energy plants. The aim is to promote renewable energy production, in order to reach the objective set in the RE directive for France (23% of primary energy from renewables in 2020), and a targeted installed capacity set by the French multi-annual investment plan (+6GW off shore for 2020, MEDDE 2009). Benefits in terms of reduced energy dependency and carbon emission reduction are also expected.

12 calls have been made since 2004, mostly for wind energy. Currently, tenders concern PV projects above 100 kWp, and a call for major investments in offshore wind power, amounting to a total of 3 GW installed capacity to be installed between 2012 and 2020 on 5 sites. There are plans for other calls to reach the target of an additional 6 GW offshore wind capacity in 2020. For each call, the tenders are evaluated on the basis of various criteria including the tariff requested by the applicant (usually for a period of 15 to 20 years, as for FiT), the environmental aspects of the installation, the impact on local employment and fauna, amongst others. Calls are published by the French regulating agency (CRE, Commission de Régulation de l'Energie) and in the European Official Journal (CRE 2013).

The effectiveness and efficiency of the instrument is difficult to establish, as no significant assessment has been made and only few of the various tenders have effectively led to capacity installation. Theoretically, the static and dynamic efficiency is quite high, as it promotes the cheapest bid for each call, and gives an incentive for increasing the output of renewables, therefore promoting innovation and correct management. The environmental effectiveness is likely to be high if fully implemented. The acceptability of large-scale renewable installation seems also to be an issue, with a lot of NIMBY syndromes developing in the location of the future installations.

Biofuel Quota

The aim of this instrument is to promote renewable energy production, to increase national energy security and to reduce the carbon emissions from cars. There is a quota of biofuels to be blended to conventional fuels for each fuel type. The quota is combined to a tax regulation mechanism: biodiesel and bioethanol used for fuel purposes and blended to conventional fuels benefit from a partial exemption of the excise duty applied to fossil fuels in transport (from 60 to 40 c€/L of conventional fuel to 16 c€/L for biofuel). The objective of this instrument is to reach a target of 10% of biofuels in the total fossil fuels production by 2015 (compared to 7% in 2010), set in the national biofuels development plan. There are some limitations to the use of crops from areas with a high biodiversity or high carbon content, but there is no accounting of land-use changes due to the development of biofuels.

Providers of petrol or diesel fuels are subjected to a tax called TGAP (taxe générale sur les activités polluantes) set at 7% since 2010 if they release fuel products for consumption with a

lower proportion of biofuels than stipulated by law. The French Government may adjust the quotas in order to reach the targets set by the national biofuels development plan.

The environmental effectiveness of the biofuel quota is not perfect (Cour des Comptes, 2012), with only a quarter of the participants blending the required share of biofuel, the others paying 150 M€ of TGAP in 2011. However, the target of 7% of biofuels (in energy terms) was almost reached in 2011 (last year with available data) with 6.84% (UFIP 2013). The economic efficiency is questionable, since the biofuel quota promotes only renewables from one source, and not the cheapest. Moreover, the benefit of biofuels in terms of climate change mitigation is questionable since indirect land-use change is ignored. The principle of a quota with a cap on prices is however more efficient than a simple subsidy in the sense that it limits the rebound effects occurring when the price of fuels decreases.

1.2.3 Energy Efficiency and Energy Consumption

Energy Efficiency Certificates

The French energy efficiency certificate (EEC) scheme aims at reducing the final energy consumption of households and the service sector. It was implemented by the 2005 energy orientation law. It is currently in its second compliance period (2011-13), the first 3-year period was considered successful and ended mid-2009. The historical state gas and electricity providers were leading the market during this first period, but during the second, an increasing number of intermediaries have entered the market, gathering energy saving projects and converting them into certificates.

The scheme is composed of an obligation to achieve a given target of energy consumption reductions, backed by a market to exchange the certificates and a penalty for non-compliance (20 €/MWh, effectively acting as a discharge penalty or maximum price). For the end of the current compliance period, energy retailers (electricity, heating fuel, gasoline) have to provide a total of 345 bn certificates, or 345 TWh cumulated and discounted over the lifetime of all the investments made. The objective for the first period (2006-2009) was 54 TWh cumulated and discounted, and has been overshot. The price of certificates did not fall to zero because unlimited banking is allowed. Obliged parties can produce certificates (issued by the Ministry in charge of energy) or buy them on a market run by the energy regulating agency (CRE, Comission de Régulation de l'Energie). To produce them, they can invest in a set of standard actions in households, industry or in the service sector (such as insulation, boiler replacement, motor replacement in some industries, energy management systems, etc.). Certificates are issued for projects producing a minimum of 20 GWh worth of certificates, but obliged parties can regroup small-scale projects to reach the threshold level.

The replacement of old boilers by more efficient ones in households represented most of the investments made during the first compliance period. Local authorities can also produce certificates (I.e. invest in the standard efficiency actions in households or industry buildings) and sell them on the market. The regulating agency for energy efficiency (ADEME Agence de l'Environnement et de la Maîtrise de l'Energie) monitors and administers the market, issuing the certificates and broadcasting an average monthly price (fluctuating between 4.2 and 4.5 €/MWh in 2012). Additional costs to energy retailers are then passed on to electricity consumers.

This instrument is subject to large indirect costs to participants. Among other costs, they have to develop an organization to find potential savings among their customers and invest in targeted advertising. Those indirect costs are not subsidized (Giraudet et al., 2011). Except those costs, the economic efficiency of the scheme is high; it incentivizes the use of the cheap potentials first. It is more efficient than a pure subsidy (Quirion & Giraudet 2008) in that it reduces the rebound effect if the cost of the system is passed on to consumers, which is not clearly the case in electricity and gas, for which the retail price is regulated. The dynamic efficiency of the scheme is however less clear. No study has been made yet to disentangle the effects of the EEC vs. other incentives and regulations (see below) on the choice of efficient technologies investment. Moreover, the major players (EDF, GDF SUEZ) are inclined to play strategically, by pushing some technologies to be certified as a standard action for certificate issuance. Some technologies (e.g. low temperature boilers) have been authorized while they were less efficient than others (e.g. condensing boilers), probably to sustain to some extent the consumption of one type of energy (electricity vs. gas). While not an interaction per se, this has consequences on other instruments as they share the same list of eligible technologies.

The list of eligible technologies is revised at least every three years, giving some flexibility over the long run. Building technologies are not expected to evolve very rapidly (compared to renewable technologies for instance). It is more relevant to assess the dynamic efficiency of this instrument (and the other energy efficiency instruments) in terms of changes in the retrofitting industry. Along this criterion, the EEC have been quite effective. These aspects are also promoted by information and formation campaigns, with possible positive interactions.

Building Codes for New Buildings (RT 2012)

The building code regulations 2012 (Réglementation Thermique 2012 or RT 2012) sets standards for the energy consumption of new buildings. It follows a long history of increasingly stringent regulations. The first one (the RT 1974), concerned only new residential buildings and was a reaction to the first oil shock. A second, third and fourth followed, (respectively in 1988, 2000 and 2005) setting more stringent standards and progressively extending the regulation to buildings in the service sector. The regular tightening has had a traceable impact on the efficiency of the stock (2,9% final energy consumption reduction in 1973-1993, despite a nearly 50% increase in building surface, Martin et al., 1998). The last one, the RT 2012, is the result of the national debate on environment and energy (the "Grenelle de l'environnement") in 2008. One of the broadest agreements of the Grenelle de l'environnement has been to set future requirements at ambitious levels, with the current building codes set as milestones toward more stringent regulations.

The building code regulations are going to evolve in 2020, to force all new buildings to be energy positive. Those regulations aims both at decreasing the energy consumption and at developing the refurbishing industry, by increasing the need for efficient material and giving the opportunity to professionals to specialize in more technical refurbishments. The RT 2012 sets a maximum energy consumption limit of 50 kWh/m2 in primary energy for new buildings (with a fixed rate of 2.58 for converting electricity consumption in primary energy), modulated to fit to various climatic conditions, to the dwelling size and to its energy carrier. It also sets standards for the air permeability, the surface of windows and their orientation, the use of renewable energies for hot water and heating, the lighting, etc. The penalty for non-compliance is the non-issuance of the building permit.

There is a debate among economists regarding the static and dynamic efficiency of regulation and performance standards. Some argue it reduces the available options, whereas other back the “Porter hypothesis”, where regulations act as a “negative economic incentive” that force regulated entities to support the diffusion of efficient technologies at the lowest possible cost (see Giraudet & Finon, 2011 for a discussion). Considering the gains in terms of reduced emissions, and considering other market failures tackled by this instrument (such as the landlord-tenant dilemma, or the energy-efficiency gap), the construction of additional costs from the RT 2012 is limited (approx. +5%, Giraudet et al., 2012). The political acceptability is high, this being the flagship instrument following the national debate on energy Grenelle de l’environnement, involving the whole civil society. The environmental effectiveness has for now not being assessed properly.

Building Codes for Existing Buildings

The thermal regulation for existing buildings sets different standards for the total energy consumption of refurbished buildings above certain thresholds and the energy efficiency of specific items (e.g. windows) in other buildings. It was set up in 2005, along with the previous regulation on new buildings, in order to comply with the Energy Performance of Buildings European Directive. It aims at both decreasing the energy consumption and developing the refurbishing industry. This regulation is not very stringent compared to the average efficiency of the market.

For the refurbishments of buildings smaller than 1000 m2 or older than 1948, there are minimum standards for following items: mechanic ventilation, walls, water boiler, boiler, cooler and windows. For buildings bigger than 1000 m2 and newer than 1948, the building as a whole has to use less than 80-195 kWh/m2, depending on the climate and on the use of renewable energy. For non-residential buildings, the total energy consumption must be at least 30% smaller than before the refurbishing. The total efficiency criteria gives some flexibility to the investor, who can choose to use less efficient materials in some part of the building and more efficient ones in other parts, if the design imposes it. The building permit is granted only if it complies with the thermal regulation, and when the building is finished a certificate of compliance must be provided.

The discussion about the economic efficiency is the same as for the building code regulation for new buildings. The potential for energy consumption reductions is important, but the retrofitting costs are significant too. No evaluation has been made yet regarding the cost effectiveness of this measure. This instrument is likely to be slightly less acceptable and feasible than the regulation on new buildings, due to the vast number of existing buildings to be refurbished and the relatively high cost to do it. However, the regulation for specific items is not very ambitious while because of the threshold of 1000 m^2, only large investors are involved by the target for the performance of the whole building.

Sustainable Development Tax Credit (Crédit d´impôt développement durable)

The objective of the sustainable development tax credit is to reduce energy consumption and promote innovation in efficient technologies for households. It gives a tax rebate to landlords or tenants for the purchase of energy efficient durables, with rates ranging from 15 to 50% of investment cost. This scheme was started in 2005 and grew until, in 2008, it benefited 1.4

million households and cost €1.9 billion for an equivalent subsidy rate of 32% (CGDD 2012, Insee 2010). Eligible technologies were modified and subsidy rates decreased several times since then, in particular in order to reduce the cost for the public budget and to target the best energy efficient durables. The scheme has been extended to 2012 and could possibly run until 2020.

As a tax credit scheme, it is administered and enforced by fiscal authorities, and eligible households have to declare their purchases in their tax return, with purchase bill. Eligible technologies include insulation material (18 to 22% of tax credit), boilers (30 to 40% of tax credit).

Households receive an income tax rebate when they purchase equipment in a specified list of efficient technologies, including heating furnaces, insulating material and renewable energy equipment. As all tax instruments, it might be changed by a new government but as an element of the Grenelle 2 law, it is likely to stay in place until 2020, the year for which the Grenelle targets for energy consumption are specified.

The level of the tax credits vary a lot according to the technologies and change from year to year. They do not necessarily reflect the marginal cost of consumption reduction. The first technology in terms of credits issued is the replacement of windows, which is not the most efficient measure in the list. In a technical note from the French Institute for Statistics and Economic Studies (Insee 2012a), Amélie Mauroux argues that the average shadow value of the investment made was below the social value of carbon, as defined by the Quinet (2008) report, i.e. €32/t CO_2. While the cost effectiveness of this instrument is not clear, it seems that it achieved only part of the emission and energy consumption reductions objectives (20000 on 70000 refurbishments, MEDDE 2012). The scheme is quite easy to administer, the eligible technologies are the same as for the energy efficiency certificates. As a result, dynamic efficiency and the assessment of the environmental effectiveness is the same.

Zero-Rated Eco-Loan (Éco-prêt à taux zéro)

The zero-rated eco-loan (ZREL) allows landlords or tenants to have a preferential loan when they invest in a series of energy efficiency measures. This instrument in part of the bundle implemented after the national debate on environment and energy (the "Grenelle de l'environnement"). Launched in 2009, the scheme has benefited 40,755 households in 2011 (compared to 80,000 in the first year, and to an objective of 30,000 per year in 2013), for average investments of €16,992 per dwelling (SGFGAS, 2012).

It aims at reducing the energy consumption of residential buildings by promoting refurbishment bundles. The rationale behind this additional instrument is that many energy efficiency investments are most effective when conducted together with other measures. Giving additional credit possibilities to investors allows landlords or tenants to conduct all efficiency measures as a whole, thus optimizing e.g. a new boiler to a newly insulated home. To set up a bundle, the investor chooses a set of actions such as wall or roof insulation, window replacement, boiler replacement in collaboration with the refurbishment craftsman and goes to his bank with the estimate to benefit from the loan. This instrument is enforced by the ministry of finance.

The authorised banks (almost all major retail banks in France) can issue an up to €30.000 loan to investors meeting the requirements, with interest entirely subsidized by the state. This subsidy is issued if the investment plan includes several efficiency measures. The works have to begin within a period of two years. This instrument has been modified several times already concerning the possibility to combine it with the sustainable development tax credit (see above). Being part of the finance law, it is subject to additional changes in subsequent finance laws.

The environmental potential of this instrument is the same as for the other instruments targeted at energy consumption in buildings. The environmental effectiveness of this instrument however has been somewhat impeded by the more restrictive conditions required by the banks to issue the loans after the economic crisis. Indeed, there is no requirement for banks to issue loans to a minimum value. Investors were probably also more careful. Much fewer loans have been issued than planned. The cost efficiency seems fairly high, although there seems to be a bias toward issuing loans to sound borrower rather than borrower with less efficient homes.

Vehicle CO_2 feebates (Bonus-Malus)

The personal vehicle feebate system gives a price incentive to all passenger car buyers reflecting the environmental value of new cars (in terms of emission per km). It aims at contributing to reach the emission reduction target in the transport sector for 2020 for France, and is currently the main instrument in place to reach this target. It is the first major instrument implemented after the national debate on environment and energy (the "Grenelle de l'environnement") took place in 2007. It started on January 1st, 2008 and was designed to be revenue-neutral from the beginning, with a revision of the thresholds and of the levels of tax/subsidy every year to incentivize technological progress in the passenger car industry (CGDD 2010).

The principle of this instrument is to combine an ear-marked tax on polluting cars (measured as emissions per km following the European normalised car use cycle) and a subsidy for comparatively less polluting cars. Subsidies start at €100 for cars emitting less than 105 g CO_2/km (in 2013), and can rise up to €7,000 for the least CO_2-intensive cars (<20 g CO_2/km in 2013). Currently, only electric and plug-in hybrids qualify for this highest rate. CO_2 emissions from the generation of electricity consumed by these cars are not accounted for. Each year, new cars registered emitting more than a threshold are taxed. The threshold decreases every year (136 g CO_2/km in 2013), and taxes range from €100 to €6,000. This feebate applies only to new cars with an exception for the most emitting cars (see below), and is implemented at the point of sale. The instrument is designed to evolve in such a way that the "neutral corridor" (105 to 136 g CO_2/km in 2013), in which cars are neither taxed nor subsidized, converge to the 2020 objectives for emission reductions in the transport sector. The system includes a "super-bonus", an additional subsidy of €200 for passenger car buyer who replaces a passenger car older than 15 years, and an "annual tax" of €160 for cars emitting more than 240 g CO_2/km.

	CO2 emission rate (in g CO2/km)	**Level in 2013 (in euros)**
Subsidy	from 0 to 20 g CO2/km	€7,000
	from 21 to 50 g CO2/km	€5,000

	from 51 to 60 g CO2/km	€4,500
	from 61 to 90 g CO2/km	€550
	from 91 to 105 g CO2/km	€200
Neutral corridor	from 106 g to 135 CO2/km	€0
Tax	from 136 to 140 g CO2/km	€100
	from 141 to 145 g CO2/km	€300
	from 146 to 150 g CO2/km	€400
	from 151 to 155 g CO2/km	€1 000
	from 156 to 175 g CO2/km	€1 500
	from 176 to 180 g CO2/km	€2 000
	from 181 to 185 g CO2/km	€2 600
	from 186 to 190 g CO2/km	€3 000
	from 191 to 200 g CO2/km	€5 000
	from 201 g CO2/km	€6 000

Figure 1: taxes and subsidies for the purchase of new cars in the feebate scheme in 2013

The threshold levels are subject to variation by the ministry in charge of environment, as it tries to find the equilibrium between revenues from the tax and expenses from the subsidy. In the first years, the amount of taxes was less than that of subsidies because so the system entailed a cost for the public budget (2.2 bn€ in 2012). Despite the difficulties to find such equilibrium and to anticipate the behavioural changes of passenger car purchasers, the system is considered a success and is likely to stay in place until 2020 (Sénat 2013).

The instrument has been assessed by the French Institute for Statistics and Economic Studies (Insee 2012). It appears that it is quite effective on a per-vehicle basis from a static and a dynamic point of view. Changes in purchase behaviour have been much larger than anticipated, and passenger car producers have reacted rapidly to the challenge of reducing the average emission rate of new cars (the CGDD, Comissariat Général au Développement Durable, estimated the gains to 1.9 $MtCO_2$ in 2008 and 3 $MtCO_2$ in 2009). The instrument provides however no incentive to reduce the use of cars. Quite the opposite, since it reduces the vehicle cost per km, it should theoretically increase car use (direct rebound effect). However, econometric studies generally conclude that the rebound effect for passenger transport is relatively low (around 20%) so it should only marginally reduce the effectiveness of the system. This leaves some potential for improvement regarding the environmental effectiveness of the instrument, with huge potentials in fuel consumption reductions. The cost effectiveness is however difficult to optimize, since the instrument needs frequent adjustments to equalize revenues and expenses. The feasibility of the instrument is however high, with no major difficulty in implementing of monitor it, since only a limited set of actors is involved and the tax is ear-marked to finance a subsidy. The main difficulty, already mentioned, was that in the first years, the amount of tax was lower than the amount of subsidies, because new car emissions decreased at a higher rate than expected. This problem has been addressed since and is being corrected.

1.2.4 Non-Carbon Dioxide GHGs

The instruments for non-carbon GHG are essentially the same as carbon emissions. No comprehensive policy exists in France; most actions are due to the EU-ETS. Agriculture (2/3 of non CO_2 GHG in France) is mostly left untouched, and only a few domestic credit measures target industrial gases. This landscape is thus inefficient and ineffective.

1.3 Identification of interactions of instruments within each policy landscape

1.3.1 Carbon Pricing

Objectives

Both the EU-ETS and the carbon tax aim primarily at reducing the emissions of GHG by putting a price on emissions.

Domestic credits and energy efficiency certificates have different primary objectives, domestic credits aim at pricing GHG, while EEC aim at reducing the energy consumption. Participants in the EEC scheme can benefit from domestic credits.

Scope and Coverage

Interactions can occur if the target groups overlap. Until now, the debate in France has focused around what should be the target group for the carbon tax. As discussed above, on one hand the Constitutional Council rejected the tax on the ground that it left too much emissions and too many actors uncovered. On the other hand, having the installations already covered by the EU-ETS be subject to an additional tax would lead to double coverage.

Functioning and Influencing Mechanisms

Depending on the coverage, interactions between carbon tax and the EU-ETS would be neutral or negative. If the target groups overlap, there is double coverage and emission reductions in France, by reducing the EUA price, would increase them in the rest of the EU (assuming that the EU-ETS cap is binding). Without overlap of the target groups, the two carbon prices would neutrally coexist except maybe for some price distortions in some carbon-intensive goods if the prices on carbon given by the two schemes differ too much.

There is a risk of double counting, with emission reductions from EEC counted a second time as (non additional) JI credits. This leads to conflicting interactions between the two instruments. It is possible to generate domestic credits in households or buildings when energy efficiency actions are undertaken. Those actions could be eligible for EEC too. The resolving of this issue could be difficult, as the two administration structures are different.

Implementation Network/Administrative Infrastructure

The two instruments would be implemented by two different networks (European and national), which could lead to problems regarding the administration and the resolution of conflicts, e.g. if the perimeter of emissions covered by the EU-ETS develops over time. In France, the fiscal authorities and the finance ministry would be in charge of the tax, with French budgetary objectives on top of the emission reduction objectives.

1.3.2 Energy Efficiency and Energy Consumption

Objectives

Several energy efficiency instruments (EEC, tax credit, eco-loan, building codes) have the same objective – reducing the energy consumption.

The objectives of the feebate system for cars are the same than the EU regulation for energy efficiency in the transport sector. In 2008, the EU set legally-binding targets for new cars to emit 130 grams of CO_2 per km by 2015, with a flexibility provision among manufacturers.

Scope and Coverage

Several energy efficiency instruments (EEC, tax credit, eco-loan, building codes) have the same core target group: households. Thermal regulations apply to participants eligible for sustainable development tax credits and zero-rated eco-loans, and to households in which EEC actions are being undertaken. Concerning energy efficiency regulation in the transport sector, the EU regulation is targeted at the car manufacturer level, and the French regulation is targeted at the car retail level.

Functioning and Influencing Mechanisms

Energy efficiency instruments for the housing sector (EEC, tax credit, eco-loan, building codes) are mostly neutral, but can be mutually reinforcing when cumulated. The possibility to cumulate tax credits and eco-loans has changed several times, now it is subject to income requirements. According to recent modelling exercises, the two measures are almost additive (Giraudet et al. 2011a). The tax credit is targeted toward specific technologies and one-time investments, whereas the loan is targeted toward bigger investments; composite projects that can last several years.

The thermal regulation is thought as a reference, not too restrictive, and the additional instruments are thought to provide incentives to invest beyond this reference. Whether this is the case is not clear. Obviously many investors are inclined to invest to catch up with the regulation, leading to a mutual reinforcement.

The interactions between the feebate system for cars and the EU regulation for energy efficiency in the transport sector are negative. If this target of the EU regulation is binding, every policy which reduces the emissions of new cars in one member state (e.g. France, through the feebate system) allows more emissions in the others and reduces the allowance price, if a market between car manufacturers develops.

Implementation Network/Administrative Infrastructure

The ministry in charge of energy administers all energy efficiency instruments for the housing sector. Those instruments are designed to work together and are frequently tuned together. However, the regulations for energy efficiency in the transport sector are administered by different authorities at the national level (the ministry in charge for energy in France) and the EU level.

1.3.3 Promotion of Renewable Sources of Energy

Objectives

The promotion of renewables is the primary objective of FiT, tenders, biofuel quotas and the secondary objective of Sustainable Development Tax Credits and Zero-rated eco-loans.

Scope and Coverage

The target groups of FiT and tenders are the same (any investor wishing to enter the electricity production market), but are different from the target group of the biofuel quotas (providers of petrol or diesel fuels) and from the target groups of Sustainable Development Tax Credits and Zero-rated eco-loans (households). They cover different renewable technologies (large scale renewable installations for FIT and tenders, biofuels for the biofuel quota, small scale renewables and biomass for the tax credit and the eco loan).

Functioning and Influencing Mechanisms

Being targeted at both different groups and different technologies, those instruments are mainly neutral.

Implementation Network/Administrative Infrastructure

FiT, tenders and the biofuel quota are administered and enforced by the ministry in charge of energy, Sustainable Development Tax Credits and Zero-rated eco-loans are administered and enforced by the ministry of finance.

1.3.4 Non-Carbon Dioxide Greenhouse Gases

Objectives

In France, only the EU-ETS and the domestic credits have explicit objectives for non-carbon GHG.

Scope and Coverage

The scope of domestic credits can overlap with the scope of the EU-ETS.

Functioning and Influencing Mechanisms

The interactions between EU-ETS and domestic credits for non-carbon dioxide greenhouse gases are essentially the same as for carbon instruments.

Implementation Network/Administrative Infrastructure

Domestic credits are administered by the ministry in charge of environment, and the EU-ETS by European authorities.

1.4 Description and evaluation of policy landscapes in the light of the concept of optimality developed in task 1.1

1.4.1 Carbon Pricing

The instruments at work for mitigation and carbon pricing are mainly defined at the EU level. Except some tentative attempts in the industry and agriculture sector (with some domestic credit projects), the price on carbon comes from the EU-ETS in France. There are historical taxes on fuels, which affect the consumption and emissions in the transportation sector, but there are also numerous tax exemptions (aviation, agriculture, national freight transport) which limit the potential of fuel taxation and provide negative incentives for mitigation. The Cour des Comptes (2011) estimated to approx. €2 bn the gains for the public budget from removing taxes having a perverse incentive on pollution. The landscape of environmental taxation is very limited in France. The total environmental taxes amount to 2% of GDP, or 5% of total tax revenues, making France rank 21 of 27 European countries considering environmental taxation.

A carbon tax has been proposed several times, and is expected to be proposed again, but it suffers from a lack of acceptability, as any major tax reform. Debates focus on ideological issues, or whether every carbon emission should be equally taxed or not (see Combet, 2013 for a discussion), considering that some are already covered by similar schemes (e.g. the EU-ETS). In the absence of such a transversal price on emissions, France lacks a truly efficient mean of limiting emission on a large scale. Much potential are left untapped and which one is the most efficient is not well known by public authorities and remains private, leaving the field to ad-hoc negotiations and regulations in each sector.

While a carbon tax would be the most efficient instrument in environmental and economic terms, the economic efficiency of the EU-ETS is quite high too, on a smaller scope. Interactions with other instruments reducing the demand for emission allowances (FiT, energy efficiency instruments, see previous section) could alter its static efficiency, especially if they led the CO_2 price from the EU-ETS to drop to zero. If, in the future, domestic credits are issued for abatement projects in sources covered by the carbon tax, there would be a double coverage, which would reduce cost efficiency.

1.4.2 Energy Efficiency and Energy Consumption

Albeit a matter of French concern for about thirty years (Martin et al.,1998; Leray and de La Roncière, 2002), energy conservation has attracted renewed attention with the emergence of climate change issues. A national debate, the Grenelle de l'environnement has set the ambitious target of reducing energy consumption in buildings by 38% in 2020 compared to 2008, and has defined additional policy tools. It is the most developed and coherent landscape in the French climate and energy legislation. It is comprised of comprehensive performance standards, along with voluntary instruments such as tax rebates or preferential loans for individuals giving incentives to invest beyond this standard, and a flexible obligation scheme for energy retailers (Giraudet et al., 2012).

The setting of standards and the construction of new buildings have been shown to be a main driver of the reductions in energy consumption for heating since the first oil shock (Martin et al.,1998). The new building codes (RT 2012) are ambitious compared to other countries (around 50 kWh/m²/yr.) and an even more ambitious legislation is planned for 2020. On the contrary, thermal regulation for renovation is rather lax, and individual voluntary measures (preferential loans, tax rebates) have been set up to incentivize investments. Those instrument have been widely used (Insee 2010, SGFGAS 2012), but they do not necessarily reflect the marginal cost of consumption reduction (Insee 2012a), despite standardization of actions and frequent changes in the eligible technology list. Moreover, they subsidize shallow renovations which are not compatible with the ambitious policy targets (-38% in energy consumption from buildings in 2020, -75% in GHG emissions overall in 2050).

Some instruments in the landscape are cost-effective, such as EEC, a market-based scheme designed to promote the cheapest technology first, and the vehicle CO_2 feebate, giving good incentives for innovation and purchase behaviour changes. Building standards set a clear reference, and additional instruments help overcome some specific market failures and investment hurdles in the household sector. However, despite such a developed policy landscape, models show that it falls short of reaching the assigned target of a 38% reduction in 2020 (Giraudet et al., 2011a, MEDDE, 2012), and some instruments are not very cost-effective, such as the sustainable development tax credit that do not necessarily reflect the marginal cost of consumption reductions. The scheme also lacks environmental effectiveness, with potentials largely untapped, but mainly because of high cost levels (especially in refurbishing old buildings). Moreover, this policy landscape fails to deal effectively with the rebound effect, with more efficiency measures and almost no sufficiency measures (measures aiming at reducing the consumption of energy services), such as effective feedback to households about their consumption, more information about available technologies and energy taxation.

Alongside those instruments, the bonus and penalty system on the purchase of new passenger cars provides an incentive for the efficiency of cars. It appears that it is quite effective on a per-vehicle basis from a static and a dynamic point of view. Changes in purchase behaviour have been much larger than anticipated, and passenger car producers have reacted rapidly to the challenge of reducing the average emission rate of new cars. The instrument provides however no incentive to reduce the use of cars.

The administration and political feasibility of this policy landscape is rather easy, most measures being the result of a national debate involving all actors of the civil society. All instruments are managed by the ministry in charge of energy, and most lobbying has been settled during the consultation phase.

1.4.3 Promotion of Renewable Sources of Energy

France is not a leader in renewable technologies promotion, and is not on track to fulfil its EU commitments. It has had a fairly carbon-free electricity sector since the big 20th century investments in nuclear and hydropower (approximately 500 TWh or 90% of the French electricity production comes from low-carbon technologies). The initial strategy of tenders for big renewable energy projects has proven to be defective, and authorities have had troubles adjusting the feed-in tariff. The FiT is however in place and functioning since 2001. The levels of the tariffs were too low for certain technologies at the beginning (including PV), but rose afterward to sufficient (and sometimes excessive) levels.

The policy landscape for renewable promotion is dominated by the FiT, representing the biggest volume of public support (with €2.6 bn devoted to financing the FiT). FiT are efficient in the sense that they equalize the marginal costs of renewable sources. The most profitable sites are equipped first and operators have an incentive to maximize production (e.g. by avoiding shades on PV panels). From a dynamic point of view, there is a clear incentive to improve existing technologies and introduce new and more efficient ones. The static and dynamic efficiency and the environmental effectiveness of the FiT is high, it has proven to provide the right protection to investors from the market risk, and to incentivize the development of efficient installations. The adjusting of the scheme however is problematic, the public decision-making process being slow and the rate of technological change higher than anticipated. This led to some windfall profits for some investors and led to some criticisms over the scheme.

The quota and the tenders have a considerably smaller financial impact. The economic efficiency of the quota is questionable, since the biofuel quota promotes only renewables from one source, and not the cheapest. Moreover the benefit of biofuels in terms of climate change mitigation is questionable since indirect land-use change is ignored. The principle of a quota with a cap on prices is however more efficient than a simple subsidy in the sense that it limits the rebound effects occurring when the price of fuels decreases. Considering tenders, in theory they should be quite effective, but no assessment has been made, and the large-scale projects they finance suffer from acceptability problems on the local scale.

The main obstacles for the development of new renewable systems are the grid connection procedure, which are very lengthy compared to other European countries and administrative hurdles for wind power (e.g., only projects with at least five windmills are allowed). Consequently, the amount of new wind capacity has decreased in 2012 and the 23% target for renewables will not be reached unless these hurdles are reduced and/or new policies introduced (MEDDE 2012). The acceptability of large-scale renewable installation seems also to be an issue, with many NIMBY syndromes developing in the location of the future installations. There is moreover reluctance from the authorities to let the CSPE tax on

electricity rise enough to cover all charges from the renewable subsidy schemes. This tempers the negative feeling that people might get from increasing energy bills, but only postpones the problem.

1.4.4 Non-Carbon Dioxide Greenhouse Gases

Essentially the same as carbon emissions. No comprehensive policy exists in France; most actions are due to the EU-ETS. Agriculture (2/3 of non CO_2 GHG in France) is mostly left untouched, and only a few domestic credit measures target industrial gases. This landscape is thus inefficient and ineffective.

2 Description and initial evaluation of the overall instrument mix

2.1 Identification and description of the main interactions between policy landscapes

Objectives

While the primary objective of the EU-ETS is to put a price on GHG emissions, it has secondary objectives of promoting renewables and energy efficiency. The energy efficiency instruments however aim primarily at reducing energy consumption, and the renewable energy instruments aim primarily at increasing the renewable energy production. Some instruments promoting electricity consumption reduction (EEC, eco-loan, SD tax credit, thermal regulations) have a secondary objective of promoting renewables in households.

Scope and Coverage

Most energy efficiency instruments aim at providing incentives for households to invest, having only an indirect effect on carbon through the reduction of the electricity demand and the emission allowance demand. Energy efficiency certificates however are directed to energy suppliers, among which the major ones are also the big energy producers in France (EDF, GDF Suez). EEC actions are not possible in installations covered by the EU-ETS.

The instruments promoting renewable electricity production (FiT, tenders) are targeted toward any investor wishing to enter the electricity production market, while the EU-ETS is targeted to the big installations of the most carbon-intensive industries. These groups overlap, and electricity producers can invest in renewables, benefit from the FiT and reduce their polluting production, hence reducing their demand for emission allowances.

The target groups of energy efficiency instruments and renewable instruments do not intersect. Some renewable technologies are eligible to eco-loans and tax rebates, but when they do, they are not eligible to FiT. The biofuel quota is targeted toward fuel producers while the feebate for cars is targeted toward car retailers.

Functioning and Influencing Mechanisms

Policy landscapes interact with each other mainly in an indirect way, through the electricity market. The carbon pricing landscape is comprised only of the EU-ETS for now (if we except domestic credits, which account for a small share of total emissions and whose price recently dropped). Instruments promoting renewables and promoting energy efficiency have one common effect: they reduce the residual quantity of electricity produced by conventional technologies. This affects directly the electricity market, by reducing demand even in peak-hours, and thus reducing the total emissions from the power sector. This induces a reduced demand for emission allowances, and affects the price of EUAs. This price being European, the effect of French instruments cannot be considered in isolation, but they contribute to a reduction of the carbon price. No comprehensive quantitative study has been made in France to assess the level of the effect of renewable subsidies and energy consumption reduction incentives on the carbon price, but studies exist at the European level (to cite only one: Böhringer and Rosendahl, 2011) and for Germany. The effect of such interactions is however likely to be smaller in France than in Germany, as less renewable electric capacity has been added in France, and according to calculations from the Caisse des Dépots (Trotignon & Delbosc 2011), only a quarter of the total allowances went to the power sector (approx. 115 Mt CO2) for the first EU-ETS period in France, compared to 60% in Germany (approx. 890 Mt CO2).

Interactions occur nevertheless, since electricity consumption reductions have an effect on total emissions from electricity producers, which are covered by the EU-ETS, whereas gas and fuel consumption reductions lead to emission reductions not covered by the EU-ETS, and both are treated the same way. However, there are good reasons to promote electricity savings in buildings, even though CO_2 emissions from the power sector are capped. First, electricity generation entail other externalities and risks than climate change, in particular in case of nuclear generation. Second, the EU-ETS cap cannot be considered fixed over the very long lifetime of a building. Third, the landlord-tenant dilemma prevents the implementation of energy-efficiency measures in rented dwellings.

Instruments promoting energy efficiency however reduce emissions not covered by the EU-ETS, hence producing synergies with the EU-ETS, increasing the total emission reductions. Conversely, the additional cost of emission allowances is likely to be passed through to the electricity price (only to some extent, the electricity price being still regulated for most of the end-users in France, especially households). This will increase the price of electricity-intensive products, limiting the rebound effect and leading to a further reduction in energy demand (on top of investments in energy efficient appliances). Those instruments have thus mutually reinforcing interactions regarding energy consumption reductions and emission reductions (Lecuyer & Bibas, 2011).

Regarding carbon pricing and renewable electricity production, even if the renewable electricity production reduces the total demand for allowances and hence the EUA price, the EU-ETS and the renewable subsidy schemes (FiT, tenders) are in some way mutually reinforcing, since the FiT effectively puts a higher price on the carbon shadow value of renewables technologies. Moreover, the additional cost of emission allowances is likely to be passed through to electricity, increasing the relative profitability of renewable energy

production investments and adding to the incentive to invest in renewable energy technologies. Instruments promoting renewables also reduce emissions not covered by the EU-ETS, increasing total emission reductions.

Instruments promoting electricity consumption reduction (EEC, eco-loan, SD tax credit, thermal regulations) and instruments promoting electricity production from renewable sources (FiT, tenders) also interact through the electricity market. While the former aim at reducing the total amount of energy consumed, the latter aim at producing more energy by forcing renewable electricity to the grid and reducing the average electricity price. This can lead to conflicting interactions: an increased rebound effect and a reduced resilience of the system to the variability of renewable production (Jonghe et al., 2011).

Interactions between renewables and energy efficiency measures, channelled through the electricity market, are rather negative, in the way that energy consumption reductions also reduce the need for renewables (but no assessment has been made of this effect), and reduce the capacity of the electricity system to absorb the variability of renewable production, thus reducing the maximum share of renewable that can be added to the system. In households, energy efficiency instruments promote some renewable technologies, but with no real emphasis. There is no scheme giving a strong incentive (from a static or dynamic perspective) for developing efficient renewable technologies for households, and a potential for positive interactions is left untouched. There are some interactions in the transportation sector, with some policies promoting biofuel and other promoting efficiency of cars. To be functioning properly, the energy efficient instrument should promote motors compatible with the technical specificities of biofuel use, which is not currently the case and could be a potential issue in meeting the renewable target in the transport sector.

Implementation Network/Administrative Infrastructure

Most instruments in the renewable and energy efficiency landscape are administered by the ministry in charge of energy (except for fiscal instruments, who are administered by fiscal authorities, but those instruments, i.e. tax rebates and eco loans, are frequently adjusted by the ministry in charge of energy). The EU-ETS, however, is managed at the European level.

No thorough assessment of the French national climate and energy landscape has been conducted yet, it is difficult to quantify the extent to which renewable instruments and energy efficiency instruments are tuned together.

2.2 Summary discussion of the combination of policy landscapes (the overall instrument mix) against each one of the elements of the concept of optimality

Economic Efficiency

The authorities have first implemented instruments targeted toward energy efficiency in investments (building codes, investment incentives, loans), then they have progressively developed other incentives, partly as an obligation to comply with European regulation, partly

to comply with Kyoto obligations, such as renewable energy production subsidies and market-based mechanisms.

While potentially quite efficient on a dynamic basis if amended often enough (right now the list of eligible technologies for EEC is revised at least every three years), investment incentives lack the static efficiency properties of behaviour incentives. The pricing of emissions through the EU-ETS, renewable production through FiT and of energy consumption reductions through EEC improved the static efficiency and possibly the cost-effectiveness of the overall policy mix (but a lack of comprehensive assessment of policy instruments in France prevents any conclusive verdict).

The price of carbon extends only to some installations and some sectors (large-scale combustion, energy-intensive industries), which cover less than one third of GHG emissions In France. Moreover, the CO_2 price in the EU-ETS is currently too low to have an impact. Additional instruments exist that promote electricity savings and renewable electricity production, which generates potentially problematic interactions. However, there are good reasons for those overlaps, even though CO_2 emissions from the power sector are capped. First, electricity generation entails externalities and risks other than climate change, in particular in case of nuclear generation. Second, considering electricity savings, the EU-ETS cap cannot be considered fixed over the very long lifetime of a building. Third, the landlord-tenant dilemma prevents the implementation of energy-efficiency measures in rented dwellings.

Considering renewables, overlaps are justified by additional positive externalities, such as knowledge spillovers, local air pollution reductions or local employment. Moreover, the slow diffusion of clean technology justifies implementing more costly but higher potential options, such as renewable technologies, before the cheaper but lower potential options, such as coal-to-gas switch (Vogt-Schilb and Hallegatte, 2011).

Through increases in the price of electricity, carbon-pricing instruments tend to incentivize sufficiency behaviours (reducing the consumption of energy services), producing positive interactions with instruments giving incentives to energy efficiency investments. Interactions with instruments promoting renewables are rather conflicting, but no quantification has been made.

Environmental Effectiveness

The main policy landscape in France is the energy efficiency and consumption landscape, both in terms of costs engaged and in terms of number of instruments. It has the longest history, being the first answer to the oil shocks in the 1970s. Renewable promotion and carbon pricing have been added later to the mix, and the three policy landscapes have coexisted until now. Each one is targeted toward its own objective, without real intention to make specific adjustments to optimize the interactions between landscapes.

The French policy mix is thus quite effective in tapping in the efficiency potential of the residential and service sector, in increasing the renewable production in the electricity sector and in reducing the emissions of large emitters. It does not allow however to use the full potential of the rest of the economy for carbon pricing, renewable promotion and energy

efficiency. There is moreover a lack of a global assessment of the climate policy in France, and while GHG emissions and carbon intensity decreased in recent years, it is difficult to quantify the role of policy instruments in this reduction.

Instrument Mix Feasibility

Except the fiscal instruments (loans, tax credits, taxes) and for European instruments (EU-ETS), the instruments in the various landscapes are implemented and administered by the Ministry in charge of energy. This ensures that, at the landscape level, a degree of optimization is ensured between instruments. At the overall instrument mix level however, some unintended side-effects occur and instruments interact with each other, mainly through the channel of the electricity market. The interactions between policy landscapes are for now not taken into account in the design of the instruments and landscapes. Flexibility has been progressively added to the instruments (variable FiT, new standard efficiency technologies added on a regular basis), and most of the major instruments of the mix are evolving with the technologies they promote.

The instruments of the renewable landscape fail to reach their target, due administrative hurdles, problems of acceptability for large-scale renewable projects and due to the level of the subsidy that has not always been coherent with the reality of the costs faced by renewable producers. The instruments of the carbon pricing landscape reach their mitigation target, partly because it was not very stringent, leading to a very low level of CO_2 price. The instruments of the energy efficiency and consumption landscape will fail to reach their target, which was unrealistic (-38% in energy consumption for existing buildings in 2020 compared to 2008).

3 Conclusions

In France, the instruments at work for mitigation and carbon pricing are mainly defined at the EU level. Except some tentative attempts in the industry and agriculture sector (with some domestic credit projects), the price on carbon comes from the EU-ETS. While quite efficient (if high enough), the pricing of carbon is subject to indirect interactions with the energy efficiency and the renewable instruments, channelled through the electricity market by power consumption reductions which in turn affect the emission allowances demand. A carbon tax has been proposed several times, and is expected to be proposed again, but it suffers from a lack of acceptability, as any major tax reform. Debates focus on ideological issues, or whether every carbon emission should be equally taxed or not. Considering non-carbon dioxide greenhouse gases, no comprehensive policy exists in France; most actions are due to the EU-ETS. Agriculture (2/3 of non CO_2 GHG in France) is mostly left untouched, and only a few domestic credit measures target industrial gases.

The energy efficiency landscape is comprised of comprehensive performance standards, along with voluntary instruments such as tax rebates or preferential loans for individuals giving incentives to invest beyond this standard, and a flexible obligation scheme for energy retailers. The energy efficiency landscape is fairly cost-effective, with a standard setting a clear reference and a market-based scheme designed to promote the cheapest technology first. Additional instruments help overcome some specific market failures and investment hurdles in

the household sector. Alongside those instruments, the bonus and penalty system on the purchase of new passenger cars provides an incentive for the efficiency of cars. It appears that it is quite effective on a per-vehicle basis from a static and a dynamic point of view. It provides however no incentive to reduce the use of cars, and falls somewhat short regarding environmental effectiveness.

The policy landscape for renewable promotion is dominated by the FiT, channelling the biggest part of public funding. FiT are efficient in the sense that they equalize the marginal costs of all sources, for a given renewable technology. From a dynamic point of view, there is a clear incentive to improve existing technologies and introduce new and more efficient ones. The adjusting of the scheme however is problematic, leading to some windfall profits for some investors in the past. There is also a quota for biofuel and tenders for large-scale renewable installations, but they have a considerably smaller financial impact. The economic efficiency of the quota is questionable, since the biofuel quota promotes only renewables from one source, and not the cheapest. Moreover the benefit of biofuels in terms of climate change mitigation is questionable since indirect land-use change is ignored. Considering tenders, in theory they should be quite effective, but no assessment has been made, and they suffer from acceptability problems on the local scale.

How feasible are more ambitious climate policies? A carbon tax faces two main hurdles. The first, which is not specific to France, is that any new tax is in general unpopular. The second, which is specific, is that any proposal risks being cancelled by the *Conseil Constitutionnel*, except if it features little or no exemptions. However, a tax without such exemptions is unlikely to survive the policy process because of the influence of powerful interest groups like farms and the heavy industry. Another ambitious instrument required to reach the official targets (like reducing GHG emissions by 75% in 2050) is a retrofitting obligation in residential buildings (Giraudet et al., 2011). In terms of feasibility, such a proposal would certainly face a large opposition from some households unwilling to retrofit their dwelling.

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Annex I: table for the description of instruments

Table 1: Description of instruments	Carbon Tax	Domestic credits	Bonus-Malus: vehicle CO2 bonus and penalty system (feebate)	Energy efficiency certificates	RT2012 (multiple instrument)
Areas of Policy interaction in design parameters					
Instrument category	Taxes	ETS	Techsupport	ETS	Command_Control
Instrument subcategory	Taxes directly applied to the pollution source (Carbon Tax)	Credit systems	Financial measures (subsidies)	Credit systems	Building codes and standards
Level of governance	France	International - Annex 1	France	France	France
Degree of bindingness	Legally binding	Voluntary	Legally binding	Legally binding	Legally binding
Objectives					
Goal(s)	Mitigation only	Mitigation only goal	Mitigation primary, innovation secondary	Reducing demand primary, mitigation secondary	Energy demand reduction primary, mitigation and innovation secondary
Type of target	price on emissions, per ton of CO2 emitted	credit on emissions avoided, per ton of CO2	Price on CO2 emissions per km with thresholds	Quantitative target in MWh discounted and cumulated over the equipement's lifetime	energy consumption standards in kWh (PE)/m2/yr
GHG Scope					
GHGs covered	CO2	All	CO2	n.a.	n.a.
Direct/indirect emissions	direct emissions	direct/indirect emissions	direct emissions	direct/indirect emissions	direct/indirect emissions
Primary/final energy	n.a.	n.a.	n.a.	final	primary
Opt-in/opt-out	No	n.a.	No	No	No
Sectoral scope					
Sectors of economy	Economy-wide	Economy-wide, focus on Food and Agriculture	Transport	All but ETS	Households, Consumer and Building
Covered entities	households, enterprises	firms	car retailers	energy retailers	households, enterprises
Covered sites	n.a.	n.a.	n.a.	n.a.	n.a.
Capacity thresholds entities/sites	no	no	No	No	No
Opt-in/opt-out for sectors	no	n.a.	No	No	No
Opt-in/opt-out for entities	No	n.a.	No	No	No

Opt-in/opt-out for sites	No	n.a.	No	No	No
Implementation network					
Competent bodies for adopting instrument	Parliament	Parliament	Parliament	Parliament	Parliament
Competent body for setting-up instrument	Ministry of finance	Ministry in charge of environment	Ministry in charge of energy	Ministry in charge of energy	Ministry in charge of energy
Competent body to administer instrument	Ministry of finance	Ministry in charge of environment	Ministry in charge of energy	Ministry in charge of energy	Ministry in charge of energy
Competent body for registration of participating entities	Ministry of finance	Ministry in charge of environment	Ministry in charge of energy	Ministry in charge of energy	Ministry in charge of energy
Competent body for Monitoring & verifying compliance	Ministry of finance	Ministry in charge of environment	Ministry in charge of energy	ADEME (no check done yet)	ADEME (no check done yet)
Competent body for enforcement of compliance	Ministry of finance	Ministry in charge of environment	Ministry in charge of energy	Ministry in charge of energy	Ministry in charge of energy
Rules & influencing mechanisms					
Market arrangements					
Non-obligatory for eligible parties	non-obligatory for installation already covered by EU-ETS	n.a.	none	none	none
Number of participants	>1m	>1m	~10,000	~3,000	~10,000/yr
Market flexibility					
Trading participants	n.a.	Not limited	n.a.	some actors are eligible to produce and sell CEE (e.g. local authorities)	n.a.
Unit type and name	n.a.	ERU	n.a.	CEE (certificats d'économie d'énergie)	n.a.
Nature of unit	1 ton CO2	1 ton CO2		1 MWh cumac	
Lifetime of unit	n.a.	no limit	n.a.	no limit	n.a.
Banking provisions	n.a.	Yes	n.a.	Yes	n.a.
Borrowing provisions	n.a.	n.a.	n.a.	No	n.a.
Financing					
Cost-recovery	possible via price increase of electricity or products	n.a.	possible via price increase of cars	possible via price increase of energy	possible via price increase of buildings
Revenues raised	expected substantial	n.a.	designed to be revenue-neutral	No	No
Technological parameters					
Eligible technologies	All	All	private mobility passenger	standard actions selected by authorities	all (for buildings)

			vehicles	(approx. 200 different actions)	
Opt-in/opt-out	n.a.	n.a.	No	yes (opt-in)	No
Treatment of additionality	n.a.	approval by JI authorities	n.a.	Deficient	n.a.
Timing					
Operational?	No	Yes	Yes	Yes	Yes
Operational changes foreseen?	possible implementation in 2014-2015	No	regular increase in the stringency	increase of the target, possible changes to comply with the EE directive	not until 2020
Compliance period(s)	n.a.	n.a.	n.a.	2006-2009, 2011-2013	n.a.
Future continuation	n.a.	Unsure	Yes	Yes	Yes
Compliance					
Monetary penalties	fiscal penalties	No		yes, 0.02€/kWh not covered by CEE at end of compliance period	No
Naming and shaming	No	No	No	No	No
Administrative liability	tbd	No	No	No	yes, no issuance of building permit if no compliance
Civil liability	tbd	No	No	No	No

Table 1: Description of instruments	Thermal Regulations for existing buildings	Sustainable Development Tax Credit (Crédit d´impôt développement durable)	Zero-rated eco-loan (Éco-prêt à taux zéro)	Feed-in tariffs	Tenders (offshore, PV on ground)	Biofuel quota
Areas of Policy interaction in design parameters						
Instrument category	Command_Control	Taxes	Techsupport	Techsupport	Techsupport	Techsupport
Instrument subcategory	Building codes and standards	Negative tax for environmentally-friendly activities	Policies to remove financial barriers to acquiring green technology	Feed-in tariffs	Financial measures (subsidies)	Renewable portfolio standard
Level of governance	France	France	France	France	France	France
Degree of bindingness	Legally binding	Voluntary	Voluntary	Legally binding	Voluntary	Legally binding
Objectives						
Goal(s)	Energy demand reduction primary, mitigation and innovation secondary	Energy demand reduction primary, mitigation secondary	Energy demand reduction primary, mitigation secondary	Renewable production primary, mitigation secondary	Renewable production primary, mitigation secondary	Renewable production primary, mitigation secondary
Type of target	energy consumption standards in kWh (PE)/m2/yr	various (ad valorem subsidy with various rates)	List of eligible actions	Feed-in tariff level in €/MWh, depending on technology	production capacity target, number of projects	percentage of fuel sales from biofuel
GHG Scope						
GHGs covered	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Direct/indirect emissions	direct/indirect emissions	direct/indirect emissions	direct/indirect emissions	n.a.	n.a.	direct emissions
Primary/final energy	primary	n.a.	n.a.	n.a.	n.a.	n.a.
Opt-in/opt-out	No	n.a.	n.a.	No	No	No
Sectoral scope						
Sectors of economy	Households, Consumer and Building	Households, Consumer and Building	Households, Consumer and Building	Energy Supply	Energy Supply	Transport
Covered entities	mainly tertiary	households	households	electricity producers	electricity producers	transportation fuel producers
Covered sites	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Capacity thresholds entities/sites	No	No	No	No	No	No
Opt-in/opt-out for sectors	No	n.a.	n.a.	No	No	No
Opt-in/opt-out for entities	No	n.a.	n.a.	No	No	No
Opt-in/opt-out for sites	No	n.a.	n.a.	No	No	No

Implementation network						
Competent bodies for adopting instrument	Parliament	Parliament	Parliament	Parliament	Parliament	Parliament
Competent body for setting-up instrument	Ministry in charge of energy	Ministry of finance	Ministry of finance	Ministry in charge of energy	Ministry in charge of energy	Ministry in charge of energy
Competent body to administer instrument	Ministry in charge of energy	Ministry of finance	Ministry of finance	Ministry in charge of energy	Ministry in charge of energy	Ministry in charge of energy
Competent body for registration of participating entities	Ministry in charge of energy	Ministry of finance	Ministry of finance	Ministry in charge of energy	Ministry in charge of energy	Ministry in charge of energy
Competent body for Monitoring & verifying compliance	ADEME (no check done yet)	Ministry of finance	Ministry of finance	CRE (Comission de régulation de l'énergie)	CRE (Comission de régulation de l'énergie)	Ministry in charge of energy
Competent body for enforcement of compliance	Ministry in charge of energy	Ministry of finance	Ministry of finance	Ministry in charge of energy	Ministry in charge of energy	Ministry in charge of energy
Rules & influencing mechanisms						
Market arrangements						
Non-obligatory for eligible parties	refurbishments >1000m2 (global efficency standards)	n.a.	n.a.	n.a.	n.a.	none
Number of participants	>100,000	>100,000	~50,000/yr	>100,000	>10	~20
Market flexibility						
Trading participants	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Unit type and name	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Nature of unit						
Lifetime of unit	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Banking provisions	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Borrowing provisions	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Financing						
Cost-recovery	possible via price increase of buildings	n.a.	n.a.	fully internalized in the electricity price through an ear-marked tax	fully internalized in the electricity price through an ear-marked tax	possible via price increase of fuels
Revenues raised	No	negative	negative	designed to be revenue-neutral	designed to be revenue-neutral	No
Technological parameters						
Eligible technologies	all (for buildings)	list of eligible technnologies	list of eligible	renewable power production	Large-scale renewable	ethanol, biodiesel

			technnologies	technologies (Wind energy, Solar energy, Geothermal energy, Biogas, Hydro-power, Biomass)	energies (wind, solar)	
Opt-in/opt-out	No	No	No	No	No	No
Treatment of additionality	n.a.	Deficient	Deficient	Deficient	Not an issue	Not an issue
Timing						
Operational?	Yes	Yes	Yes	Yes	Yes	Yes
Operational changes foreseen?	in discussion	rates, technologies change frequently	rates, technologies change frequently	rates, technologies change frequently	No	No
Compliance period(s)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Future continuation	Yes	Yes	Yes	Yes	Yes	Yes
Compliance						
Monetary penalties	No	fiscal penalties	fiscal penalties	n.a.	n.a.	Providers of petrol or diesel fuels are subjected to an increased rate of TGAP if they release fuel products with a biofuel proportion below the quota
Naming and shaming	No	No	No	No	No	No
Administrative liability	yes, no issuance of building permit if no compliance	No	No	No	No	No
Civil liability	No	No	No	No	No	No

Annex II: Types of interactions between instruments

	Carbon Tax - ETS	**Energy efficiency certificates - ETS**	**Thermal Regulations for new buildings - ETS**
Instrument type	different instruments	different instruments	different instruments
Degree of bindingness	m-m	m-m	m-m

Objectives	p-p, carbon pricing p-p, non carbon GHG pricing s-s, energy demand reduction	p-s, carbon pricing p-s, non carbon GHG pricing p-s, energy demand reduction	p-s, carbon pricing p-s, non carbon GHG pricing p-s, energy demand reduction
Scope	pa-pa	i-i (or pa-pa?)	i-i
Implementation network	different	different	different
Rules and influencing mechanisms	trading	trading	trading
Type of interaction	conflicting relationship - (carbon pricing) conflicting relationship - (non carbon GHG pricing)	conflicting relationship - (carbon pricing) conflicting relationship - (non carbon GHG pricing) mutually supportive - (energy demand reduction)	conflicting relationship - (carbon pricing) conflicting relationship - (non carbon GHG pricing) mutually supportive - (energy demand reduction)

	Thermal Regulations for existing buildings - ETS	**Feed-in tariffs - ETS**	**Tenders (offshore, PV on ground) - ETS**
Instrument type	different instruments	different instruments	different instruments
Degree of bindingness	m-m	m-v	m-v
Objectives	p-s, carbon pricing p-s, non carbon GHG pricing p-s, energy demand reduction	p-s, carbon pricing p-s, non carbon GHG pricing s-s, energy demand reduction p-s, renewable promotion	p-s, carbon pricing p-s, non carbon GHG pricing s-s, energy demand reduction p-s, renewable promotion
Scope	i-i	pa-pa and i-i	pa-pa and i-i
Implementation network	different	different	different
Rules and influencing mechanisms	trading	trading	trading
Type of interaction	conflicting relationship - (carbon pricing) conflicting relationship - (non carbon GHG pricing) mutually supportive - (energy demand reduction)	conflicting relationship - (carbon pricing) conflicting relationship - (non carbon GHG pricing) mutually supportive - (renewable promotion)	conflicting relationship - (carbon pricing) conflicting relationship - (non carbon GHG pricing) mutually supportive - (renewable promotion)

	Vehicle CO2 bonus and penalty system - CO2 emissions from cars regulation (EU regulation 2008)	Domestic credits - energy efficiency certificates	Vehicle CO2 bonus and penalty system - biofuel quota
Instrument type	different instruments	different instruments	different instruments
Degree of bindingness	m-m	m-v	m-m
Objectives	p-p, carbon pricing p-p, non carbon GHG pricing	p-s, carbon pricing p-s, non carbon GHG pricing p-s, energy demand reduction	p-s, carbon pricing p-s, non carbon GHG pricing s-s, energy demand reduction p-s, renewable promotion
Scope	f-pa	pa-pa	i-i
Implementation network	different	different	same
Rules and influencing mechanisms	regulatory	trading	regulatory
Type of interaction	conflicting relationship - (carbon pricing) conflicting relationship - (non carbon GHG pricing)	conflicting relationship - (carbon pricing) conflicting relationship - (non carbon GHG pricing) conflicting relationship - (energy demand reduction)	conflicting relationship - (carbon pricing) conflicting relationship - (renewable promotion)

	Sustainable Development Tax Credit - Zero-rated eco-loan	Thermal Regulations for existing buildings - Zero-rated eco-loan	Thermal Regulations for existing buildings - Sustainable Development Tax Credit
Instrument type	different instruments	different instruments	different instruments
Degree of bindingness	v-v	m-v	m-v
Objectives	p-p, energy demand reduction	p-p, energy demand reduction	p-p, energy demand reduction
Scope	f-pa	os-pa	os-pa
Implementation network	same	same	same
Rules and influencing mechanisms	regulatory	regulatory	regulatory
Type of interaction	mutually supportive - (energy demand reduction)	mutually supportive - (energy demand reduction)	mutually supportive - (energy demand reduction)

	Renewable energy instruments – energy efficiency instruments	Vehicle CO2 feebate -- ETS
Instrument type	different instruments	different instruments
Degree of bindingness	m-m	m-m
Objectives	ps-s, energy demand reduction p-s, renewable promotion	p-p, carbon pricing p-s, non carbon GHG pricing
Scope	i-i	i-i
Implementation network	same	different
Rules and influencing mechanisms	trading	trading
Type of interaction	conflicting relationship - (energy demand reduction) conflicting relationship - (renewable promotion)	conflicting relationship - (carbon pricing) conflicting relationship - (non carbon GHG pricing)