The Energy Transition Tax Credit (CITE) in France

Fact sheet

for:

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU)

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This study is based on a policy paper with an overview of greenhouse gas emission reductions and policy instruments in non-ETS sectors across Europe (hereafter referred to as 'Policy Paper'). The Policy Paper can be downloaded from the EUKI website.

FRENCH ABBREVIATIONS

ADEME	L'Agence de l'environnement et de la maîtrise de l'énergie
ANAH	Agence Nationale pour l'Amélioration de l'Habitat
CGEDD	Conseil général de l'environnement et du développement durable
CIDD	Le crédit d'impôt développement durable
CITE	Crédit d´impôt pour la transition énergétique
DGFiP	Direction Générale des Finances Publiques
Eco-PTZ	L'éco-prêt à taux zero
INSEE	Institut national de la statistique et des études économiques
LTECV	Loi relative à la transition énergétique pour la croissance verte
MEEM	Ministère de L'Environnement, de l'Energie et de la Mer
MTES	Ministère de la transition Ecologique et Solidaire
PPE	Programmation pluriannuelle de l'énergie
RGE	Reconnu Garant de l'Environnement
SNBC	Stratégie nationale bas-carbone

ENGLISH ABBREVIATIONS

a	Year
ADEME	Environment and energy management agency
ANAH	French Housing Improvement Agency
approx.	Approximately
CGEDD	General Council for the Environment and Sustainable Development
CIDD	Sustainable development tax credit
CITE	Energy transition tax credit
EPBD	Energy Performance of Buildings Directive
ESD	Effort Sharing Decision
ETS	Emissions Trading System
EU	European Union
EUR	Euro
GHG	Greenhouse gas
INSEE	National Institute of Statistics and Economic Studies
KfW	Kreditanstalt für Wiederaufbau
kWh	Kilowatt hour
LTECV	Energy Transition Toward Green Growth Act
m^2	Square metre
MEES	Ministry of Environment, Energy and Sea
MTES	Ministry for an Ecological and Solidary Transition
Mtoe	Million tonnes of oil equivalent
MWh	Megawatt hour
NAPE	National Action Plan for Energy Efficiency
p.a.	Per year (per annum)
RGE	Recognised Guarantors of the Environment
USA	United States of America
VAT	Value added tax

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1. SUMMARY

In the current context of ambitious climate policies and given the weight of the residential sector in industrialised countries' energy end use and greenhouse gas (GHG) emissions, the promotion of energy efficiency investments in the existing building stock is a major task in climate and energy policy. Enhancing climate action in this sector is all the more warranted as it is considered one of the sectors with the highest energy savings potential. Consequently, incentives such as income tax credits have been introduced in many countries (e.g. USA, Italy) to encourage households to invest in energy-efficient refurbishment of their dwellings.

The energy transition tax credit in France ('Le crédit d'impôt pour la transition énergétique', **CITE**) was implemented in 2014. The specifications regarding the material and installations covered under the CITE scheme were modified multiple times to account for technological change; however, the overall design of the instrument remained basically the same since 2005, when the previous sustainable development tax credit ('Le crédit d'impôt développement durable', CIDD) scheme was introduced. The policy instrument is providing an income tax credit of 30% for expenditures related to certain building renovation work to improve the energy efficiency of private dwellings or the modernisation of heating installations. Between 2005 and 2011, more than six million of the 34 million principal residences in France benefitted from CITE at least once. The cost of a tonne of CO_2 avoided by the tax credit is estimated at EUR 80 to 90.

In Germany, current funding schemes have not been able to provide sufficient incentives for investments in the energy-efficient modernisation of residential buildings. The present renovation rate of about 1% continues to be too low to achieve the federal government's savings targets. In order to achieve higher rates of refurbishment, stepping up government support measures would be helpful, since energy-efficient modernisation requires considerable investment, especially in the older building stock. However, to date such investments can often only be amortised on the market in the course of decades. In this respect, tax incentives could improve the profitability of energy-related renovations and trigger the investments needed.

A tax relief for energy-efficient refurbishment in Germany has been already intensively discussed since 2011, when a draft bill for a tax relief similar to CITE was rejected by the parliament. After several attempts to establish a tax relief designed specifically for energy efficiency improvements, the coalition agreement of the current government again contains a reference to establish such a scheme. Thus, the political acceptability of such a measure in Germany can be assumed. However, the political feasibility is limited by the considerable amount of public expenditure, which is needed for such a scheme. A tax incentive scheme with a similar policy design such as CITE would, for the German context, amount to several billion EUR of public spending. Yet, positive economic stimuli and increased tax revenues can be expected due to additional investments in renovation actions.

Regarding the policy design of a tax incentive scheme, it is also important to consider potential drawbacks for the effectiveness, namely windfall and rebound effects as well as cannibalisation with similar subsidies. In the light of the heterogeneity within the residential sector, a tax incentive should preferably be targeted towards groups where the number of likely free-riders is expected to be relatively low. In addition, low-income households and house-owners with liquidity constraints should receive special attention to be eligible for such a scheme.

2. INTRODUCTION TO THE INSTRUMENT

The energy transition tax credit in France ('Le crédit d'impôt pour la transition énergétique', **CITE**) is a tax credit, which is available for private households in France to trigger households' investments in energy conservation and renewable energy equipment in their dwellings. It succeeded the sustainable development tax credit (Le crédit d'impôt développement durable, **CIDD**), which had been in place since 2005. In general, all owners and tenants who carry out renovation work in their property (as their principal residence) are eligible for this scheme. No means testing is required, so eligibility is not subject to the level of household income.[1]

From an economic point of view, the CITE scheme is a **tax incentive** to carry out energy-related renovations, since the total investment is reduced by the subsidy in each case, thus increasing the profitability of the measures supported. In principle, CITE can set two kinds of incentives:

1) Energy efficiency related renovations that otherwise would not have taken place (or would have taken place later) are stimulated.
2) A higher level of ambition is achieved in cases where energy efficiency related renovations are already planned to be carried out.

Since 2015, CITE has been capped at a maximum of **30% of the expenses on eligible renovation works**. There are limits on the level of expenditure that can be used to obtain CITE. The maximum tax credit subsidy for a single person is EUR 8,000 and EUR 16,000 for a couple, which increases by EUR 400 for each minor child in the household. The allowance can be used once within a consecutive five-year period. The CITE scheme differs from a direct subsidy insofar as there is a delay in the reimbursements and as households need to have conducted a tax declaration.

The CITE scheme covers a broad range of renovation activities to increase energy efficiency and to improve heating systems in private dwellings, ranging from double glazing windows, wall insulation and the installation of heat pumps or different types of efficient boilers.[2]

The installations and materials must usually meet specific energy performance standards. In addition, the renovation work must be entirely undertaken by a registered builder, a so-called RGE ('Reconnu Garant de l'Environnement'), to ensure a minimum standard for the quality of renovation work carried out.

[1] All information on CITE are derived from the current French legislation, Art. 200 quater Code Général des Impôts.

[2] More detailed information on the conditions and eligibility criteria to benefit from CITE can be found in Ademe (2018) and I´administration francaise (2018).

3. NATIONAL CONTEXT

3.1 National climate policy in France

Since Emmanuel Macron became president of France in May 2017, addressing climate change has been a priority on the French policy agenda. France is also driving force for more ambitious climate goals on the European level. In March 2018, France called on other European Union (EU) Member States to adopt a regional carbon price floor of EUR 25 to EUR 30 per tonne CO_2 for power generators in the EU Emissions Trading System (ETS) to promote a shift away from coal and towards more climate-friendly energy sources (Reuters, 2018). Furthermore, France pushes the EU to increase the ambition of its emission reduction targets under the Paris Agreement (MTES, 2017a).

Also given its strong reliance on nuclear energy, the country's greenhouse gas (GHG) emissions per capita are already below the EU average and more than a third lower than Germany's (Eurostat, 2017). Since the late 1990s, France has fully decoupled CO_2 emissions and primary energy supply from economic and population growth (Figure 1). Therefore, the carbon intensity of the French economy has been declining rapidly in recent years, largely due to the reduction in industrial demand, greater energy efficiency and the decreasing reliance on fossil fuels.

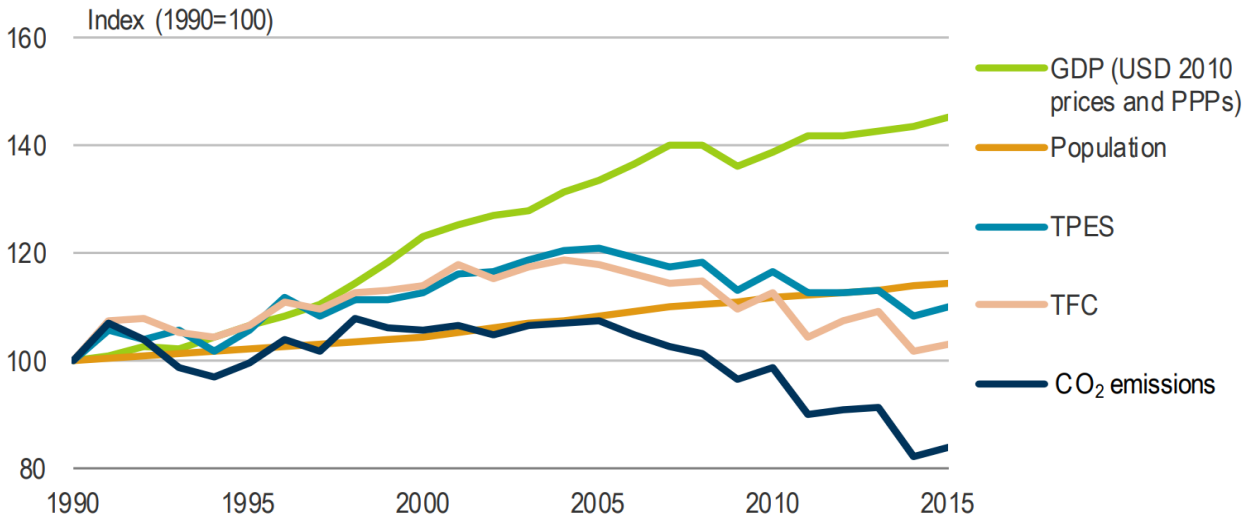

Figure 1: CO_2 emissions, energy consumption, population growth and GDP in France, 1990–2015 (IEA, 2016);

TCF: Total Final Energy Consumption; TPES: Total Primary Energy Supply.

Of relevance for the decarbonisation of the energy sector is that almost three quarters of the generated electricity comes from nuclear power plants (Figure 2). This is the highest share in the world. Renewables, dominated by hydro power, currently have a share of 19%, but this share is projected to rise to 40% by 2030 (Légifrance, 2015). The few remaining coal power plants, which currently have a 2% share of electricity generation, will be phased out by 2021 (Independent, 2018). The contribution of nuclear energy to the electricity mix was projected to decline to 50% by 2025, but the government is currently working towards a 2030 to 2035 timeframe to avoid increased GHG emissions and the risk of supply shortages (Reuters, 2017).

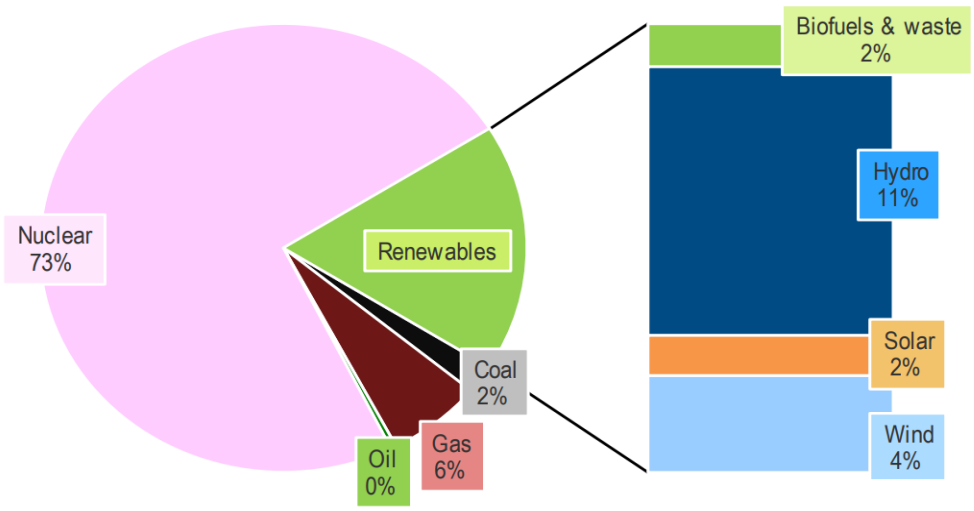

Figure 2: Electricity generation in France by source, 2015 (IEA, 2017).

The foundation of the current French national climate and energy policy is the Act on Energy Transition for Green Growth ('La loi relative à la Transition Énergétique pour la Croissance Verte', LTECV), enacted on 17 August 2015. The Act requires producers and consumers of energy in all sectors to play their part in reducing GHG emissions, while at the same time leaving France leeway to promote economic growth. At the national level and all sectors combined, these commitments concern in particular:

- A 40% reduction in GHG emissions by 2030 and a 75% reduction by 2050 ('factor four') from 1990 levels[3];
- A cut in final energy consumption of 20% by 2030 and 50% by 2050 compared to 2012 and a 2.5% annual reduction rate for the final energy intensity until 2030.

In order to implement the long-term targets of the LTECV in a transparent and deliberate manner that provides investors with certainty, the law required two strategic plans to be developed: the Multiannual Energy Programme 2014–2020 ('Programmation Pluriannuelle de l'Énergie' 2014–2020, PPE) and the national low-carbon strategy ('Stratégie Nationale bas-Carbone', SNBC). The SNBC sets carbon budgets that reflect the targets of the LTECV and outlines cross-sector and sector-specific policies to achieve them. For instance, it sets specific ambitions for the construction sector (new constructions and renovations) since, in its reference scenario, it aims for reduced GHG emissions in this sector by 54% between 2013 and 2028, and by 87% by 2050.

In addition, the French carbon tax (mainly covering the transport, industry and buildings sectors) is already among the highest in the world. It increased from EUR 30.5 in 2017 to EUR 44.6 per tonne CO_2equivalent (tCO_2e) in 2018 and is scheduled to reach EUR 86.2 per tCO_2e in 2022 (World Bank and Ecofys, 2018). This increase is occurring at an accelerated rate compared to the initial trajectory outlined in the LTECV in 2015.

[3] In comparison to Germany's 80% GHG emission reduction goal for 2050, France's 75% target looks less ambitious at the first glance. However, it is important to take into account that by 1990 the French electricity sector had already very little emission intensity due to the high share of nuclear energy.

3.2 Sector context

Generally speaking, the buildings sector offers considerable potential for reducing energy use and GHG emissions, particularly through energy-efficient renovations. The energy retrofitting of dwellings is therefore an important part of the efforts to achieve the sector-specific commitments that France and Germany have made in recent years. In 2014, the buildings sector accounted for 40% of the final energy consumption in France and for 20% of GHG emissions (MEES, 2015). It is the largest sector by energy consumption, which also points to the relatively low-carbon intensity of the French electricity sector (see chapter 3.1).

In 2016, the number of housing units in France was at 34.5 million (INSEE, 2016). According to official data of the French National Institute of Statistics and Economic Studies (ibid.), these units had the following characteristics:

- Principal residences accounted for 28.4 million dwellings (82.3% of the housing stock);
- Second homes were at 3.3 million dwellings (or 9.5% of the stock);
- Uninhabited dwellings were at 2.9 million (8.2% of the housing stock);
- Single- and two-family houses represented 19.3 million dwellings (56.0% of the housing stock); and
- Apartment buildings represented 15.2 million dwellings (i.e. 44.0% of the housing stock); within the apartment buildings, condominiums represented approx. 8 million units; about half of the condominiums were occupied by owners, the other half were tenants.

In France, the first thermal building code was implemented in 1974 and has been updated and strengthened six times since then. Around 55% of the current residential building stock was built without any energy building codes (INSEE, 2017). It is assumed that approx. 20 million buildings in France are poorly insulated in terms of energy efficiency (Tandem, 2015). As a result, the average performance of the building stock in terms of energy consumption per square metre (m^2) is one of the lowest in Europe (Ademe, Enerdata, 2011). At present, the average energy consumption of buildings in France is approx. at 240 kWh/m²a, and in Germany at 177kWh/m²a (Tandem, 2015). For comparison, modern buildings have an average energy consumption of only 80–110 kWh/m²a. New buildings with very low energy consumption make only about 1% of the total building stock in France (Sebi et al., 2018). The efficiency standards of dwellings with the highest energy consumption are comparable to the German building stock which has been built during the economic upswing after World War II.

With the development of the French nuclear fleet in the 1980s, electricity has become a widespread heating source in France: 34% of dwellings (individual or collective) are heated with electricity (mostly direct electrical heating), compared to 46% with gas and 16% with oil (Cerema, 2017). The share of electricity has been stable for 20 years, but that of oil is rapidly declining in favour of city gas, whose price is more stable and does not require storage (Andriosopoulos, 2017). As for the firewood market share, it remains stable at around 3%.

To estimate the current renovation rate, the EU ZEBRA2020 project (ZEBRA, 2016) developed a ‘major renovation equivalent rate’ to monitor and benchmark renovation activities in line with the Energy Performance of Buildings Directive (EPBD) Article 7 definition, with France having the second-best rate in the EU concerning the residential sector (1.75% of the residential stock has undergone a major renovation in 2013). However, regarding the important aspect of deep retrofitting in the existing building stock, despite all economic incentives and related financial instruments established in France, 40% of thermal renovations are light (OPEN-ADEME 2015), i.e. maximum one measure is implemented and the number of maintenance-work-only projects (i.e. renovation without thermal improvement) is still

high. This lock-in effect due to missed energy efficiency improvement opportunities is particularly problematic.

The potential for energy savings in the French residential building sector remains high and is one of the top priorities in the French energy efficiency policy roadmap (MTES, 2015). Several regulatory instruments have been implemented in recent years to achieve the climate and energy policy goals in the private residential sector (see chapter 4.4). For instance, income tax credits for the purchase of energy-efficient goods, zero-rate loans for energy renovation, reinforced constraints on the energy consumption of buildings and mandatory thermal renovations during structural work on buildings (Andriosopoulos, 2017).
Among others (see chapter 3.1), the following sector-specific commitments have been made in the LTECV Act:

- Article 1 of the LTECV Act states that the whole building stock must be completely renovated by 2050 to 'low-energy buildings' or similar standards;
- Article 3 of the LTECV Act sets a target of 500,000 housing units per year to benefit from an energy renovation, half of which are occupied by low-income households, to reduce fuel poverty by 15% by 2020;
- Article 5 of the LTECV Act states that all private residential buildings, which currently have a primary energy consumption of more than 330 kWh/m^2/year, corresponding to the building code labels G and F (approx. 30% of the fleet), must have been subject to energy retrofits by 2025.

According to a study led by the French energy ministry (MTES, 2015), the current policy mix will permit France to achieve the main quantitative targets set by the LTECV Act. However, this scenario considers the full implementation of ambitious targets (e.g. 500,000 existing dwellings retrofitted each year) without specifying any renovation level requirements to achieve this target (Sebi et al., 2018). In addition, quantitative studies that would prove the effectiveness of energy-orientated refurbishment measures in reducing GHG emissions are rare.

Furthermore, the regulatory leeway in the buildings sector is considered to be relatively weak: The propensity of households to save energy is largely related to the cost of energy, and the use of central heating is, among others, one major obstacle in achieving savings (Belaïd and Garcia, 2016). Moreover, most incentives are relatively ineffective for tenants, especially those with low incomes (Charlier, 2015).

4. GENERAL DESCRIPTION OF THE INSTRUMENT

4.1 History

Financial incentives such as income tax credits have been introduced in many countries to encourage households to invest in energy-efficient retrofitting of their dwellings. In some countries the first wave of tax credit implementation occurred in the 1970s in the post oil-crisis period, e.g. with the US tax credit system from 1977 to 1986. In Europe, Italy for instance has a similar scheme in place since 2007 ('Detrazioni fiscali per il risparmio energetico del patrimonio edilizio esistente'). As such, the CITE scheme is not an entirely new policy type and France could derive experience and pattern from various preceding international tax credit variations.

In 2005, the French government modified the previously existing tax credit schemes for private households (Article 200 of the General Tax Code) and introduced the sustainable development tax credit (CIDD). The tax credit was initially implemented for the period from 2005 to 2009 and was extended until 2014.The specifications regarding the material and equipment covered under the scheme were modified multiple times to account for technological change (most notably in 2006, 2007 and 2009).

CITE has replaced the CIDD scheme as of September 2014. Thereby, a single 30% rate replaced the two previously existing CIDD rates for different types of renovation works. Most recently, the procedures for applying CITE were amended by the Finance Act No. 2017-1837 of 30 December 2017 for 2018, which extends CITE until 31 December 2018.

Currently, the French government is pursuing a plan that from 2019 onwards CITE should be converted into an investment bonus, paid at the moment when the work is carried out. Further details of this plan have not been released yet.

4.2 Legal basis

Entitlement to the tax credit scheme CITE is guaranteed by law (Article 200 of the General Tax Code). All natural persons that are owners, tenants or rent-free tenants of their principal residence are eligible (tit. 28, chap. 1, sec. 1, BOI-IR-RICI-280-20150422) (Res Legal, 2018). The tax credit may be claimed for investments only in the principal residence; second residences are not eligible. The tax credit is granted on the income tax, after the eligible person has submitted the invoice for the investments and after other tax benefits and subsidies (except for subsidies for the installation of a power plant) have been deducted. The authority responsible for the administrative process is the respective tax office, the so-called DGFiP ('Direction Générale des Finances Publiques').

Besides energy-efficient renovation work, the tax credit also applies to the building-integration of the following renewable electricity generation technologies: solar, wind, hydro and biomass energy (art.18 bis, Annex IV of the 'Code Général des Impôts'). However, expenditures in solar energy installations for the sole production of electricity paid after 1 January 2014 are no longer eligible for the tax credit (Res Legal, 2018). The Finance Act for 2016 however enlarged the eligibility of the tax credit to hybrid solar systems producing both electricity and heating or hot water (art.106, loi de finances 2016). The capacity of the eligible plant shall not exceed 3 kWp. Plants that generate more than 3 kWp are eligible only if the electricity consumption of the building is higher than half of the nominal installed capacity (Tit. 28, chapitre 1, sec. 2, BOI-IR-RICI-280-10-20-20120912) (Res Legal, 2018).

The procedures for applying CITE were amended by Finance Act No. 2017-1837 of 30 December 2017 for 2018, which extends the scheme until 31 December 2018 (CEDEF, 2018). In accordance with Article 79 of the 2018 Finance Act, eligible equipment is amended by the decree of 30 December 2017 (Legifrance, 2018).

4.3 Functioning

In order to encourage private individuals to renovate their homes and increase energy efficiency, CITE provides a tax credit as a financial incentive. CITE enables private individuals, regardless of whether they pay taxes, to be reimbursed via their tax declaration for up to 30% of the cost for certain types of renovation work, such as heating system improvements, insulation and the installation of heating facilities.[4]

More specially, CITE provides for a refund of 30% of the total cost of energy renovation work, up to a cap of EUR 8,000 for a single person, EUR 16,000 per couple and an additional EUR 400 for each child in the same household (Article 200 of the General Tax Code). The tax credit can be granted once within a period of five years. To be eligible for the tax credit, the building in which the equipment is used must be the principal residence of the owner or tenant and at least two years old; for the installation of renewable heating equipment, new buildings are also eligible. Eligible investments include both energy conservation measures, such as opaque and glazed surface insulation[5], heating system improvements[6] and renewable energy systems, such as wood heating appliances, photovoltaic panels and solar heaters.

CITE needs to be distinguished from a 'tax relief'. While a tax relief offers only a reduction in the amount of income tax payable ("directly **reduces the income** on which to pay tax"), a tax credit entitles to a refund by the tax authority, even if the respective individual does not pay income tax ("directly **reduces the amount of tax** to be paid"). If a taxpayer is entitled to receive a greater sum than he is obliged to pay, the tax authority must provide a cheque for the balance. If the applicant is not subject to tax, the total amount is paid out (Article 200 of the General Tax Code, tit. 28, chap. 3, sec. 1 BOI-IR-RICI-280-20150422) (Res Legal, 2018).

The tax credit is calculated on the amount of eligible expenditure, after the deduction of aid and subsidies received elsewhere. Thus, if a household receives public aid for the purchase of equipment and materials (e.g. from local authorities or the National Housing Agency, etc.), the calculation will be based on the remaining amount spent by the household (i.e. cost of the equipment minus aid received). To claim the tax credit, the respective individual needs to send in the invoice from the builder with his tax return.

In accordance with Article 79 of the 2018 Finance Act, some rates for eligible equipment are amended from 1 January 2018 as follows:

- Oil-fired boilers are excluded from the scheme (exception: those meeting enhanced performance criteria still benefitted from a reduced 15% rate until 30 June 2018).

[4] More detailed information on the conditions and eligibility criteria to benefit from CITE can be found on Ademe (2018) and l´administration francaise (2018).

[5] Opaque surface insulation refers to the insulation of the attic, the walls (indoor or outdoor) or the floor (or a combination of different types of insulation), while glazed surface insulation refers to the installation of more energy-efficient windows and/or shutters.

[6] Heating system improvements are, among other, the installation of heating regulation systems (thermostatic valves, heat cost allocators, ambient thermostat, programming equipment) and the installation/replacement of energy-efficient heating systems (boilers, heat pumps).

- The replacement of single glazing with double glazing with a reduced rate of 15% until 30 June 2018.
- Between 1 January and 31 December 2018, the 15% credit is still available for both cases if an estimate has been accepted and a deposit is paid by 30 June 2018.
- Insulating shutters and entrance doors are excluded from CITE as of 1 January 2018.
- CITE is extended to certain costs of equipment for the connection to district heating or cooling networks, as well as to the performance of an energy audit in the respective building.

In addition, since 1 January 2015, the professionals carrying out the work must be 'Recognised Guarantors of the Environment' ('Reconnus Garant de l'Environnement', RGE)[7]. This is to ensure that as a prerequisite for public funding, the companies entrusted with the renovation work are sufficiently qualified and technically capable of carrying out energy-related renovations.

4.4 Interlinkages with other policy instruments

There are three policy instruments which are closely related to CITE and support private households for retrofitting their home in order to increase energy efficiency: interest-free loans, reduced value added tax (VAT) rates and special renovation subsidies for fuel poor households (**Error! Reference source n ot found.**). Increasing energy efficiency is one goal of these instruments, but they are often not limited to energy-related renovation work. The policy instruments have the following characteristics:

1. Most notably, the **'l'éco-prêt à taux zero' (Eco-PTZ)** loan scheme provides an interest-free loan of up to EUR 30,000 available to property owners carrying out energy retrofit work. **The Eco-PTZ loan scheme is cumulative with CITE since March 2016** without any restrictions**.** The lending period ranges between three to 15 years. The scheme was introduced in 2009. It has been redesigned in recent years (alignment of eligible equipment with those eligible for CITE and the possibility to combine the two schemes). However, in a context of low interest rates, the Eco-PTZ has seen a sharp decline in demand since its creation and is nowadays only occasionally used by households (22,725 loans were granted in 2016), leading to an estimated cost for the state of EUR 75 million for 2016 (CGEDD, 2017).
2. Secondly, a **reduced VAT rate of 5.5% (TVA à taux réduit),** which applies to various kinds of renovation work (including installation, maintenance, repair and overhaul), as well as removal and disposal of existing structures, products or equipment, and also materials and equipment eligible for CITE. The system has been redesigned in recent years: From 1999 to 2014, a single reduced rate (5.5%, then 7.0% as from 2012) was applied to all maintenance-improvement work on dwellings, including energy renovation projects. Since 2014, energy renovation work has been separated from other work, namely maintenance-improvement of housing: the reduced VAT rate applicable was lowered to 5.5% while at the same time the reduced rate of VAT applicable to other maintenance and improvement work was set at 10% (CGEDD, 2017).

[7] A public register of professionals who are RGE-certified can be found here: http://renovation-info-service.gouv.fr/trouvez-un-professionnel

3. Another policy instrument closely related to CITE is the **Habiter Mieux programme**, carried out by the French Housing Improvement Agency ANAH *(*'Agence Nationale pour l'Amélioration de l'Habitat'). This scheme is targeted at low-income households to mitigate energy poverty. To qualify for this aid, the renovation work must lead to a reduction in energy consumption of at least 25% per household. This programme amounted to EUR 349 million in public spending in 2016 and enabled the renovation of 40,726 housing units in 2016 (the initial target set was 70,000 units, for 2017 it is 100,000 units) (CGEDD, 2017).

Table 1: Policy instruments for energy-related housing renovation (private households) (based on CGEDD, 2017 - Report of the CGEDD on the coordination of aid and subsidies)

	CITE	Eco-PTZ	TVA à taux réduit	Habiter Mieux
Founding of the scheme	2014 (CIDD: 2005)	2009	1999	2010
Beneficiaries	Owners, Tenants, Landlords	Owners, Tenants, Landlords	Owners, Tenants, Landlords	Owners, Low-income households, Landlords
Required age of the dwelling	2 years	Before 1990	> 2 years	> 2 years < 15 years
Tax reduction / subsidy by scheme	30% of eligible expenses deducted from income tax	Loan at 0% interest rate over 3 to 15 years	Reduced VAT rate: 5.5%	Various, depending on dwelling type and ownership
Amount granted	EUR 8,000 for singles and EUR 16,000 for couples within 5 years	EUR 10,000 (basic modernisation), EUR 30,000 (extended modernisation)	-	Between EUR 20,000 and 60,000 depending on various criteria
Public expenditures in 2016 (EUR million)	1670	75	1100	349

5. IMPACTS OF THE POLICY INSTRUMENT

5.1 Effectiveness

In the context of energy efficiency retrofitting in the residential sector, private households face many barriers, one of them being imperfect information. As a result, only few households undertake investments in energy efficiency measures – even though they might be profitable for many of them (Nauleau, 2014). To incentivise households to undertake such investments, the CITE[8] tax scheme was introduced by the French government.

As data from the energy management survey (supervised by the ADEME) revealed, French households have benefitted from the tax credit scheme far more compared to other related instruments in the building sector. That is, between 2005 and 2011 for each year more than 50% of households that invested in retrofitting their dwellings have used the tax scheme (even up to 70% since 2007), while only about 7% of them used other types of subsidies (Nauleau, 2014). The survey further revealed that the tax scheme is widely known, i.e. by approx. 85% of households in 2009, and that it has been considered "as the most decisive incentive" for retrofitting since 2006 (from data collected between 2002 and 2011) (Nauleau, 2014). Nauleau's research results also suggests "a significant and positive effect of CITE on householders' investment decisions but with a lag of two to three years depending on the category of retrofits".

However, the effectiveness of the CITE tax scheme is rather difficult to assess; especially the impact of the policy on GHG emissions is difficult to isolate. In an extensive governmental study (CGEDD, 2017), it was noted that the results of public policies pursued by the French government in the building sector are often expressed only in terms of the number of homes renovated, even though France's commitments at European and international level are expressed in terms of GHG emission or energy consumption reductions.

In a modelling exercise carried out by ADEME, the effects of the current energy renovation support schemes (including CITE, 5,5% VAT, Eco-PTZ and ANAH) were evaluated, considering their evolution between 2015 and 2017 and then replicating them identically from 2017 until 2030. The conventional energy consumption of the housing stock for the year 2016 was estimated at 525 TWh. The **instruments** mentioned above were estimated to have generated an additional **EUR 10.6 billion in energy renovation investments in 2016**, which collectively reduced energy consumption by **0.76 TWh, corresponding to 0.15% of the housing stock's total consumption**. If this trend continues, this would lead to energy savings of about 18% of the existing housing stock by 2030.

When looking at the CITE scheme in isolation, the latest official figures were reported by the MEEM (2017): The **implementation of CITE over the period of 2009 to 2012 led to a reduction of the annual final energy consumption by 0.78 million tonnes of oil equivalent (Mtoe) in 2013, 0.93 Mtoe in 2016 and was projected to amount to 1.08 Mtoe in 2020**. Also, the report outlined that in 2015 alone, 1.12 million households had benefitted from the tax credit scheme for works carried out in the previous year. On average, the tax credit granted was EUR 800 per household (for works with an amount of EUR 4,100 on average). The impact on emission reductions was unfortunately not quantified.

Taking a closer look at **earlier figures** reported, the evaluation of CITE by several French ministries in 2011 reveals important insights for the first years of the scheme in place: According to the synthesis report, CITE had already **reduced the primary energy consumption of the residential stock by**

[8] CITE is used interchangeable with CIDD in the following chapters due to the very similar policy design of these instruments and for ease of reading.

almost 8% between 2008 and 2010. Furthermore, the implementation of the scheme was said to have **reduced the GHG emissions of the residential sector by almost 7.5% for the same period**. Hence, the government report concluded that CITE had already contributed to the achievement of environmental objectives, namely the reduction of energy consumption and GHG emissions (MEDDTL et al., 2011). With the focus on future impacts, the report projected that maintaining the CITE scheme until 2020, as it was set up during the evaluation period, would allow for a 30% reduction in the housing stock's emissions between 2008 and 2020 and a 30% reduction in residential energy consumption. At that time, the tax credit scheme was considered a central although not sufficient policy instrument to reach the ambitious environmental objectives for the buildings sector (MEDDTL et al., 2011).

As this review has shown, various rough estimates exist on the effectiveness of the CITE tax scheme in terms of reducing energy consumption and GHG emissions. The CITE scheme has changed several times over a long period (regarding eligibility criteria and level of support), making a final assessment rather difficult. Also, CGEDD (2017) underlines that there is no complete statistical basis for the energy renovations carried out in the housing stock. Hence, the number, content, cost and performance of these renovations are estimated by surveys or by the exploitation of various databases without a clear harmonisation of their underlying methods. The figures stated above should hence be regarded with prudence. Despite these uncertainties, regarding the exact effect of the CITE scheme, a common understanding in the reports reviewed was that CITE has *contributed* to achieving the national and sector targets as it helped to induce energy renovations in the residential sector.

However, it must be noted that CITE shares the same challenges as other energy efficiency related incentive schemes. Namely, two effects are of particular relevance to hamper the effectiveness (Bozonnat et al. 2016):

- When implementing energy efficiency measures, a **rebound effect** can occur. This is the case where a consumer tends to increase his/her consumption of the same good or service in reaction to the decrease of the price thereof. In the case of energy renovations, i.e. when a dwelling becomes better insulated, the household's energy bill decreases, at equal indoor temperature. It is thus tempting for the consumer to increase the thermal comfort, which in turn harms the targeted energy savings.
- Energy efficiency related incentive schemes can also support **free-ridership** (or **windfall gains**). Free-ridership describes a phenomenon where public money is provided to households that would have undertaken the envisaged actions anyways, also in the absence of the financial incentive. As research by Nauleau (2014) has shown (see Chapter 5.2), free-ridership is a serious negative side-effect in the context of CITE.

5.2 Cost efficiency

Besides the principal objective of an instrument to achieve the targets it is designed for, the related investment is an important criterion for assessment. As governments' budgets are constrained, the aim of successful policies in the building sector should be to mitigate GHG emissions, foster energy efficiency and to increase the share of low-carbon energies at the lowest possible costs. Figure 3 below illustrates the breakdown of total public expenditures for national incentive schemes related to the energy renovation of housing over the last decade (please see for a detailed description of these instruments chapter 4.4). In 2016, a total of EUR 3.2 billion was spent on CITE, Eco-PTZ, TVA à taux réduit and Habiter Mieux.

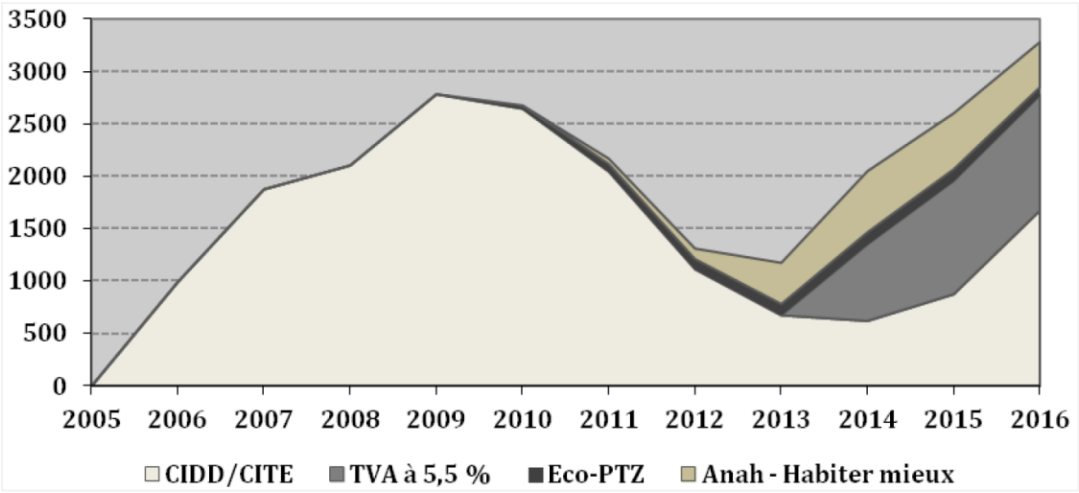

Figure 3: Expenditures for the energy renovation of housing by national public support schemes in France in EUR million (CGEDD, 2017).

Since 2005, the **annual public costs** for CITE has varied **between EUR 0.6 billion and EUR 2.7 billion per year** (Figure 3). According to the latest available data, the public spending on the CITE scheme amounted to approx. **EUR 1.6 billion in 2016** (CGEDD, 2017). In recent times, the replacement of the CIDD scheme by CITE resulted in an increase of the expenditures, in particular due to the following amendments:

- The application of a fixed tax credit rate of 30% of the total amount of expenses, regardless of the type of energy retrofit carried out (note: the previous CIDD scheme differentiated the applicable rates according to the type of work performed);
- The possibility for private households to carry out only one type of work (logic of renovation "par éléments", i.e. by single elements), whereas the previous CIDD scheme has been based on a logic of 'bouquet de travaux' (compulsory combination of several renovation actions).

In the 2011 evaluation report on the first years of CITE implementation, French ministries have particularly considered the **cost efficiency** of the scheme by analysing the public cost of reducing CO_2 emissions. Therefore, the ratio of total public expenditure to the sum of the CO_2 emission savings over the lifespan of the respective installations and equipment was assessed. The cost per tCO_2 avoided by the CITE tax scheme was estimated at **approx. 80 to 98 EUR per tCO_2 over the period 2008 to 2012**. As the estimate is not considering the rebound effect, these figures might however underestimate the actual costs per tCO_2 avoided (MEDDTL et al., 2011).

When analysing the cost efficiency of the CITE tax scheme, two further considerations should be taken into account that go beyond the mere discussion on public costs for the reduction of CO_2 emissions:

1. Whether the money invested was spent on measures with the potential to induce significant GHG emissions/energy consumption reductions;
2. Whether the money spent was driving investments that otherwise would not have occurred.

With reference to the first consideration, CITE has for a long time been criticised for **not concentrating on the most efficient measures** in terms of leverage effects and cost-benefit ratios to induce energy savings (MTES, 2017b). For instance, in the 'Revues de Dépenses', the French expenditure review, it was laid out that the insulation of windows has led to a significant public expenditure even though this type of measure represents a rather unfavourable relationship between the public spending and the energy savings induced. CGEDD (2017) reports that the average amount required to save one MWh/year is EUR 1,350 for insulating windows while it is only EUR 100 for roof insulation measures. For these reasons, during the last major amendment of the scheme, it was decided to concentrate CITE on the most efficient measures, e.g. insulating attics or changing boilers (MTES, 2017b).

Regarding the second consideration, i.e. whether the public spending was driving *additional* investments (and hence additional energy savings), studies are in general rather pessimistic with regard to financial incentive schemes such as CITE. Nauleau (2014) puts forward the issue of '**free-ridership**', defined as behaviour occurring "when the agents targeted by the policy take the incentives but would have made the investment anyway" (Alberini et al., 2014). Free-ridership **needs to be taken into consideration to not overstate a policy's efficiency**, for instance when assessing energy or GHG emission savings. In an evaluation for the CITE scheme, 52% to 62% of households that benefitted from the scheme declared themselves as free-riders (for the period 2006-2011), supporting the suggestion that free-riding is an important phenomenon regarding financial incentives (Nauleau, 2014).

Given the above considerations, it can be acknowledged that efforts have been undertaken by the French government to refocus the design of the tax scheme to allow for greater cost efficiency due to the focus on particular measures. However, the problem of free-ridership reduces the potential for better cost efficiency to a large extent. Although it might not be possible to fully solve this problem, efforts should be undertaken to identify households which have no prior intention to conduct energy efficiency measures and to provide them with the financial incentive to induce actual *additional* energy savings activities.

5.3 Co-benefits and side-effects

Several co-benefits were reported in the context of CITE. According to an evaluation report by MEDDTL et al. (2011), the CITE scheme supports the **development of technological and organisational innovations**, such as through a market shift towards the most efficient equipment. Furthermore, CITE is a stimulus programme **for the French economy**. As MEDDTL et al. (2011) points out, it was observed that the sales of heat pumps have been multiplied by five times since the establishment of the tax scheme. Similarly, sales of the most efficient domestic wood-burning appliances increased three-fold between 2003 and 2009. The increased demand for energy renovation installations and equipment was estimated to have had a considerable positive impact on the corresponding economic sectors.

Moreover, the tax scheme likely has positive effects on **decreasing activities in the informal economy**: households need to document their expenditures for them to be accounted for CITE; since 2015, professionals carrying out the renovation works must also be 'recognised'. These features allow for a greater transparency and traceability of funds. Hence, the French state might increase tax

revenues from renovation measures by actively supporting energy efficiency. In addition, the **inflationary effect** is a potential side-effect of the CITE scheme, describing the potential increase in the price of work related to energy renovations as a consequence to (the announcement of) a subsidy or tax credit. Bozonnat et al. (2016) report that there was no assessment of this effect until 2016. The authors note, however, that the inflationary effect is likely to be little as markets are naturally regulated at European level.

5.4 Success factors and challenges

By its design, the CITE tax scheme is **open to all households** in France, regardless of the level of income or other socio-economic characteristics. Hence, in principle, all owners and tenants who carry out renovation work in their dwellings are entitled to receive the tax credit for such investments. This universal approach led to concerns regarding **distributional issues**: As it has been observed, about 80% of the households benefitting from CITE had an income superior to the median income (MTES, 2017b).

One of the scheme's challenges for households is that it requires them to invest upfront in energy efficiency measures. The tax credit is usually only released after a long period when the expenditures for the energy efficiency measures have already been undertaken (i.e. during the following fiscal year). Therefore, the policy design is particularly problematic for low-income households with **liquidity constraints**. For this reason, from 2019 onwards, the tax credit is envisaged to be transformed into a bonus, at least for low-income households (MTES, 2017b). By allowing households to receive the financial support as soon as the respective work is carried out, the amended version of the support scheme could have a considerable positive impact on the level of implementation of energy efficiency measures in low-income households.

A further challenge to reduce energy consumption in the residential sector is underinvestment in energy efficiency due to **split incentives**[9] between landlords and tenants. As Charlier (2015) points out, considering that a considerable share of occupied housing units are rental units (i.e. 36.3% in France), "the amount of energy consumption affected by […] misaligned incentives might be substantial". Charlier shows that financial measures such as the CITE tax scheme are "ineffective in inducing energy-efficient investments in the context of split incentives". Hence, Charlier (2015) points out that "tenants are doubly penalised: They have high energy expenditures because they live in less energy-efficient housing units and are poorer than homeowners". The challenge of split incentives is particularly relevant for the German context due to the high share of tenancy.

Finally, the problem of **free-riding** as outlined already in the previous sub-chapters is a challenge for the success of the tax scheme. Charlier (2015) therefore argues that "a strong assessment of this measure" needs to be undertaken "to avoid free-ridership and inefficiency on the part of the public action".

[9] "Split incentives arise when participants in an economic exchange do not share the same goal. When the owner and the occupier of a housing unit are different people, a split in incentives occurs. Whereas landlords want to minimise the purchase cost of energy systems (heating and hot water) and have no return on this investment, tenants want to minimise their energy bill. Therefore, neither party wants to invest in energy-efficient systems. Landlords are not inclined to make investments in energy efficiency because tenants are the ones receiving the dividends" (Charlier, 2015).

6. TRANSFERABILITY

6.1 General comparability of the context

Both Germany and France have set themselves ambitious goals in the context of international and European climate commitments, for instance regarding the reduction of GHG emissions in the years to come. In this context, the buildings sector plays a central role since buildings account for a significant proportion of the national energy consumption, i.e. 43% in France and 40% in Germany and for about 20% to 30% of national GHG emissions in both countries. In terms of the carbon intensity of the heating fuel supply, the French heating supply has a slightly lower carbon intensity but still large abatement potentials form replacing natural gas (IEA, 2017). Therefore, both countries need to put additional effort in the reduction of the buildings sector's energy consumption and the supply of heating systems based on renewably energy (Tandem, 2015).

The building stock conditions in Germany and France are comparatively similar: In both countries, a large portion of the buildings was constructed before the first legal requirements for thermal insulation were established. About 78% of apartments do not meet the targeted energy consumption of 80 kWh/m^{2}a by 2030. As Sebi et al. (2018) points out, France and Germany therefore aim for a substantial increase in renovation activity, both in terms of number of dwellings and in terms of level of ambition (i.e. comprehensive retrofits instead of single-measure activities). According to Rüdinger (2013), approx. 550,000 flats in France and 720,000 flats in Germany would need to be renovated per year in order to meet the national goals (see Table 2).

Table 2: Comparison of sector-specific targets for 2020 in France and Germany. Source: Rüdinger, 2013.

2020 target	France	Germany
Reduction of energy consumption*	-20%	-20%
Reduction of energy consumption in buildings	-38%	-20%
Goal for renovations per year	500,000 (2% p.a.)	720,000 (2% p.a.)
Improvement of energy intensity	-2.5% p.a.	-3.7% p.a.

*** The target of -20% is defined in final energy and in relation to the 2020 value of a trend scenario in France. In Germany, the target is set in primary energy compared to the 2008 reference year.**

However, achieving a greater impact with their current policy mix to incentivise renovation activity is a challenge for both countries. For instance, the split incentive dilemma, as described in chapter 5.4, is a great obstacle. In Germany, the building stock is characterised by a 55% rental rate, "which is unique in Europe" (Sebi et al., 2018). In addition, the current funding schemes have not been able to provide sufficient incentives for investments in the energy-efficient modernisation of residential buildings in Germany. The renovation rate continues to be too low to achieve the federal government's savings targets. To achieve the higher rate of refurbishment, government support measures are helpful, since energy-efficient modernisation requires considerable investment, especially in older buildings. However, to date such investments can often only be amortised on the market in the course of decades. In this respect, tax incentives could improve the profitability of energy-related renovations.

6.2 Properties of the instrument

Generally speaking, the CITE scheme should be relatively easy to transfer to the German context since there has been a longstanding debate about whether a very similar designed tax incentive scheme for the energy-efficient renovation of dwellings should be implemented in Germany.

As early as 2011, a draft bill on tax incentives for energy-efficient refurbishment measures in residential buildings was introduced to the Bundestag by the federal government (Deutscher Bundestag, 2011a), but failed in the governmental mediation committee in 2012 (Deutscher Bundestag, 2011b). The bill provided a tax progression-dependent subsidy for energy-related renovations in owner-occupied and rented buildings. Like the existing subsidy-schemes of the Kreditanstalt für Wiederaufbau (KfW), the proposed scheme related to residential buildings and only buildings built before 1995 would have been eligible. Furthermore, the eligibility to the scheme was planned to be based on the energy efficiency standard obtained to the extent that the energy requirements of the building are reduced to 85 percent of the current standard for new buildings ('KfW-Effizienzhaus 85'). At the end of the renovation, the level of energy efficiency would have had to be proven by a certificate issued by an independent expert in order to receive the tax relief.

Subsequently, a further design proposal for the introduction of tax incentives for energy-efficient refurbishment was presented in the National Action Plan for Energy Efficiency (NAPE) (BMWi, 2014). The scheme presented in the NAPE provided a progression-independent support by deduction from the tax liability and included not only complete refurbishments of buildings but also support options for individual measures. The proposed support was intended to promote individual measures with a tax relief of 11% from the investment and comprehensive renovation measures with a tax relief of 22% (Efficiency House 70), both paid over a period of 10 years. The amount of the tax relief was determined on the basis of the existing KfW investment subsidy (430) (KfW, 2017a). The relative disadvantage of a payment extended over several years would have been compensated by a slight increase in the tax relief amount.

In contrast to the French CITE model, under the German proposal non-taxable persons would not have been eligible (e.g. pensioners, low-income households, social benefit recipients). Therefore, the tax incentive schemes proposed in the German context provide only a tax relief and not a tax credit such as CITE (see section 4.3). This is an important distinction to bear in mind when considering social implications.
Up to now, support for energy-efficient building refurbishment in Germany is mainly provided in the form of low interest loans or investment grants from the state-owned KfW. In 2013, the volume of commitments in energy-efficient renovation and construction amounted to around EUR 13 billion, of which EUR 6.3 billion was allocated to new construction (KfW, 2017b).

From an economic point of view, a tax incentive for residential housing differs from the existing KfW programmes in the following aspects:

- Compared to the 'Energy-efficient renovation - credit (Nr. 151)' programme,[10] no loans are required for tax incentives. Tax incentives are therefore particularly attractive for owners who are unable or unwilling to take a loan.

[10] The energy-efficient renovation credit programme (Nr. 151) is a subsidised loan scheme (current interest rate 0.75% p.a.) for energy-related refurbishments up to 100,000 EUR per household.

- Compared to the 'Energy-efficient renovation - investment subsidy (Nr. 430)' programme,[11] a tax incentive differs in a way that the subsidy is deducted from the tax liability usually over a period of 3–5 years.
- In general, tax incentives differ from KfW programmes in terms of the application process, which is considered to be relatively easy via the tax office. In contrast, KfW applications are quite comprehensive and complex, and the application procedure must be completed before the construction begins.

6.3 Potential impacts

In general, the impact of a tax incentive scheme for the buildings sector touches upon the ETS and non-ETS sector. Two aspects are particularly relevant for the distinction of sector impacts:

- fostering energy efficiency for central district heating (mostly ETS) and decentralised heating systems (non-ETS); and
- a shift among heating systems, e.g. from direct electrical heating (e.g. radiators and heat pumps), with electricity generation (under ETS) towards other heat sources not based on electricity (non-ETS).

Thus, electrifying heating or moving to district heating expands the scope of what is under the EU ETS (while the cap is fixed) which results in lower emissions outside the EU ETS, i.e. under the Effort Sharing Decision (ESD). Electric heating is therefore desirable from an ESD emission reduction perspective, and, additionally, electricity in France has relatively little carbon intensity. Likewise, the reduction of electricity consumption or district heating consumption from increased energy efficiency in electrically heated/district heated dwellings cannot reduce emissions in ESD sectors since they are already under the EU ETS umbrella.[12]

In France, direct electric heating plays a larger role and accounts for about 30% of heating provided in private households (Cerema, 2017). In Germany, direct electric heating is very rare and accounts for only 2% of heating provided in private households. In addition, the share of central district heating systems in Germany currently corresponds to only 15 % of the total heating energy provided for residential housing. For this reason, demand-side reduction in Germany would largely affect the non-ETS sectors. Therefore, the energy savings and GHG emission reduction achieved by a tax incentive would mainly be credited for the non-ETS sector.

In order to estimate expected impacts by a tax incentive scheme similar to CITE for the German context, energy standards before refurbishment should be compared to the situation after energy-efficient renovations. The number of funding cases in the respective funding categories can be estimated based on available data on already existing KfW funding programmes (KfW, 2017b, IWU&IFAM, 2018), namely the 'Energy-efficient renovation - investment subsidy (Nr. 430)' programme (see section 6.2). Based on that data, the number of single renovation actions (e.g. boiler replacement) and combined renovation actions (e.g. comprehensive refurbishment), as well as the funding rates and average subsidies can be estimated for a tax relief system for energy refurbishment (see Table 3). According to a study by DHI (2014), public expenditures of such a scheme could add up to EUR 1.5 billion per year.

[11] The energy-efficient renovation investment subsidy programme (Nr. 430) is a direct subsidy for energy-related refurbishments up to 30,000 EUR per household.

[12] For a more elaborated discussion on these conceptual aspects, please refer to section 2.3 of the Policy Paper.

However, it should be noted that the estimate is subject to considerable uncertainties, mainly because the buildings sector in Germany is very heterogeneous in terms of building feature and resident characteristics.

Table 3: Impact estimation for a tax relief system for energy renovation actions in Germany (based on KfW, 2017b, IWU&IFAM, 2018, DHI, 2014)

Instrument	Tax relief for single renovation actions (e.g. boiler replacement)	Tax relief for combined renovation actions (e.g. comprehensive refurbishment)
Depreciation period (years)	3	5
Average subsidy (EUR)	15,000	75,000
Funding rate (%)	11–20 %	27–35 %
Number of supported actions (per year)	300,000	12,000
Public expenditure (EUR)	EUR 1.5 billion per year	

An earlier study on the impact estimation of a tax incentive scheme in Germany comes to the conclusion that the tax incentive model for energy-efficient refurbishment would be used for 61,000 to 152,000 residential units (equivalent to 5.4 to 13.5 million m² of living space) per year (IW, 2011). This would potentially trigger annual investments of between EUR 2.4 billion and EUR 6 billion and avoid emissions of between 238,000 and 592,000 tCO_2e (ibid.). According to this study, the estimated public expenditure will be offset by additional VAT revenues and social security contributions due to higher employment.

Generally, by introducing a tax incentive scheme similar to CITE, a broader group of households could be reached in addition to the existing KfW programmes, especially due to the simplified administrative process and access, lower prerequisites in terms of capital expenditure and more flexible eligibility criteria. However, in principle the promotion of energy-efficient refurbishment measures through tax incentives is only relevant for those target groups that have a corresponding taxable income. This condition is met by a large proportion of residential owners, but at the same time at least partially excludes various target groups (e.g. pensioners, persons with low taxable income, e.g. through unemployment, parental leave, etc.).

In addition, several side-effects have to be taken into account when a tax incentive scheme should be properly implemented in Germany:

- **Windfall effects:** As with all subsidy programmes, windfall effects are also an issue when it comes to tax incentives for energy-related refurbishment measures. As a rule, windfall effects are lower if the level of ambition of the proposed measures is significantly above the legally prescribed minimum level. At the same time, the number of measures implemented is expected to decrease as the level of ambition increases. A policy design of the tax relief with a low level of ambition is therefore likely to lead to a higher investment (but also to higher windfall effects), while a policy design with a higher level of ambition is likely to encourage a lower quantity of renovation measures, but at a higher energy-efficient quality level.
- **Market cannibalisation effects:** A certain amount of a tax incentive scheme such as CITE would likely be used by households who would otherwise have taken advantage of another type of support (e.g. KfW programmes). However, regarding different target groups within the residential sector, it

can be assumed that both schemes, KfW loans/grants as well as a tax relief similar to CITE, would have their respective target groups with different motivation levels and needs.

6.4 Conclusion

A tax incentive scheme modelled on the French CITE could be an important component for a comprehensive decarbonisation strategy of the residential building sector in Germany. Considering the ambitious sector-specific targets in Germany, comprehensive investments are necessary to achieve the desired renovation rate of existing buildings. This holds in particular true for energy-efficient refurbishment of dwellings since the amortisation periods for such measures are often considered to be too long from a private household perspective. A comprehensive tax incentive scheme could potentially have significant impact in terms of energy efficiency related investments for the housing stock. By increasing the profitability of individual installation measures, a tax incentive scheme could also accelerate the replacement of fossil fuel-based heating systems. Demand-side reduction as well as decarbonised heating supply are both essential to achieve substantial GHG emission reductions in the buildings sector.

A tax incentive could effectively complement the existing KfW loans and subsidies by providing an easily accessible support scheme for a broad range of households which are intending to carry out energy-efficient renovations of their dwelling. In terms of policy design, inertia in households' response to new policies demands the implementation of a consistent and simple tax incentive design, accompanied by a broad dissemination and good communication. Furthermore, as shown in various studies, the sensitivity of households' response to the level of subsidy suggests that increasing the level of subsidy while strengthening the eligibility requirements would trigger more additional private investment for the same level of public expenditure.

The impact of a tax incentive scheme for the buildings sector touches upon the ETS and non-ETS sector by fostering energy efficiency for centralised (mostly under ETS) and decentralised heating systems (non-ETS). However, the share of central district heating systems in Germany currently corresponds only for 15 % of the total heating energy provided. Therefore, the energy savings and GHG emission reduction achieved by such a measure would be mainly credited for the non-ETS sector.

Regarding the policy design of a tax incentive scheme it is also important to consider potential drawbacks for the effectiveness, namely windfall and rebound effects as well as cannibalisation with similar subsidies. In the light of the heterogeneity within the residential sector, a tax incentive should preferably be targeted towards those households where the number of likely free-riders is expected to be relatively low. In addition, low-income households and house-owners with liquidity constraints should receive particular attention to be eligible for such a scheme.

The introduction of such a scheme has been on the German political agenda for quite a long time and is considered to enjoy relatively broad political and economic support. The current coalition treaty revives the tax incentives topic and promises the implementation within the next four years: "We want to promote energy-efficient building refurbishment with a tax scheme. We will provide applicants with a choice between a subsidy and reduction in their taxable income" (Coalition Agreement, 2018, p. 114). In terms of likely policy windows, the unfolding discussion about the difficulty of Germany to meet its 2020 and 2030 climate targets, particularly in the non-ETS sectors, opens a window to discuss new measures more thoroughly, especially since the buildings sector is responsible for a large share of the total energy consumption and GHG emissions in Germany (see section 3.2). With sector-specific targets of the German Climate Action Plan (‘Klimaschutzplan’), the improved monitoring of the buildings sector’s emissions consistent with sector-specific 2030 goals can provide another opportunity for the strengthening of existing policy instruments and the introduction of novel ones.

However, it is not without reason that the measure yet failed to be implemented. The main potential obstacle to political feasibility is the considerable amount of public expenditure which is needed for such a scheme due to the widespread availability under the eligibility criteria previously suggested. A tax incentive scheme with a similar policy design such as CITE would, in the German context, could amount to several billion euros of public spending. On the upside, positive economic stimuli and increased tax revenues can be expected due to the additional investments in renovation works.

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