About I4CE

I4CE is an initiative of Caisse des Dépôts and Agence Française de Développement. The Think Tank provides independent expertise and analysis when assessing economic issues relating to climate & energy policies in France and throughout the world.

I4CE aims at helping public and private decision-makers to improve the way in which they understand, anticipate, and encourage the use of economic and financial resources aimed at promoting the transition to a low-carbon economy.

I4CE benefits from a large network of partners.
In 2013, up to €36bn of investment contributed to climate mitigation in France

The Landscape of Climate Finance surveys investment in tangible (physical) assets contributing to climate change mitigation and resulting directly or indirectly in greenhouse gas emissions (GHG) reductions – generally referred to as climate investments. This total is made up of investments of €17.6bn in energy efficiency, €5.1bn in renewable energy and €12bn for sustainable transport infrastructure. Investments in new nuclear plants and GHG reductions outside of energy consumption (agriculture, forestry, industrial processes, etc.) totaled an estimated €1.4bn. An increase in investment was noted in low-emission new buildings and sustainable transport infrastructure, while investment in renewable energy decreased over the same period.

38% of investment made by households; 50% in the building sector

In France, households initiated €13.6bn or 38% of total climate investment in 2013. To finance their investments - most of which occur in the housing sector - households primarily mobilized their own equity (€8.3bn) and commercial debt (€5.5bn). They benefitted from €1.4bn of public grants and subsidies. The building sector concentrated 50% of total investment, of which €13.5bn was initiated by households and €3.2bn by public housing authorities, while actors investing in non-residential commercial buildings totaled only €1.4bn. Transport was the second-largest sector of investment, with most of the investment dedicated to sustainable infrastructure projects (€11.8bn).

In total, grants, transfers and subsidies account for €7.4bn towards public project developers, and €2.7bn towards private project developers, thus totaling €10bn. Commercial debt, whether from the banking sector or from capital markets, was the principal instrument used by private companies to finance their investments, particularly in the case of large-scale renewable energy projects. Concessional debt – primarily issued by public financial institutions and featuring preferential conditions in terms of volume, interest rate or maturity – was principally oriented towards public housing.

Between 2011 and 2013, total annual investments contributing to GHG mitigation increased by €6bn.

€18.7bn, or 51% of climate investment, was driven by the public sector

Out of the total financial flows in the Landscape, 51% depended upon public action to foster the channeling of finance towards project developers, whether in the form of: direct public investments from State and local governments and public institutions (€5.8bn); public grants and subsidies (€8.7bn); concessional debt for specific beneficiaries (€2.9bn) or transfers between private actors through publicly-established mechanisms (€1.3bn).

The role played by the public sector in climate finance is twofold:

• **traditional uses of public finance in France**, such as support for public housing, for home ownership or investment in urban public transportation. Accounting for €14.8bn in 2013, these financial flows are linked with the greening of public policies and as public operations take into account climate change and the energy transition;

• **public incentives to reorient private finance to support a low-carbon economy and the energy transition**. This form of public support represented €3.9bn in 2013. In addition to these public financial incentives, the integration or ‘mainstreaming’ of climate into investment decisions occurs through the strengthening of regulatory framework more favorable to energy transition, thus shaping the risk-return profiles of investments. Carbon price signal, energy efficiency regulations in new equipment, and more broadly, coherent low-carbon economic and industrial policies.

### Variations in the role of public incentives reflect the general evolution of sectorial climate policies in France

The apparent stability of public incentives to reorient private finance, representing between 11 and 13% of total investment, hides diverse trends across sectors:

- for the construction of new buildings, the implementation of a new energy efficiency regulation (RT2012) led to an increase of mobilized private finance;
- for building retrofitting, public support in favor of climate investment increased in 2013 and 2014, after a dip in 2012, totaling 22% of total climate investment over the entire period;
- for renewable energy, particularly large-scale electricity generation projects, private actors were responsible for the majority of investment with limited up-front public support. Nevertheless, the financial equilibrium of these projects remains highly dependent on the contribution of public support schemes, such as feed-in tariffs, to secure future revenue streams.

### While increasing, current investment flows remain below the levels estimated as needed to reach medium-term climate objectives

Comparing the investments covered in the Landscape with those estimated as needed to implement the National Low-Carbon Strategy (SNBC) is challenging given differences in perimeter and calculation methods. In residential retrofitting and energy production sectors, investments of about €10 to 15bn euros per year would be needed, on top of the already realized €16bn covered in the Landscape, to reach the average annual levels estimated as needed in the SNBC. This gap highlights the need for the continued reorientation of current investments towards climate actions. In a context of limited capacity of public finance, this further accentuates the question of how to best allocate public resources to reorient private finance in support of the low-carbon energy transition.
In 2013 in France, investment contributing to GHG mitigation is estimated at up to €36.3bn across the five sectors displayed on the right side of the diagram. This investment was initiated by public and private project developers, who were most often considered to be the end-owners of the assets created. For example, households realized a majority of their investments in the residential (building) sector, whereas private companies invested primarily in transports and energy production.

To finance these investments, project developers resorted to four principal types of instruments: 1) grants, transfers and subsidies; 2) concessional debt at interest rates, tenure or volume preferential to typical market conditions; 3) commercial market-rate debt; 4) and equity or own funds. Balance-sheet financing, which is used by private companies, is represented as a combination of company-wide commercial debt and equity. Financial flows such as VAT reduction for energy efficiency in buildings, or feed-in tariffs for renewable energy, are not represented in this diagram even though they are discussed in the report.

These four types of instruments are used to channel financing to project developers, either through public or private intermediaries or directly from the sources of revenues and capital on the left side of the diagram. Public intermediaries, such as the State, public agencies and local governments mainly provide grants and subsidies - whereas commercial banks and public financial institutions provide market-rate and concessional debt.
Intermediaries mobilized capital and savings from sources grouped into categories of the national economy. Public fiscal revenues financed the State, public agencies and local governments. Banks were refinanced through household savings through deposits and capital markets. A share of households’ savings and revenues was directly invested in projects in the form of equity or self-financing.

List of acronyms:

- NE = not estimated
- <.1 = amounts of less than €100 million
- EE = energy efficiency
- RE = renewable energy
- Infra = sustainable infrastructure
- Nuc. = nuclear
- GHG = Greenhouse Gas emissions excluding fuel combustion.

The Landscape of Climate Finance maps investment in tangible (physical) assets producing direct or indirect reductions in GHG emissions. This includes construction and material acquisition, limited durable goods as used in national accounts (i.e. vehicles), but excludes research and development, preparatory studies, operating costs, administrative costs and public procurement. Debt includes both loans and bonds issued by or to project developers, but does not include the reimbursement of previously borrowed funds. All amounts are expressed in billion euros in the current value of the years covered in the Landscape.
In 2013, 50% of climate investment (€18.1bn), went to the building sector. Expenditure targeted both energy efficiency (€15.8bn) and renewable energy (€2.3bn). Households were the main project initiators and financed their investments with their own savings (€8.2bn) and commercial loans (€5.5bn).

**Background**

The building sector comprises residential and commercial buildings. Together, in 2012, these two building categories accounted for 44% of energy consumption and 20% of greenhouse gas emissions excluding LULUCF (CITEPA, 2014a; SOeS, 2014a). GHG emissions from the sector increased by 6% between 1990 and 2012, while over the same period, housing expanded from 21 million to 27 million primary residences (INSEE, 2015a). This sector represents major potential for energy efficiency improvement and emissions reductions through the construction of new, efficient buildings and energy retrofitting of existing buildings. Compared to other sectors examined in the Landscape, most building operations require only modest investments of around several thousand to several tens of thousands euros.

While residential building activities are well documented overall, information on expenditure and financing in the tertiary (commercial) sector is fragmented.

**Key results**

**CHANGES IN CLIMATE INVESTMENT EXPENDITURE**

Increased expenditure in new construction while retrofits of existing buildings remain stable.

In the construction industry, stricter energy efficiency requirements have led to new heating regulations (RT 2012) being adopted since 2013. Compared to previous heating regulations (RT 2005), we estimate that investments related to improving building energy efficiency subject to the RT 2012 amounted to €5.4bn in 2013 and €5.6bn in 2014.

The low-energy certification in France (BBC), which was established prior to and in preparation for the RT 2012, made it possible to set requirements. It disappeared with the entry into force of the later regulations. Additional investment associated with this certification, compared to the implementation of the RT 2005, was estimated at €2.7bn in 2011 and €3.3bn in 2012.
From 2011 to 2014, expenditure in building retrofitting remained stable at around €10bn to €11bn per year. Expenditure in individual homes increased slightly, from €5.8bn to €6.1bn. Expenditure for multi-family housing units remained stable at around €2.9bn per year. In social housing, expenditure increased from €1.9bn to €2.5bn.

Expenditure on photovoltaic panel installations in the building sector fell from €1.6bn in 2011 to €0.4bn in 2014, which reflects the general downward trend this industry has experienced since 2011.

In 2013, households and companies accounted for 80% of investment expenditure in the building sector, compared to 20% for the French state, local authorities and social investors.

THE ROLE OF PUBLIC FUNDING
Public funding includes direct investments by public authorities and operators, grants or subsidies, concessionary debt, and payments between private stakeholders within the framework of public schemes.

In the building sector, public financing totalled €5.8bn in 2013, or 32% of all expenditure. Of this total, about half, or €2.7bn, corresponds to public incentives for climate initiatives.

PUBLIC INCENTIVES FOR CLIMATE INITIATIVES
Public incentives for climate initiatives financed 15% of expenditure, or €2.7bn, in 2013. This financing is dependent on achieving specific performance targets for the actions or installations it supports.

While this type of financing represents only 15% of all investment, public incentives for climate initiatives ensure that projects maintain a high level of quality.

In 2013, the main instruments were:

- **For the renovation of private housing**: sustainable development tax credit (CIDD, renamed the tax credit for energy transition, or CITE, in 2014) of €527 million (according to PLF, 2015), white certificates (CEE) of €473 million (DGEC, 2015) and zero per cent eco-loans (éco-PTZ) issued for €542 million (SGFGAS, 2014);

- **For the renovation of social housing**: social housing eco-loans (éco-PLS) issued by the Caisse des Dépôts for €523 million in 2013 (Plan Bâtiment, 2012–2013).

Certain measures, which are not included in the Landscape totals, reduce investment expenditure for project initiators. For example, construction undertaken to maintain or improve private housing is eligible for a lower VAT rate. From 2011 to 2013, the reduced rate was applicable to all maintenance and improvement work, without specifying work relating to energy performance. In 2014, a separate lower VAT rate – 5.5% instead of 10% – was created for energy efficiency improvement work. The fiscal expenditure for this reduced rate was valued at €1.7bn in 2014 (PLF, 2015).

PRIVATE FINANCING
In 2013, private financing totalled €10.5bn, or 58% of all investments in the building sector. In the area of housing renovation, households were the major financiers, with €5.2bn in direct investments from their savings or current incomes. Traditional bank loans, i.e., without preferential rates or terms, completed self-financing at €2.3bn (according to ADEME, OPEN survey, 2014).
Methodology

ADDITIONAL COSTS FOR ENERGY EFFICIENCY IN NEW CONSTRUCTION

In the Landscape, we consider the RT 2005 as the benchmark level above which a building is considered energy efficient. Three types of buildings are taken into account, based on statistics from Observatoire BBC and the SIATADEL database:

- **Buildings subject to RT 2012**, i.e. for which construction permit applications were made after 1 January 2013, must comply with a consumption threshold of 50 kWh/m² of primary energy and are required to use renewable energy. It is difficult to isolate additional investment costs due to these stricter requirements as part of a statistical analysis. Feedback and impact studies carried out by industry professionals, ADEME or energy consulting firms estimate the additional costs of RT 2012 compared to RT 2005 to be between 7% and 11%;

- **Buildings having received the BBC Effinergie certificate** for building permit applications made between 2011 and 2012.

- **Positive energy buildings** (BEPOS), for which it should be noted that no common or regulatory definition currently exists. We consider that these buildings have received the BEPOS Effinergie certificate.

For BBC and RT 2012 buildings, we retained additional costs of 10% (i.e. €120 per square metre for individual houses and €140 per square metre for multi-family housing units) and 20% for BEPOS buildings compared to the average cost observed for RT 2005 constructions.

FINANCING INSTRUMENTS IN NEW CONSTRUCTION

The PTZ+ amounts are documented by the Société de Gestion du Fonds de Garantie à l’Accession Sociale (SGFGAS), which publishes an annual report on this scheme. Grants from the Agence Nationale de la Rénovation Urbaine (ANRU) are described based on the annual report of its national urban renovation programme (PNRU). The amounts received from the European Regional Development Fund (ERDF) were taken from the PRESAGE database and analysed with help from the Commissariat Général à l’Égalité des Territoires (CGET). Loans for the construction of social housing are documented using financial reports published by the Fonds d’Épargne de la Caisse des Dépôts and statistical reports by the Union Sociale de l’Habitat (USH). The Comptes du Logement housing reports serve as the basis for evaluating non-specific financing for energy efficiency improvements, particularly bank loans and self-financing from household savings.

RETROFITTING OF EXISTING HOMES

The Landscape relies on information from the OPEN survey and the 2014 report on the French energy efficiency and renewable energy markets and employment (ADEME, 2014a). The operations labelled as “optimum” by OPEN were taken into account (roof and façade insulation; window, door and wall insulation; condensing boilers) as well as all heating equipment installations that use renewable energy, such as wood burning stoves, heat pumps and solar thermal energy. The 2015 edition of the Landscape extends the expenses studied to include work undertaken to achieve “optimum” level energy efficiency in co-owned housing. Figures for 2014, not yet updated in the OPEN survey, are estimated based on ADEME forecasts in its markets and employment report. The unit costs of the operations are those provided in the two ADEME studies.

For individual homeowners, the main instruments are tax credits (CIDD/CITE) and the éco-PTZ. We noticed a significant increase in grants paid by the Agence Nationale de l’Habitat (ANAH), supplemented by bonuses from the Fonds d’Aide à la Rénovation Thermique as part of the Habiter Mieux programme, which rose from €52 to €571 million between 2011 and 2014 (ANAH, 2015). However, it was impossible to estimate grants from local and regional authorities.

ESTIMATING INVESTMENT EXPENDITURE IN THE TERTIARY SECTOR

Expenditure was estimated based on the BBC and BEPOS certifications granted by the Effinergie organisation for new construction and retrofitted buildings. It should be noted that these volumes are likely to underestimate the breadth of the retrofitting carried out on tertiary buildings, because there are currently no financial incentives to obtaining the certification. Expenditure is attributed to various project initiators (French state, local authorities, companies) based on the percentages observed in the database of...
certified buildings, which is available on the Effinergie website. The average cost per retrofitted square metre was calculated based on feedback from ADEME for PREBAT projects. This cost, which is relatively high at €1,149 per square metre, compensates for the low volumes covered by the BBC retrofit certification.

Climate-specific financing in the tertiary sector is limited to ADEME and European Regional Development Fund (ERDF) grants when such grants were unable to be traced to housing or public beneficiaries. The remaining expenditure is added to the public budgets of the French state and local authorities, as well as to the financing reported in annual reports for private tertiary stakeholders. Credit lines extended by the European Investment Bank (EIB) for construction and retrofitting to improve the energy efficiency of buildings owned by local authorities (namely middle and high schools) are taken into account.

THE DISTRIBUTION OF PHOTOVOLTAIC SYSTEM INVESTMENT

Photovoltaic installations, disaggregated by output power (ADEME, 2014a), are distributed between the various building types (new construction, retrofit, housing and tertiary, public or private project initiator) based on the author’s hypothesis. Other than the ADEME and European Regional Development Fund (ERDF) grants, financing for these installations depend on traditional instruments for each building category.

2011-2014 CLIMATE INVESTMENT TRENDS

CLIMATE INVESTMENT TRENDS
Building sector, France

EVOLUTION OF PUBLICLY SUPPORTED CLIMATE FINANCE*
Building sector, France

Traditional uses of public finance in France
- New buildings
- Existing building retrofitting

Public incentives to reorient private finance
- New buildings
- Existing building retrofitting

* Financing whose mobilization towards climate investment depends on a public decision: direct investments from public administrations, subsidies and grants, concessional debt from public financial institutions, European public funds, energy efficiency certificates (CEE), etc.
In 2013, the transport sector represented 33% of climate investments, or €12bn. Most investment relates to sustainable transport infrastructures, mainly the development of rail networks and urban public transport. The challenge of these investments is to shift the transport of passengers and merchandise from individual modes towards shared modes that emit fewer greenhouse gases.

**Background**

In 2012, the transport sector accounted for 31% of energy consumption and 28% of greenhouse gas emissions excluding LULUCF (CITEPA, 2014a; SOeS, 2014a). Most energy use and emissions come from road transport, whether from passenger vehicles or goods transport. The challenge is to improve emissions ratings on current vehicles, reduce distances travelled and increase the share of efficient collective transport modes (train, urban public transport). The systemic nature of the transport network complicates the analysis of climate performance of projects, especially that of infrastructure development.

**Key results**

**A RISE IN EXPENDITURE FOR THE ACQUISITION OF LOW-EMISSION VEHICLES, FINANCED BY THE BONUS/PENALTY SYSTEM AND LEASING OPTIONS**

This rise applies to all buyers (local authorities, companies, households) and, to a greater extent, individuals. It is explained by favourable conditions of public support and the pro-active purchasing policy of local authorities, the French state and certain private companies. In 2013, public subsidies covered approximately 45% of the additional cost of purchasing a low-carbon vehicle compared to fuel-powered compact car, and nearly all of the additional costs compared to a fuel-powered mid-size car.

The cost of the bonus given to low-emission vehicle buyers, which amounted to €6,300 per vehicle in 2013 and 2014, was in part covered by the penalties paid by high-emission vehicle buyers. The budget balance of the “bonus/penalty” measure, which was negative between 2008 and 2011, was close to zero in 2013 and positive in 2014 (CGDD, 2013a, Cour des Comptes, 2014c).

Expenditure for the acquisition of low-emission vehicles rose sharply between 2011 and 2014, from €70M to €250M.
The remaining additional cost of acquiring these vehicles is financed by buyers through leasing, a common practice with regards to electric cars. From the standpoint of the Landscape, leasing is similar to a loan, because the person leasing the car pays a monthly fee in exchange for using the vehicle. Vehicle manufacturers rely on banking institutions to provide this service.

HIGH INVESTMENT IN SUSTAINABLE TRANSPORT INFRASTRUCTURE COMPARED TO HISTORIC LEVELS

Investment expenditure in sustainable transport infrastructure increased from €7bn in 2011 to €11.8bn in 2013. Nearly all of the variation can be attributed to urban public transport, which rose steadily over that period, and to rail transport, which peaked in 2013 with €7.6M being invested. In this area, network expansion projects for high-speed train lines (LGV) are responsible for most of the variation, with an intensification of construction on the LGV Sud Est Atlantique line. This level of investment in transport infrastructure is high compared to historic levels (CGDD, 2014a). By means of comparison, in the Strategic Transport Infrastructure Needs to 2030 report, the OECD estimates that average annual investment in rail infrastructure in France to support long-term economic development needs should be €3bn per year (OECD, 2012a). However, the concomitance between the major LGV projects was unusual in 2013, which means future investments are likely to be lower.

A SECTOR DOMINATED BY PUBLIC FINANCING

The French transit operating authorities (AOT), semi-public operators like RATP, Voies Navigables de France (VNF) and Réseau Ferré de France (RFF, which became SNCF Réseau in 2014) represent 84% of investment expenditure in 2013. The main financing instrument for transport infrastructure projects were subsidies and transfers paid by public organisations (mainly local authorities, the French state and AFITF), totalling €5.9bn. This support reflects the "traditional" role of public authorities in France as the main financial backer of transport infrastructures.

FINANCING URBAN PUBLIC TRANSPORT

In metropolitan areas outside Paris, investments in urban public transport infrastructure were made by French transit operating authorities (AOT), and totalled €1.9bn in 2013. AOTs are financed by regional authorities (investment subsidies of €178M in 2013, see GART, 2014), the French state and the French agency for transport infrastructure financing (AFITF, with subsidies of €218M in 2013), as well as by European subsidies. The EIB also finances local authorities and AOTs, with concessionary loans with special terms, rates or guarantees, issuing loans of €260M in 2013 and €829M in 2014.

For historical reasons, in the Île-de-France metropolitan area, the RATP and SNCF handle infrastructure investments, with €1.6bn in 2013 for their scope of responsibility. The local AOT (STIF) finances these two companies, with subsidies of €615M in 2013 in addition to those from the French state (€64M in 2013) and local authorities (€531M in 2013). The RAPT and STIF borrow to make up for any discrepancy between their expenditure and investment.

THE ROLE OF PUBLIC-PRIVATE PARTNERSHIPS IN RAIL INFRASTRUCTURE FINANCING

Financing for the development of new rail lines can be divided into three categories:

- **Investments made entirely by RFF as project manager**, with the support of subsidies from the French state, local authorities and European funds. This type of financing, used in 2013 for the LGV Est Europe line (phase 2), accounted for 11% of LGV expenditure.

- **Investments made in part by RFF as project manager and in part by private companies who have entered into a public-private partnership (PPP)**. However, all the initial investment is financed...
Investment in rail infrastructure is a major source of expenditure in the Landscape, totalling €1.9bn in 2014 and €4bn in 2013.

by RFF with the support of the funding mentioned above. In this situation, used for the LGV Bretagne-Pays de Loire line and the Nîmes/Montpellier bypass, accounted for 28% of LGV expenditure in 2013.

• **Investments made by a private consortium,** financed through a combination of public funding, private equity and concessionary loans (Fonds d’Epargne de la Caisse des Dépôts, EIB) and commercial (bank) loans. The Sud Est Atlantique line was funded through commercial loans and represented 61% of LGV expenditure in 2013.

While the financial situation has improved since 2010, RFF continues to finance its investments through debt, mainly in the form of bonds. RFF’s long-term debt totalled €35.9bn in 2013 (RFF, 2014).

**Methodology**

**LOW-EMISSION VEHICLES**

Although new vehicles do not fall within fixed capital in terms of national accounting, they are nevertheless durable goods due to their long lifetimes (around 15 years). In the Landscape, low-emission vehicles are individual vehicles (passenger cars or lightweight utility vehicles) with low carbon dioxide emission ratings of less than 60 g/km.

All electric vehicles and certain hybrid vehicles meet this condition. Information on the sales of electric and hybrid vehicles is available until 2014, with figures published by the Comité des Constructeurs Français d’Automobiles (CCFA) and communicated by the AVERE-France association for the development of electric mobility.

We feel that it is more relevant to establish the climate-related cost of electric vehicles by comparison to equivalent fuel-powered models, rather than the average of all fuel-powered vehicles. Indeed, this average includes ranges and models for which electric vehicle options are not yet available (saloon cars, 4x4s). By comparing the average cost of electric vehicles (excluding bonuses) to the average cost of fuel-powered compact cars, an additional cost of around €10,000 per vehicle was observed.

Based on feedback from AVERE-France, we have maintained a distribution of vehicles by buyer profile: public (French state and local authorities) or private (companies and individuals). The share of individuals in purchases increased from 30% to 70% between 2011 and 2014, buoyed by a larger bonus given for electric vehicles and the introduction of the “super bonus” in for upgrading from an old diesel car.

**SUSTAINABLE TRANSPORT INFRASTRUCTURES**

The Landscape considers public transport modes, i.e., urban public transport, rail, river and maritime. The corresponding infrastructures are, respectively: urban public transport sites in cities (bus lanes, underground or on-the-ground rail networks), the development and maintenance/improvement of rail lines (LGV and traditional lines), the development of the river network, and the development of port infrastructures. This choice of modes reflects those in several national and international studies (CPI, 2013; MDB, 2014; MEDDE, 2013a) and the objectives identified in the Mobilité 21 report. The acquisition of rolling stock was not included in the Landscape, due to the difficulties in identifying the proportion of expenditure that corresponds to improvement in its energy efficiency.

Investment expenditure in infrastructures examined in the Landscape are mainly taken from the Comptes des Transports and completed when necessary with information from the RFF’s financial reports, particularly when taking account of expenditure by the LISEA consortium in the LGV Sud Est Atlantique project.

In terms of financing of investments in urban public transport infrastructures, data are taken from the STIF’s annual reports and the RATP’s financial reports. Subsidies paid to transport companies are estimated using the annual survey carried out by the Groupement des Autorités Responsables de Transport (GART).

Given the complex structure of financing, it was not possible to separate the financing of infrastructures from the overall financing of investments (rolling stock, IT, etc.). This method may potentially underestimate state contributions (particularly from the AFITF) which, in principle, mainly pertains to infrastructures.
The financing of rail investments is documented from the RFF’s financial reports. Subsidies paid to RFF are documented in the Comptes des Transports. For the LISEA project, financing provided by the various partners – equity and debt – are documented using the project’s press kits which are available online.
In the industry sector, climate investment was estimated at €1.8bn in 2013, or 5% of all sectors combined. Major uncertainties make it difficult to precisely identify expenditure in the area of energy efficiency. Public banks, particularly the BPI and the EIB, participate in financing this sector alongside debt and private equity.

**Key results**

- Climate investments by industry were estimated to be €2.3bn in 2011 and €1.8bn in 2013 and 2014. Of this total, energy efficiency accounts for between €1.4bn and €1.5bn, while renewable energy fell from €0.9 to €0.3bn.
- The drop in renewable energy is mainly explained by shifts in the investment in photovoltaic installations. Estimated at €755M in 2011, renewable energy totalled only €271M in 2013 and €324M in 2014. Investment in biomass applications was €151M in 2013 and €130M in 2014.
- Project initiators received subsidies from ADEME (€35M in 2013) and white certificates (CEE, up to €56M, including for specific operations, i.e., for which no standardised white certificate exists). According to available information, the BPI is the main stakeholder involved in financing energy efficiency, with €298M issued in “green loans” (as part of the French “Investissements d’Avenir” initiative) between 2011 and 2013.
Methodology

Investments in energy efficiency are estimated from the total amount invested by the NAF industry classification, reported in the ESANE survey by INSEE. According to the quarterly industry investment survey, energy savings represent between 8% and 9% of reasons for investment (INSEE, 2014). We have chosen to retain only 30% of the product of these two amounts, due to the considerable uncertainty involved in the estimation method used as well as amounts that have been judged as too high for a basic product, in light of expert opinions. By means of comparison, the only projects financed by green loans – one of the main public instruments in this sector – accounted for more than €2bn in investment between 2011 and 2013.

Of environment-related expenditure reported by companies, expenditure to reduce greenhouse gas emissions (particularly nitrous oxide) were estimated to represent 10% of air quality investment expenditure (CGDD, 2014a).

Financing from the BPI include amounts issued as green loans as well as a fraction of other development loans for industry. While green loans are mainly issued for projects to improve the energy efficiency of industrial processes, other BPI loans co-finance the development of strategic sectors in energy and environmental transition.
In 2012, the agricultural sector accounted for only 3% of final energy consumption, but was responsible for 21% of greenhouse gas emissions (CITEPA, 2014a; SOeS, 2014a). The French forestry sector is a carbon sink representing -44.3 MTCO₂E per year. These two sectors are marked as being sources of diffuse emissions and emitters of greenhouse gases other than carbon dioxide (methane and agricultural nitrous oxide). These emissions are difficult to measure accurately. Climate investments in the agriculture and forest sector are difficult to document precisely.

**Key results**

- Excluding photovoltaic systems, climate investments in the agriculture sector are estimated to be between €120M and €220M per year, of which around 65% is used to improve energy efficiency (facility insulation and heat recovery from milking systems) and 35% for renewable energy (agricultural methanisation, solar heating, biomass heat).
- Investment in photovoltaic systems decreased between 2011 and 2014, dropping from €589M to €110M.
- Investments in the forestry sector are estimated at €70M a year on average from 2011 to 2013.
- Project initiators are supported by a combination of public funding, largely mobilised by the French state (€56M in 2013), local authorities (€62M) and the European Agricultural Fund for Rural Development (EAFRD, €22M). We estimate that the remaining expenditures are financed by bank loans (75%) and own funds or self-financing (25%).

**Background**

In 2012, the agricultural sector accounted for only 3% of final energy consumption, but was responsible for 21% of greenhouse gas emissions (CITEPA, 2014a; SOeS, 2014a). The French forestry sector is a carbon sink representing -44.3 MTCO₂E per year. These two sectors are marked as being sources of diffuse emissions and emitters of greenhouse gases other than carbon dioxide (methane and agricultural nitrous oxide). These emissions are difficult to measure accurately. Climate investments in the agriculture and forest sector are difficult to document precisely.

**Project initiators are supported by a combination of public funding sources, largely mobilised by the French state, local authorities and the European Agriculture Fund for Rural Development (EAFRD).**
Methodology

The total funding amounts covered by the Landscape correspond to actions from the Energy Performance Plan (PPE), which was part of the French Rural Development Plan (PDRH). These investments are supported by a combination of public funding in the form of subsidies: funding from the French state, local authorities and the European Agricultural Fund for Rural Development (EAFRD) cover an average of 45% of the investment. The allocated funding is documented in the PPE assessment report prepared by the Conseil Général de l’Alimentation de l’Agriculture et des Espaces Ruraux (CGAER, 2013).

In the agricultural sector, information was only available for energy-related actions. With the exception of methanisation, actions aiming to reduce other greenhouse gases, such as nitrous oxide related to nitrogen fertilisers or methane related to enteric fermentation, may require changes in practices, i.e., increased operational expenditure (OPEX) rather than capital investment (CAPEX). There is little documentation on investments in crop management techniques or precision farming.

Investment expenditure in the forestry sector includes landscaping and plantation costs for afforestation operations and support for improved management of existing tree populations. This funding is described in the report by the French Court of Auditors on the support given to the forestry and wood products sector (Cour des Comptes, 2014a). These are average annual figures for the 2007–2013 period, which we have extended to 2014. It should be noted that these are upstream amounts, i.e., forest exploitation. Downstream applications are calculated in the operational sectors (e.g., building, industry and agriculture for biomass heating).
In 2013, centralised energy production and networks accounted for 11% of climate investment, or €4bn. Investments in this sector have been declining since 2011, especially in electric renewable power generation. The sector is dominated by private investment in the form of project companies or balance sheet financing.

Background

The Landscape groups together all centralised energy production activities – both electricity and heating – intended to be sold and distributed through a network infrastructure. This definition includes, for example, large-scale, ground-mounted photovoltaic power stations, but does not take into account small-scale installations – PVs, solar thermal energy, central heating systems – which are instead reported in the corresponding sectors (buildings, agriculture, industry).

In 2012 in France, the energy production and transformation sector produced 11.7% of greenhouse gas emissions, excluding LULUCF (CITEPA, 2014a; SOeS, 2014a). This sector comprises by large-scale, capital-intensive installations (OECD, 2012b). Since 2005, the electricity production sector has been covered by the European emissions trading system (EU-ETS 1), which has a target to lower GHG emissions on the European level by 21% compared to 2005 levels by 2020.

1 Pour une discussion détaillée des enjeux de l’EU-ETS voir les publications d’I4CE dans le cadre du programme de recherche Coordination des Politiques Energie et Carbone pour les secteurs de l’EU ETS à l’horizon 2030 (COPEC).
Key results

INVESTMENT IN ELECTRICITY FROM RENEWABLE SOURCES DROPPED CONSIDERABLY FROM 2011 TO 2013, FROM €5.9BN TO €3.5BN

This shift is explained almost entirely by the decline in expenditure for photovoltaic installations, which represented two-thirds of total investment in renewable energy in 2011. In this industry, the reduced investment is linked to two simultaneous developments: revision of the tariff support policy and the drop in unit installation prices. The latter fell from €2.5/W to €1.9/W between 2011 and 2014. Despite this decrease, renewable energy continues to make up the largest share of investment in this sector, with 63% of expenditure for 2013.

2014 marked the end of the strong decline in expenditure for renewable energy, with a rebound in installed capacities and investment.

2014 marked an upturn in wind power installations (800 MW compared to 591 MW in 2013) and photovoltaic installations (345 MW compared to 308 MW in 2013 for ground-mounted stations) with a slight increase in investment across all renewable industries combined (€3.5bn compared to €3.3bn).

INCREASED INVESTMENT IN NEW NUCLEAR POWER THAT REFLECTS THE PROGRESS AND ESCALATED COSTS OF THE FLAMANVILLE EPR PROJECT

The Landscape includes investments made by EDF in the construction of the EPR at Flamanville, the first of a new generation of nuclear reactors. Since the start of the project, the costs of the EPR announced by EDF have risen steeply, from €3bn to €10.5bn. According to our estimates, investments in 2013 were around €1.3bn. EDF has recently stated that the EPR is scheduled to come into service in 2020.

CLIMATE INVESTMENTS STABLE IN NETWORKS OVER THE 2011–2014 PERIOD

With regards to electricity networks, the Landscape evaluates the renewable energy grid connection costs based on research published in the French regional grid connection schemes (S3RER). From 2011 to 2014, these investments fell from €102M to €61M. It should be noted that these are investments generated by renewable capacities installed in a given year. Given the waiting times required for grid connection, investments may be delayed over several years.

With regard to heating networks, the Landscape takes into account network expansion costs (linear kilometres) and the installation expenditure on distribution substations. While renewable energy continues to represent the minority of distributed heat (40%) compared to fossil fuels, the expansion of heating networks is generally considered to be a prerequisite to supplying urban areas with renewable energy (ADEME, 2013a). Investments financed by local authorities totalled €63M in 2011 and 2012, while they increased to €162M in 2013. ADEME, European Regional Development Fund (ERDF) and the white certificates (Certificats d’économie d’énergie or CEE) provided several project initiators with additional funding of around €10M to €15M per year.

A SECTOR DOMINATED BY PRIVATE PROJECT INITIATORS AND PRIVATE FINANCING MECHANISMS

Local authorities and network operators (Réseau de Transport d’Electricité, RTE and Electricité Réseau de France, ErDF) represent 11% of the total. The energy sector finances its investments in two main ways:

- “Project” financing, which is characterised by debt reimbursement and capital investments by margins generated by the project. This type of financing, which is often based upon the creation of a project company (special purpose vehicle or SPV), limits risk for outside investors and for the parent company. Project financing has grown considerably in the area of electricity from renewable energy sources;

- “Balance sheet” financing, which is used when the profits from a project are expected to be generated many years later, or when the risk is too high to directly finance the project (capital and debt). In this case, the investing company incorporates the
liabilities into its balance sheet, supporting them through debt and capital injections. This type of financing is generally used in nuclear investments (IFRI, 2015).

These investments receive public funding support: for example, ADEME provided €34M while the European Regional Development Fund (ERDF) provided €11M in 2013. This type of financing is mainly directed towards less mature industries (methanisation, waste management) or towards support for local authorities in developing heating networks. BPI France co-financed the initiators of renewable electricity production projects through concessionary loans; in 2013, it issued €390M in loans.

Finally, a major increase in credit lines extended by the EIB was observed. These credit lines allow commercial banks to finance renewable energy investments and increased from €67M to €303M between 2011 and 2014.

**PRIVATE INVESTMENT IS SECURED BY DOWNSTREAM INCENTIVES FOR PROJECTS’ FINANCIAL PROFITABILITY**

While private financing represents 76% of investments, public funding of investments is provided through downstream measures that reinforce project profitability. The purchase price of renewable electricity represents the sole source of revenue for mature renewable energies, such as wind or solar power. To finance feed-in tariffs at levels that incentivise project initiators, the French state collects a tax for public electricity service (CSPE) on the selling price.

In terms of the photovoltaic industry, according to our preliminary calculations, the amounts paid to project initiators and covered by the CSPE are higher over the project lifetime than the initial investment. This estimate is made from the viewpoint of local authorities, discounting sums paid in the future at the rate of 2.5%. Uncertainty about the estimate result from assumptions about the annual production of photovoltaic panels and changes to the benchmark price of electricity which is added to the buyback price. The sector appendix presents the reasoning on this subject in more detail.

Public funding of investments is also provided through downstream measures that reinforce project profitability.

**Methodology**

**SUBSTITUTING FOSSIL FUELS IN ELECTRICITY PRODUCTION (FUEL SWITCH)**

We take into consideration investments in electricity produced using combined-cycle gas turbines (CCGT) when they replace coal or fuel oil installations. The similarity between installations and withdrawals was confirmed in 2011 (at 80 MW) and in 2012 (at 1,012 MW) based on RTE’s electricity reports. We estimate the investment in gas capacities based on the unit costs identified by the IEA. We estimate that financing of this investment comes from 50% equity and 50% debt (ALSTOM, 2006).

**NEW RENEWABLE ENERGY PRODUCTION CAPACITIES INSTALLED**

We take into consideration new capacities installed in the following renewable energy sectors: hydraulic, onshore wind, ground-mounted photovoltaic, solid biomass, methanisation and household waste.

The data used were sourced from ADEME’s markets and employment study (ADEME, 2014a), which compiles the capacities installed each year and estimates the investment costs per kW.

For the photovoltaic sector, we broke ADEME’s disaggregation down into small, medium and large installations to distribute them by sector (residential, tertiary, industry, agriculture, ground-mounted stations). Only ground-mounted stations are included in the “centralised energy product and networks” sector. All other installations are included in their respective sectors (construction, agriculture, industry) to link specific financing to the project initiators of this sector.
CONNECTING RENEWABLE ENERGY TO THE GRID

The new method suggested in the 2015 edition is based on work by the French regional grid connection schemes for renewable energy (S3RER). These schemes are a result of cooperation between RTE, ErDF and local stakeholders and outline a grid connection programme for electricity derived from renewable energy at the regional level between now and 2020. They divide additional costs between producers using a system of shares in €/kW. Remaining investments, particularly in the transport network, are financed by consumers.

THE EPR CONSTRUCTION PROJECT

Due to the lengthy amount of time required for the EPR construction project, we have decided to divide investments into annual expenditure. Our method takes into account the successive announcements and revisions regarding the cost of the reactor and the date that it will come into service since the project began in 2006. At each new announcement, outstanding investments needed to finance the entire cost of the project are separated in a linear manner between the time of the announcement and the expected date that it will come into service. Expressed in this way, the investment timeline is purely theoretical, but offers the advantage of not needing to be modified retrospectively every time the project timescale is revised.

2011-2014 CLIMATE INVESTMENT TRENDS

CLIMATE INVESTMENT TRENDS
Centralized energy production & networks sector, France

<table>
<thead>
<tr>
<th>Year</th>
<th>Renewable energy</th>
<th>Other energy production</th>
<th>Networks</th>
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<tbody>
<tr>
<td>2011</td>
<td>Wind</td>
<td>Nuclear 3rd generation (EPR)</td>
<td>Electrical networks, district heating</td>
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<tr>
<td>2012</td>
<td>Solar PV*</td>
<td></td>
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<tr>
<td>2013</td>
<td>Biomass**</td>
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<tr>
<td>2014</td>
<td>Biogaz** and waste</td>
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TRENDS IN FINANCING INSTRUMENTS USED
Centralized energy production & networks sector, France

<table>
<thead>
<tr>
<th>Year</th>
<th>Grants, subsidies and transfers</th>
<th>Concessional debt</th>
<th>Commercial market-rate debt</th>
<th>Equity and own funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
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<td>2014</td>
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* Utility-scale of minimum 100kW
** Excluding sectorial/decentralized installations (buildings, agriculture, industry)
Climate investment in France is estimated to have reached €36.4bn in 2013. Of this total, around €18bn went to energy efficiency, €5bn to renewable energy and €12bn to sustainable infrastructure. Private households were the principal project initiator, with around 38% of total investments, while private companies accounted for 24% and public or quasi-public operators represented the remaining third of the total. Overall, and estimated 51% of finance made available to project initiators were driven by the public sector.

Building on these results, I4CE is committed to improving and extending the coverage of financial flows in France with the support of current and news partners. This would confirm the role of the Landscape as a diagnostic tool to improve public policy and private sector perception of related risks and opportunities.

Conducting the second edition of the Landscape of climate finance in France has led to a number of conclusions and the identification of opportunities for further development – particularly if this diagnostic approach is to be extended to emerging and developing economies.

Some dimensions of climate investment can only be captured at the national level

The specificities of national levels of development, economic and social priorities and domestic pathway for a transition to a low-carbon development model are key in defining what investments to include in the Landscape and defining the baselines against which to distinguish climate investment.

- **Energy efficiency** investments are closely related to the quality of existing building or equipment stocks and to the local availability of technologies improving efficiency.

- Likewise, the definition of **sustainable infrastructure**, while typically limited to modes with higher per passenger efficiency (rail, urban transport), is also very much dependent on the context of national policies.

- As for **energy generation**, renewable energy technologies are clearly eligible. However, in less developed countries, short to medium-term use of highly efficient conventional technologies may be viable steps of the transition and count thus count as climate investment.

At the national level, the Landscape could access more sources of data than from a global perspective. In the case of France, investment spending is well covered by sectorial studies (with the exception of the industry and tertiary sectors). Data on project initiators, their access to public and private capital sources, is also much more detailed, and allows, in some case, cross-referencing between sources. Other countries may or may not provide the same level of accuracy or completeness. Nevertheless, gaps in knowledge are easier to bridge with estimates at the level of one economy than at the global level.

Climate finance is mostly domestic finance

This finding is consistent with the figures observed at the global level (CPI, 2015). Particularly in the context of developed countries, a majority of financial flows supporting climate investment stem from national capital sources, typically the equity of households and companies, national public budgets and a share of national savings collected and distributed by commercial banks.

This, however, may not be the case for countries where the national capacity to collect taxes and savings are limited and/or not centralized. The structure of their climate finance flows would be characterized by a greater importance of external public and private sources (overseas development aid, direct foreign investment, remittances, etc.). In both cases, however, data availability on domestic finance flows is key and may not always be available.
Seeing the bigger picture beyond financial flows

Financial flows identified in the Landscape were closely related to the broader policy, regulatory and incentive frameworks that influence the viability of the economic model of projects, with significant variations across sectors and types of project initiators. This economic environment and associated incentives supports or sparks the motivations of project developers to invest in activities with climate benefits.

- Between 2011 and 2014, investments in renewable electric energy reflected the with the level of support provided to projects by the feed-in tariffs, in accordance with project initiators’ motivation for projects with a better risk-return profile.
- The implementation of a new energy performance standard (RT 2012) in the building sector was first anticipated with the help of public incentivizing instruments such as low-interest debt. When the standard became compulsory, private sources of capital (equity and debt) kept being mobilized to sustain the higher levels of investment required by project initiators.

In turn, the financial value chain - and the different sources, intermediaries and other actors – respond to the financial viability of projects. Different public instruments and approaches such as concessional finance and targeted incentives and investment in pilot projects appear to help improve the capacity of the private financial value chain to better perceive risk and opportunities around projects, technologies and sectors.

In many instances, the financial value chain appears ready to develop and deploy the necessary financial instruments and approach needed to finance the low-carbon economy when information and capacity building can demonstrate the viability of these investments.

The way forward

The Landscape of climate finance in France can become a tool to take stock of current progress towards mobilizing public and private finance in support of national climate policy objectives.

Furthermore, it can provide the basis to identify how the financial chain can be scaled up to fit with medium turn objectives. This allows for an informed discussion with public and private stakeholders on how to strengthen, secure and optimize financial support for current and future projects.

This domestic-focused methodology developed by the Landscape in France could allow both developed and developing countries to join in the effort to better understand the interactions between climate action plans, climate investment and climate finance.

I4CE aims to work with other actors to use this study and methodology as a blueprint for domestic climate finance reviews and to help broaden and sharpen the picture currently provided to policy makers on these issues in the post-Paris era.

A domestic climate finance landscape can help policy makers understand and improve the interactions between the incentivizing economic environment and the enabling financial value chain.
The following references concern the main sources used in the 2015 Edition of the Landscape of climate finance in France. They are listed by leading institution and by date. References to the institutions can be found in the report, for example under the format (ADEME, 2013).

<table>
<thead>
<tr>
<th>Institution</th>
<th>Year</th>
<th>Reference</th>
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<tbody>
<tr>
<td>ALSTOM</td>
<td>2006</td>
<td>Carl Bozzuto, Power Plant Economics.</td>
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<tr>
<td></td>
<td></td>
<td>- b Comptes du logement 2012, Références.</td>
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<td>- b 51er rapport à la Commission des comptes des transports de la Nation, tome 1, Les comptes des transports en 2013.</td>
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<td></td>
<td></td>
<td>- c Comptes du logement 2013, Références.</td>
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<td>2015</td>
<td>Construction de logements : résultats à fin janvier 2015 (France entière), Chiffres et statistiques n°612.</td>
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<td>2014</td>
<td>Emissions de GES directs au format « Plan Climat » en France, périmètre Kyoto.</td>
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<td>2014a</td>
<td>Les soutiens à la filière forêt-bois.</td>
</tr>
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<td></td>
<td></td>
<td>- b Compte d’affectation spéciale : aides à l’acquisition de véhicules propres, Note d’analyse de l’exécution budgétaire.</td>
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<td>2013</td>
<td>Institut national de la statistique et des études économiques, Enquête annuelle de consommation d’énergie dans l’industrie (EACEI).</td>
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<td>2014</td>
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<td>2015</td>
<td>Laure Crusson et Séverine Arnault, Le parc de logements en France au 1er janvier 2014, INSEE Focus n°16.</td>
</tr>
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<td>Observatoire BBC</td>
<td>2015</td>
<td>L’Observatoire des bâtiments basse consommation, Statistiques, tableau de bord de la certification (2011-2015).</td>
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<td>Sources</td>
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