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COMPARING THE GERMAN CO₂ BUILDING
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DEAL.

by

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Reprinted from

ENERGY &
ENVIRONMENT

VOLUME 24 No. 1 & 2 2013

MULTI-SCIENCE PUBLISHING CO. LTD.
5 Wates Way, Brentwood, Essex CM15 9TB, United Kingdom

OVERCOMING THE UPFRONT INVESTMENT BARRIER - COMPARING THE GERMAN CO₂ BUILDING REHABILITATION PROGRAMME AND THE BRITISH GREEN DEAL

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ABSTRACT

This paper compares two flagship policies in the area of energy efficient building refurbishment, the German CO₂-Building Rehabilitation Programme and the Green Deal in the UK. Although both policies are essentially loan programmes to finance energy efficiency measures, the nature of the two policies is very different regarding scope, financial architecture, integration with other policies, and carbon reductions. The paper draws out the main differences of the programmes as well as similarities.

Keywords: energy efficiency finance, soft loans, building refurbishment, policy instruments

1. INTRODUCTION

The UK and Germany are internationally recognised for their innovative policies in the area of energy efficient building refurbishment and were recently ranked first and second respectively for their energy efficiency efforts in a ranking of 12 of the world's largest economies conducted by the American Council for an Energy Efficient Economy [1]. Both countries have put in place loan programmes for energy efficient refurbishment of buildings.

The German *CO₂-Gebäudesanierungsprogramm*¹ (CO₂-Building Rehabilitation Programme - CBRP), a loan and grant programme for building refurbishment, is widely considered to be a 'big success' [2]. Due to this programme Germany is

¹ Note that the programme was renamed after 31.03.2009. Since then it has been called *Energieeffizient Sanieren*. For the purpose of readability we use the term *CO₂-Gebäudesanierungsprogramm* which is still used unofficially.

labelled a 'front runner' [3] in the area of energy efficient building refurbishment. Germany is one of the few countries in the world that has a large-scale funding programme for energy efficient refurbishment [4], and a successful example of 'long term financial efforts' with 'considerable impacts in terms of energy savings and CO₂ emissions reductions' [5, p. 273]. In 2010, the CBRP resulted in a reduction of CO₂ emissions from homes of almost 1% [6], but this figure is based on an evaluation commissioned by the organisation administering the programme and is not peer-reviewed. The CBRP's contribution to CO₂ reduction is not sufficient for reaching a carbon neutral building stock by 2050, an official policy goal [7].

The Green Deal is a new policy instrument, which started in October 2012 and is untested in the UK, allowing financing of energy efficiency retrofits of buildings via an on-bill charge, which is attached to the property rather than the occupant. Similar instruments have been in place in the US with mixed results [8-12]. The Green Deal is supposed to deliver significant carbon reductions across the UK housing stock and will, according to the Government, cause 'a revolution in British property' [13, p. 10]. Because the Green Deal is a new policy instrument, no evidence exists with regard to its efficacy.

This paper compares the two programmes and starts by providing background information on each of them. In a second step, the key differences and similarities are analysed including the supported measures, the financial architecture, and the integration with other policies. Finally, the paper concludes and provides a summary comparison.

2. METHODOLOGY

Because the CBRP has already been in place for more than 10 years and the Green Deal is in its infancy, a like-for-like comparison is impossible. Nevertheless, at this stage it is feasible to compare the two instruments regarding some of the key features of such schemes including:

- **Scope:** which technologies are eligible for support?
- **Financial architecture:** how is the instrument funded and what are the market volumes?
- **Interaction with other policy instruments:** is the instrument integrated with other policy measures and if so how?

The effectiveness in terms of reducing carbon emissions of the two instruments is more difficult to compare, not just because of the different levels of experience with the two programmes, but also because the methodologies for calculating carbon savings for various measures differ, are complex, and cannot easily be homogenised. However, we decided to at least provide a high level assessment based on the official figures provided by government documents and evaluations.

As described above, the Green Deal is closely linked to the ECO (Energy Company Obligation) and the UK government presents the two instruments as a package. Hence, one could argue a comparison should include ECO as well. However, ECO is a succession of supplier obligations which have been in place in the UK since 1994 and fall under a completely different legal framework going back to the 1986 Gas Act and the 1989 Electricity Act. The purpose of this paper is to compare two types of soft-loans rather than totally different policy instruments and the inclusion of ECO is

beyond the scope of this research. Therefore, we exclude ECO from the comparison and restrict the analysis to its interaction with the Green Deal.

3. BACKGROUND

Germany and the UK are very alike regarding climate and energy use. The housing stock is, however, quite different with regard to tenure, size, and energy performance. UK housing is dominated by single-family houses and owner occupation, whereas Germany has more multi-family and rental accommodation. German residential buildings are much more energy efficient than their UK counterparts, but floor space per capita is lower in the UK [14].

3.1. KfW CO₂-Building Rehabilitation Programme

The CBRP is administered by the *KfW Bankengruppe* (KfW), usually known as the German Development Bank. KfW was formed in 1948 after World War II as part of the Marshall Plan as *Kreditanstalt für Wiederaufbau*. Since its creation KfW has run several loan and grant programmes related to housing refurbishment. The first programmes started in 1990, although their primary focus was not energy efficiency but modernising the housing stock in former East of Germany after reunification. Only with the *CO₂-Minderungsprogramm* (CO₂-Minimisation Programme), which started in 1996, did the KfW introduce a programme with the specific aim of reducing carbon emissions of the housing stock [15].

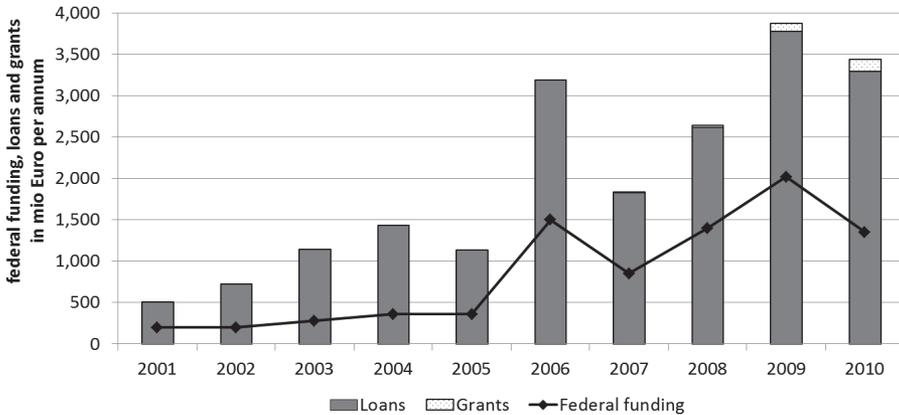
By far the most significant loan and grant programme in terms of its budget was the CBRP which started in 2001. In 2009, CBRP was replaced by two programme elements called *Energieeffizient Sanieren* (energy efficient refurbishment) and *Energieeffizient Bauen* (energy efficient construction). Both elements are often subsumed by the old term CBRP. We use the term CBRP throughout the paper to avoid confusion, but it should be borne in mind that after 2009 the two new elements constitute the CBRP. For the existing building stock the government has indicated that the CBRP is the most important policy instrument in terms of its contribution to carbon reduction [16]. There is anecdotal evidence that, over time, the CBRP has become an accepted ‘brand’ with a good reputation in the construction industry and is frequently used to advertise buildings to buyers.

The Federal Government funds the CBRP and enables the KfW to issue loans with an interest rate lower than the market rates (see section on the financial architecture for details). The responsible government department is the *Bundesministerium für Verkehr, Bau und Stadtentwicklung* (Federal Ministry of Transport, Building and Urban Development - BMVBS). BMVBS sets the framework of the Programme and KfW carries out the delivery according to BMVBS’s specifications. In addition to loans, some of the funding provided is used to issue grants.

While the Programme has changed over time, the core idea of providing low interest loans (and later grants) for energy efficient refurbishment and construction remains.

Historically, the CBRP was 100% financed by federal funding. Funding levels changed over time and are now about 15 times higher than in 2001 when the CBRP started. There are many drivers for changing budgets of the programme and they include economic stimulus programmes during the recession, labour market policy,

austerity measures, and climate policy. For a detailed analysis of the drivers see Rosenow [17].



Source: based on BMVBS [18, 19]

Figure 1: Federal funding of the CBRP & loans and grants issued

Since 2011, however, the CBRP has been partially funded by the *Energie- und Klimafonds* (Energy and Climate Fund), a Government owned fund to finance climate policy, energy storage technologies, electric vehicles, energy efficiency measures, and renewable energy. The fund was to be financed by the large energy suppliers which were obliged to pay a tax on profits due to the delay in the phase-out of nuclear power plants (which is now obsolete due to the decision to not delay the phase out nuclear power plants following the Fukushima disaster) and windfalls gained from free EU Emissions Trading Scheme permits. Note that the fund was not specifically introduced to finance the CBRP – it was supposed to provide funding for a range of activities. The introduction of the Energy and Climate Fund meant that for the first time in the history of KfW, the loan and grant programmes part of the funding was not based on the budget alone, but also on a separate fund. The establishment of the fund was supposed to provide more long-term stability in terms of funding. However, because of falling EU ETS allowance prices this is not clear cut. For a critical discussion of the introduction of the Energy and Climate Fund see Rosenow [17].

3.2. UK Green Deal

In the UK, historically, policies aimed at reducing carbon emissions from the existing housing stock mainly consist of obligations on energy companies to save energy and carbon in existing homes. Supplier obligations have been in place since 1994 and although they have been modified, the general approach has been consistent [20, 21]. The key policies for carbon reduction in households in place at the moment are the Carbon Emissions Reduction Target (CERT) [20] and the Community Energy Saving

Programme (CESP) [22]. Their predecessors achieved impressive results by promoting low cost energy efficiency measures [23, 24] with about 2% savings of annual household energy use [25]. Both policies will come to an end in December 2012 and will be succeeded by the Energy Company Obligation (ECO). Alongside ECO, the Green Deal is supposed to deliver a large share of the required carbon reductions [26].

The Green Deal is based on the idea of attaching loans from an accredited 'Green Deal provider' for low carbon refurbishment of buildings not to the owner, but to the property itself, i.e. technically the electricity meter in the property. Repayment of the loan is then via a surcharge on the electricity bill, collected by the electricity supplier and paid on to the Green Deal provider. If the value of the energy savings triggered by the measures installed is greater than this surcharge, the occupant is better off financially. There may be instances where this is not the case, for example if the recipients use less energy than the average. If a lower than average energy user wishes to take out Green Deal finance, the Green Deal Provider must obtain a written acknowledgement that they are aware that, based on their energy use, the Green Deal charge may not be fully offset by their energy savings [27]. Similar programmes have been in place in the US for some years [8-12]. The Green Deal approach was tested in the UK from November 2009 to July 2011 in so-called Pay As You Save (PAYS) pilots, an initiative put forward by the previous government. However, the Green Deal differs from the PAYS pilots in a number of ways and particularly with regard to the finance mechanism: the Green Deal is subject to a 'Golden Rule' which prescribes that estimated savings must be greater than repayments [27]. Households taking part in the PAYS pilot schemes were not subject to this Golden Rule and could install measures that would not pay back within the chosen repayment timeframe [28]. PAYS provided up to £20,000 per property for energy saving measures at a 0% interest rate. The energy savings were deliberately not monitored because the pilot schemes were intended to provide insights into marketing strategies and perceptions of households [28].

Because the Green Deal focuses on the most cost effective measures, ECO is supposed to cover those measures that do not meet the Golden Rule and provide assistance to customers living in fuel poverty. The two policy instruments will not operate separately but are linked via various mechanisms as will be explained in section 3.3.

Although difficult to predict, the UK government estimates that the Green Deal will lead to investment of €380-525m per year between 2013 and 2022 [26], which is about 14-21% of the volume of loans and grants provided by the CBRP from 2006 to 2010 [17].

4. COMPARISON

This section compares the CBRP and the Green Deal regarding:

- supported measures;
- financial architecture;
- interaction with other policy instruments; and
- carbon savings.

It concludes with a summary pointing out the main differences and similarities.

4.1. Supported measures

CBRP

Over time, the requirements with regard to qualifying measures have changed. Overall, the CBRP has moved from strictly defined *Massnahmenpakete* (packages of measures, numbered 0-6), listing possible combinations of technologies, towards an energy performance benchmark based on the *Energieeinsparverordnung* (Energy Savings Ordinance – EnEV) regulations on new buildings. EnEV sets out detailed guidelines of how to calculate the annual primary energy demand per m² and provides rules concerning the heat transfer coefficient of different parts of the building envelope. Note that the CBRP's requirements exceed the requirements in the EnEV for substantial building alterations.

The idea of setting the standard according to a defined benchmark featured in the CBRP from the beginning as part of the package of measures no. 4, which combined defined measures with a prescribed limit of kg CO₂/m²a emissions. Even though the benchmark refers to CO₂ rather than primary energy, the underlying concept of setting a standard was the same. While the types of measures permitted were restricted, the basic idea of defining a standard in terms of energy efficiency or carbon emissions existed early on in the Programme. However, its role was less important than the concept of packages of measures which dominated until 2007.

Alongside the packages of measures, a further option was then introduced for buildings that were refurbished to a standard 30% better than the EnEV requirements [29]. When EnEV 2009 came into force in October 2009 this was relaxed to 10% as the minimum standard had been raised by 30%, with greater support for cases that achieved higher percentages. This benchmark was called *Energieeffizienzhaus* (Energy Efficiency House). The major change in 2009 was that this became the main principle of the Programme and packages of measures were no longer required. Currently, the CBRP provides loans for up to €75,000 per property if the standard of *Energieeffizienzhaus* is reached. KfW also offers a reduction of the loan repayment if this standard is achieved. The percentage of reduction depends on which category of the *Energieeffizienzhaus* the property falls into. In 2012, there were six different categories:

Table 1: Categories of Energieeffizienzhaus (refurbishment)

<i>Category of Energieeffizienzhaus</i>	<i>Energy performance compared to new building requirements in EnEV [% better than EnEV]</i>	<i>Primary energy demand [kWh/m²a]</i>	<i>Loan reduction</i>
KfW-Effizienzhaus 55	+45%	52-30	12.5%
KfW-Effizienzhaus 70	+30%	66-39	10.0%
KfW-Effizienzhaus 85	+15%	80-47	7.5%
KfW-Effizienzhaus 100	0%	94-55	5.0%
KfW-Effizienzhaus 115	-15%	108-63	2.5%
KfW-Effizienzhaus Denkmal [listed buildings]	-60%	not known	2.5%

Source: [30-32]

From August 2001 to March 2009, loans provided by the CBRP only funded packages of measures - single measures were explicitly not supported. Packages of measures no. 1 included, for example, renewal of the heating system, loft insulation, and external solid wall insulation. Not until March 2009 did the CBRP also provide funding for single measures, a modification designed to make the CBRP attractive to home owners who did not want to retrofit a whole house but were interested in getting funding for single measures. The following single measures are currently supported:

- wall insulation;
- loft insulation;
- insulation of the ceiling between floors;
- energy efficient windows and doors;
- replacement or installation of the ventilation system;
- replacement of heating system; and
- optimisation of heat distribution.

Table 2 provides the technical specifications regarding the heat transfer coefficient (U-value) and the thermal conductivity of example measures.

Table 2: Types of measures supported (requirements after 03/2013)

<i>Measure</i>	<i>Energy performance requirements</i>
Solid wall insulation	0.20 W/(m ² K)
Cavity wall insulation	$\lambda \leq 0,035$ W/(mK)
Loft insulation	0.14 W/(m ² K)
Roof insulation	0.14-0.20 W/(m ² K) (depending on roof type)
Floor insulation	0.25 W/(m ² K)

Source: [33]

Support for single measures is limited to a loan of €50,000 per housing unit [31]. The volume of loans for single measures in 2009-2011 was about 50% of the volume of loans for *Effizienzhaus* retrofits [18]. The majority of the funding is allocated to quite ambitious retrofits; in 2011, 74% of all *Effizienzhaus* retrofits achieved new built standard or better [6].

In addition to the existing low interest loans, grants were added to the scheme in January 2007. Grants could be used for the same packages of measures and for achieving the energy performance of a new building or better according to the EnEV. Single measures were also supported by grants after 01/2009; the eligible measures had to be part of the package of measures no. 4 and the minimum requirements of the EnEV for the measure concerned needed to be fulfilled. Homeowners could also get a grant worth 10% of the total investment (maximum €5,000 per property) for refurbishment of existing buildings if they achieved the same energy efficiency level of a new building. If they became 30% more energy efficient, 17.5% of the total costs (maximum €8,750 per building) would be provided. For carrying out packages of measures in existing buildings resulting in lower savings, 5% of costs (maximum

€2,500 per property) were paid by a grant [34].

Green Deal

At least 45 different measures are eligible for Green Deal funding. The standardised assessment tools of the Department of Energy & Climate Change DECC's prove that these measures are compliant with the Golden Rule [35]. The list of potential measures currently covers a wide range of technologies including:

- insulation: cavity wall insulation, loft insulation, roof insulation, under-floor insulation, hot water cylinder insulation;
- heating and hot water controls;
- condensing boilers;
- heat recovery devices; and
- micro-generation: biomass, solar thermal, micro-wind, heat pumps, micro-CHP.

Note that the above list is not comprehensive, please refer to the latest DECC publication for a complete list of measures [35]. Some measures are explicitly excluded from the Green Deal such as photovoltaics and lighting systems.

Analogous to the section on the CBRP, Table 3 provides the technical specifications regarding the heat transfer coefficient (U-value) and the thermal conductivity of example measures.

Table 3: Types of measures supported (requirements as set out in Building Regulations 2010)

<i>Measure</i>	<i>Energy performance requirements</i>
Cavity wall insulation	0.55 W/(m ² K) (equivalent to $\lambda \leq \sim 0,04$ W/(mK))
Loft insulation	0.16 W/(m ² K)
Roof insulation	0.18 W/(m ² K)
Floor insulation	0.25 W/(m ² K)

Source: [36]

The Golden Rule determines the combinations of measures eligible for Green Deal finance; bill savings in the first year must exceed the Green Deal repayment and the repayment term must not exceed the expected lifetime of the measure [26]. Additional measures can be added to the list over time, as long as they fulfill the criteria. The potential savings are modelled with the Reduced Data Standard Assessment Procedure (RDSAP) tool, which is the UK standard for assessing energy efficiency (e.g. for Energy Performance Certificates) with easily obtainable data. RDSAP energy savings are based on documented U-values and efficiencies [37], based on monitored data where these are available and the assumption that all houses are maintained at a standard temperature. For the purposes of the Golden Rule, savings will be reduced by 'in use factors' that represent the extent to which this assessment can over-estimate actual energy use. Green Deal providers can apply for specific measures to be added to the list. It is expected that the measures list will be updated on a regular basis, at least annually. Cost savings are calculated using prices averaged across regions for the

previous 3 years.

Whether a measure is suitable for Green Deal finance depends, however, on the individual property. Only when the projected savings exceed the investment, is the proposed investment deemed eligible (Golden Rule, see section 3.2). Households can co-finance measures either by providing some of the required investment themselves or by using assistance from other policy instruments such as ECO (see section on interaction with other policy instruments). This ‘partial financing’ means that where customers choose measures that are unlikely to pay for themselves in their lifetime, they can still get money towards the installation cost up to value of the estimated savings.

We provided energy performance figures in terms of primary energy demand for the various *Effizienzhaus* categories of the CBRP above. As discussed, for the Green Deal no such system exists. However, based on DECC’s impact assessment it is possible to derive a crude estimate for the energy performance likely to be reached in homes that receive Green Deal funding. According to DECC, attractive measures in gas heated homes for finance through Green Deal only include cavity wall insulation, draught-proofing and floor insulation. The total savings of all these measures together add up to 4,406 kWh/a [26]. Uninsulated homes in the UK consume about 20,000 kWh/a [38]. Hence, the savings attractive under Green Deal only are about 22%. Using the average floor area of 92 m² [39] this is equivalent to an improvement from 217 kWh/m²a to 170 kWh/m²a. The figures refer to energy end use rather than primary energy demand.

There are a number of caveats to this calculation. First, savings of individual measures, used in combination, cannot simply be added together. Second, if combined with additional measures that might become attractive as a package but not in isolation, or by using finance from ECO or other sources to part-fund measures, the potential savings might be higher than assumed here. Once the first Green Deal projects are completed, further analysis could generate more reliable estimates of the energy performance achieved with Green Deal funding.

Comparison

Although the technical minimum requirements for single measures, such as particular types of insulation, are fairly similar, the two programmes differ in a number of ways. In general, the CBRP focuses its support on high performance and high cost measures, particularly solid wall insulation. The Green Deal does exactly the opposite; by definition, the Golden Rule does not allow high cost measures (unless partially funded, see section 4.3) and focuses on the most cost-efficient measures. Furthermore, the CBRP defines the energy performance standard that has to be reached in a property that receives loans (except for single measures) whereas Green Deal funding does not require the achievement of a specific energy performance. For individual measures, however, it does prescribe the technical standard required and in practice high standards will have to be reached to secure large loans. Even though it is difficult to compare the energy performance achieved by the CBRP and the Green Deal (due to different methodologies and the uncertainties surrounding the Green Deal), the evidence presented above suggests that the *Effizienzhaus* standards of the CBRP

clearly outperform likely Green Deal improvements.

The criticism of both programmes does not come as a surprise; the CBRP has been criticised its strict requirements and it was proposed to relax the standards in order to include more cost-effective renovations so that more households could benefit and the effectiveness be increased [40, 41]. However, others criticise the laxity of the CBRP standards as they are not compliant with the long term CO₂ targets for the building sector [7]. In contrast, critics feel that the Golden Rule of the Green Deal is too prescriptive and does not allow more costly measures to be included [42]. In principle, the CBRP could be modified and require refurbishments to reach a standard that is compliant with the 2050 goal of a carbon neutral building stock [43], although this would have quite significant cost implications [44]. The Green Deal does not allow such ambitious standards to be set because the Golden Rule limits measures to those of low cost unless combined with additional funding.

Despite the remarkable differences, there are also similarities: neither programme supports energy efficient appliances or lighting in homes, although the Green Deal does support lighting in the non-domestic sector; both the CBRP and the Green Deal focus on the heating system and the building envelope, and both instruments are more or less technology neutral; the CBRP based its provisions on the EnEV without prescribing the technologies that have to be used in order to achieve the standard whereas the Green Deal demands that measures meet the Golden Rule. In practice neither will deliver very low cost measures as the transaction cost of the loan would be too high.

4.2. Financial architecture

CBRP

Making use of both federal funding and national as well as international capital markets, KfW offers financial products to finance housing refurbishment and construction. The federal funding is used for two purposes. First, it is used to ‘buy down’ the interest rate which enables KfW to offer loans significantly below market rates. For example, in 2012, the interest rate for loans supported by the CBRP was 1% [45], which is much lower than in previous years where it usually exceeded 2% [21]. This compares to a market rate of around 5-9% in 2008/2009 and 3-8% in 2010-2012 depending on the conditions [46].

Second, KfW uses some of the funding to provide grants for energy efficiency measures, which were introduced in 2007 after suggestions to open the CBRP to households adverse to debt [47]. The loans issued by the KfW more or less follow the federal funding (Figure 1) and on average the value of loans and grants issued is about 2.3 times more than the federal funding provided in a given year [18, 19]. From 2007-2010 total grant provisions accounted for about 5% of the total federal funding [17].

Homeowners, housing companies, and public bodies can apply for loans at an intermediary bank which assesses the individual financial circumstances of the applicant based on the bank’s individual credit check criteria. The intermediary bank then forwards the application to the KfW, which approves the loan or grant. KfW checks that the application fulfills the requirements and, if confirmed, allows the intermediary bank to sign a contract with the applicant. Once the contract is signed by

both parties, KfW transfers the money to the intermediary bank, which is legally responsible for the agreed loan [15]. The intermediary bank receives a brokering fee from KfW for facilitating the loan agreement. Because facilitation through retail banks involves additional formalities, the CBRP's reliance on them as middlemen between potential borrowers (homeowners) and the actual creditor (KfW) received some criticism in the past [48, 49]. Also, there is anecdotal evidence that some retail banks were reluctant to promote the CBRP in the past, probably due to insufficient incentives in the form of larger brokering fees.

Green Deal

Green Deal Providers will need to provide the upfront cost of supported measures. They can make use of finance provided by the Green Deal Finance Company, a national aggregator designed to make finance available to all accredited Green Deal Providers on an equal and open basis. The Green Deal Finance Company is an industry led consortium with over 50 members from across the industry, both public and private sector. The Company was incorporated in March 2012 as a not-for-profit mutual limited by guarantee. Green Deal Providers are assumed to make a profit from the investment and the UK government predicts a 7.5% interest rate [26]. Over the last two years, in the UK market interest rates for household loans were about 3.5% for secured loans (mortgages) and 6-7% for unsecured loans [50]. Research commissioned by the UK government illustrates that homeowners find interest rates below 3% attractive, in the commercial sector this is below 5% [51]. Given that expected interest rates for the Green Deal are much higher than this it is likely that this will have a negative effect on uptake.

The Green Deal finance will be attached to the property rather than to the owner of the property as is the case with normal loans. Therefore, if the owner moves he or she will have no further liabilities. Instead, the responsibility for repaying the loan rests with the bill-payer [27]. Customer repayments to Green Deal providers will be through electricity bills, even though most savings will be on the gas bill. Therefore, the default failure rate for Green Deal loans will be the same as for electricity payments. DECC argues that 'existing tools available to energy companies for collecting debt will be sufficient for Green Deal purposes' [27, p. 52]. Suppliers attempt to collect outstanding debt by a variety of means including the installation of pre-payment meters and ultimately by legal action through the courts. However, at some point outstanding debt is written off and in this case, according to the Electricity Retail Association, 'suppliers will relinquish responsibility for collecting the Green Deal arrears and the Green Deal provider will have sole responsibility for pursuing the outstanding Green Deal arrears' [52, p. 7]. In 2010, about 3.2% of all domestic electricity customers were repaying a debt through an agreed repayment arrangement with their supplier [53]. While the Green Deal makes provisions to exclude customers already in debt and not all customers in arrears fail to pay off their debt, there is the risk that at least some customer will not be able to repay the Green Deal loan. In this case the risk lies fully with the Green Deal provider. However, the number of non-payment related disconnections in the UK is relatively small – only 1,988 disconnections occurred in 2010, and the figure for 2011 is just 921 [54]. Since

vulnerable customers are legally protected from disconnection, the default rate for the Green Deal may be higher. However, such customers are assumed to be less likely to take out Green Deal finance in the first place [26].

The recent establishment of a Green Investment Bank in the UK, being an initiative to accelerate private sector investment in the UK's transition to a green economy, potentially offers an opportunity to underwrite loans and minimise the risk to investors. This idea had been promoted by the Green Investment Bank Commission [55], but was subsequently rejected by Government because 'Government's primary aim remains for this [the Green Deal] to be a private-sector led scheme' [56, p. 7]. However, more recent documents indicate that there may be some support from the Green Investment Bank for the Green Deal. According to DECC [57], the Green Deal has been identified as a 'priority sector' for the Green Investment Bank and the Bank is in discussions with a number of private sector entities regarding potential investments of up to £300m. However, whether the Bank supports the Green Deal and to what extent remains to be seen.

Comparison

The financial architecture of the two programmes is quite different. The CBRP is based on federal funding made available to KfW in order to lower market interest rates whereas the Green Deal will operate independently of tax payer funded subsidies. As a result, the interest rates of the two schemes are at different levels – the CBRP currently provides loans with a 1% interest rate [45] compared to a projected interest rate under Green Deal of 7.5% [26].

Currently (December 2012), the CBRP offers loans of up to €75,000 per home [45]. Under the Green Deal it is likely that for most properties total funding required will not exceed €12,000, although it is possible to exceed this figure if customers obtain three independent assessments from different Green Deal providers [27].

Furthermore, in case of the CBRP the loan is attached to a person or organisation, Green Deal loans are instead linked to the property. The risk of non-repayment in the CBRP is minimised by applying strict criteria assessing whether the investor is worthy of credit. The remaining risk lies with the intermediary bank, not with KfW and the authors are not aware of any data on default rates for the CBRP. As far as the Green Deal is concerned, the risk of non-repayment ultimately lies with the Green Deal Provider, although default rates are likely to be low.

4.3. Interaction with other policy instruments

CBRP

The CBRP is closely linked to the EnEV as illustrated in section 3.1. EnEV sets the benchmark against which the requirements of the CBRP are set. However, the CBRP is also expected to drive technology development by providing funding for high performance energy efficiency retrofits which in return creates the basis for tightening of the EnEV. Hence, the CBRP depends on the EnEV but the EnEV's frequent revisions are influenced by technology development driven by the CBRP.

Labour cost expenditures for domestic renovations, not just for energy retrofits, are eligible for income tax reliefs. If a tax funded low interest loan like the CBRP is used

for financing these measures, the tax relief may not be granted.

There is also a link to support programmes for energy efficiency advice. KfW requires all applicants to use independent experts for the verification of the measures installed. For the most sophisticated renovation standards a continuous evaluation of the process by an independent expert is mandatory. Eligible experts include those approved by the *Bundesamt für Wirtschaft und Ausfuhrkontrolle* (Federal Office of Economics and Export Control - BAFA), a superior federal authority subordinated to the Federal Ministry of Economics and Technology. Since 2011, BAFA has published a list with more than 1,500 energy advisers, and KfW provides funding for energy advice when combined with the CBRP.

Unlike in Britain, Germany's feed-in tariffs for electricity and renewable heat do not include any minimum requirements for energy efficiency.

Green Deal

The Green Deal focuses on the most cost effective measures. ECO is supposed to fund those measures that do not meet the Golden Rule, providing assistance to customers living in fuel poverty who are less likely to benefit from the Green Deal. However, because ECO is paid for by all households and focuses on high-cost measures, a larger number of households will contribute to ECO without receiving the benefit of any measures potentially making fuel poverty worse [58].

The two policy instruments will not operate separately but are linked via various mechanisms. Green Deal providers, i.e. businesses that offer Green Deal packages to occupants, may offer finance plans that combine funding from ECO and the Green Deal mechanism. Some of the measures that do not fulfil the Golden Rule can be funded by ECO and be bundled in with Green Deal funded measures. A brokerage mechanism is supposed to allow Green Deal providers to access ECO funding from the energy companies by offering carbon savings in competition with other providers via an online portal [27]. The exact details of how the brokerage mechanism will work and to what extent ECO funding has to go through it are currently at pre-consultation stage (November 2012). DECC has indicated in the Green Deal consultation that it is considering obliging energy suppliers to channel 50% of their ECO delivery through the brokerage mechanism [13]. The interaction between the Green Deal and ECO is important because funding from the saving obligation can be used to partially fund Green Deal measures as long as they fulfil the Golden Rule.

Small scale energy supply technologies, used at the level of the individual building, (microgeneration) in the UK are separately supported through Feed-in Tariffs (FITs) for electricity generation and a proposed Renewable Heat Incentive (RHI) for renewable heating systems, including heat pumps. The support is (or is proposed, in the case of the RHI) in the form of annual payments based on metered electricity generation (FITs) or projected heat output (RHI). This form of payment does not address the capital availability barrier that drives the design of the Green Deal. Although some microgeneration technologies such as solar thermal and micro-wind are included in the list of measures eligible for the Green Deal, customers will not be able to use the expected future revenue from FIT or RHI payments to count as savings for the purposes of meeting the Golden Rule [35]. However, to benefit from the RHI,

properties will be required to have adopted the key thermal efficiency measures eligible for support under the Green Deal. Similarly, receipt of the full rate of feed-in tariff payments for solar PV installations is conditional on the building meeting Energy Performance Certificate level D [35]. Those provisions potentially drive the uptake of the Green Deal.

The Green Deal will require use of energy surveyors, Green Deal providers and installers that are accredited under the terms of the legislation. The aim of this restriction is to ensure that assessments, materials, installation practices and customer support meet high quality thresholds, thereby addressing a known barrier to energy efficiency.

Comparison

Both policy instruments are considered ‘flagship policies’ in their respective countries, i.e. they represent key instruments in home energy efficiency policy. However, both depend on other policies for their functioning: The Green Deal is supposed to make use of funding provided through the ECO and the CBRP sets its requirements according to the EnEV standard for new buildings. The reverse is also the case: CBRP also funds technologies that go beyond EnEV standard and thereby pushes technology development and commercialisation enabling policy makers to tighten the EnEV standard. The Green Deal could lower the cost of the ECO if a high proportion of ECO measures are partially funded through Green Deal finance. Furthermore, by providing finance of basic energy efficiency measures it also helps households interested in benefiting from the RHI or feed-in tariffs to achieve the minimum energy efficiency standards required by those policies. In Germany no such requirements exist to date.

4.4. Carbon reduction

Comparing the carbon reduction of the two programmes is not straightforward. The CBRP has been evaluated regularly since its inception, whereas the Green Deal is still in its infancy and carbon savings are only projected based on assumed uptake. Therefore, it is difficult to compare the two programmes with regard to carbon savings. Furthermore, a comparison is subject to various limitations because the energy and carbon savings accounting methodology differs in the UK and Germany.

CBRP

The CBRP has been evaluated many times with regard to energy and carbon savings [6, 47, 59-64]. Note that the evaluation studies of the CBRP cited above, calculated the annual reduction of carbon emissions rather than the induced lifetime CO₂ emission reductions. However, the annual reductions can be converted into lifetime emissions saved by assuming an average lifetime of measures of 30 years, as shown by an additional analysis complementing the evaluation of Clausnitzer et al. [61] by Gabriel and Balmert [65]. From 2006 to 2010 the CBRP saved on average about 19 million tons of CO₂ (lifetime) per year [66]. This figure does not include any rebound and free rider effects or any other reduction factors; those are not considered in the evaluations. Therefore, the actual carbon savings are likely to be somewhat lower.

Green Deal

Projections for the Green Deal of expected carbon savings are provided by DECC in the Impact Assessment of the Green Deal and the Energy Company Obligation (ECO). The Impact Assessment estimates that by 2020 the Green Deal and the ECO together will result in savings of 84 million tons of non-traded (i.e. not covered by EU ETS) CO₂ (lifetime) and 44 million tons of traded (i.e. covered by EU ETS) CO₂ (lifetime) [26]. This equates to 13 million tons of CO₂ (lifetime) per year and is in a similar range as the CBRP. However, this includes both the Green Deal and the ECO, which on its own is supposed to generate carbon savings of 27 million tons CO₂ (lifetime) from January 2012 to March 2015 and this is supposed to continue until 2022, although it is unclear at which level [26]. Unfortunately, at the time of writing no separate projections for the Green Deal are available. We therefore estimate a range of potential savings.

In order to estimate the minimum the Green Deal is going to deliver, we assume that the ECO will deliver the same carbon savings of 12 million tons of CO₂ (lifetime) per year until 2020. This leaves just 8.3 million tons of CO₂ (lifetime) out of the projected 128 million tons of CO₂ (lifetime) for the Green Deal. On an annual basis this equates to just 0.8 million tons of CO₂ (lifetime).

The maximum is calculated by assuming that the ECO will stop after March 2015. Under this assumption the Green Deal will save 10 million tons of CO₂ (lifetime) per year. We may therefore assume that the Green Deal is supposed to deliver between 0.8 to 10 million tons of CO₂ (lifetime) per year. The mid-point figure of this range is about 5 million tons of CO₂ (lifetime) per year.

Comparison

Comparing a programme that has more than 10 years of history behind it to a policy that has not even started is by definition uncertain and potentially inaccurate. However, the figures derived from past evaluations of the CBRP and the projections for the Green Deal give a sense of the scale of the two programmes.

Our best guess for the savings of the Green Deal based on DECC's predictions is that it will save about 5 million tons of CO₂ (lifetime) per year. This is about a quarter of the 19 million tons of CO₂ the CBRP has been estimated to generate in recent years.

Although difficult to compare because of the different methodologies in the two countries, the value of loans and grants provided by the CBRP per ton CO₂ (lifetime) are about €158, which is significantly higher than the Green Deal estimates of around €91 per ton CO₂ (lifetime) (mid-point figure of estimated carbon savings projected and investment). This reflects the different focus of the two programmes, which aim at very different energy performance and cost levels. Note that an economic assessment also needs to take into account the discounted cost savings² due to saved energy; for the CBRP this results in a much lower figure of €34 per ton CO₂ (lifetime) (value of loans and grants minus discounted energy cost savings). Using the same energy/carbon ratio as previous energy savings obligations [23], we estimate that the Green Deal will save about 16 TWh (lifetime) per year resulting in investment costs

² We use a discount rate of 3% in this paper.

minus discounted energy cost savings per ton CO₂ (lifetime) of -€15. This makes it cost effective from a household perspective.

While from a household perspective, the CBRP investment is not cost effective, it is still socially cost effective given that the recommended price for carbon valuation is €70 in Germany [67] (69 in the UK for the non-traded sector [68]).

5. CONCLUSIONS

This paper compared two flagship policies in the area of energy efficient building refurbishment - the German CO₂-Building Rehabilitation Programme and the Green Deal in the UK. Although both policies are essentially loan programmes to finance energy efficiency measures, the nature of the two policies is very different regarding scope, financial architecture, integration with other policies, and carbon reductions (see Table 4).

Table 4: Summary of comparison of CBRP and Green Deal

	<i>CBRP</i>	<i>Green Deal</i>
<i>Cost of measures supported</i>	high	low
<i>Energy performance requirements</i>	high	moderate
<i>Subsidies of loan</i>	yes	only initially
<i>Size of loan</i>	large	small
<i>Interest rate</i>	low	high
<i>Annual market volume [in million €]¹</i>	value of loans and grants: 2,995	value of investment:380-525
<i>Source of funding</i>	federal budget via KfW	Green Deal Finance Company via Green Deal Provider
<i>Amount of subsidies</i>	high	low
<i>Source of subsidies</i>	tax payer subsidised	only subsidies for high cost measures from consumer funded policy ECO
<i>Attachment point of loan</i>	person or organisation	electricity meter
<i>Integration with other policies</i>	yes (EnEV, energy advice)	yes (RHI, FITS, ECO)
<i>Carbon savings [in million t CO₂ (lifetime) per year]</i>	19	mid-point figure: 5 [0.8-10]

¹ figure for CBRP represents average from 2006 to 2010

As a publicly funded soft loan scheme for high performance energy efficient buildings, the CBRP has proven effective in delivering relatively ambitious retrofits in German homes and is widely considered a success [3-5].

The Green Deal, an on-bill finance mechanism for low cost retrofits, still has to prove that such programmes can generate significant and long-term upgrades of the building stock. In theory, it offers a way to leverage more private investment without requiring large subsidies. There are, however, several drawbacks. On-bill financing

instruments often suffer from not offering enough assistance to low-income households, a problem that can in principle be addressed by providing additional subsidies [11]. At the moment, the only subsidies provided are generated through the ECO, which is paid for by consumers and may even exacerbate fuel poverty [69]. Furthermore, relying on an untested mechanism such as the Green Deal poses the risk of a shortfall in carbon reduction, an issue of concern that has previously been raised [42, 70].

The two instruments have very different nature and are not alternatives, but complementary. One could even imagine a policy landscape in which both schemes operate, focusing on different technologies and segments of the building stock. In fact, some *Stadtwerke* (communal utilities in Germany) already offer on-bill financing for energy efficient appliances such as fridges, freezers, washing machines, and hobs, for example the Stadtwerke Bonn (SWB) [71]. So far, however, there are no attempts at the national level to implement the two instruments alongside each other. In principle, one could imagine an instrument similar to the Green Deal in Germany for those measures not covered by the CBRP because they are not ambitious enough.

In theory, the UK could fund high performance measures via an exchequer-funded programme, avoiding some of the equity issues surrounding the use of energy savings obligations for high cost measures [58]. However, in the current climate of austerity it seems an unlikely scenario and important stakeholders such as the Treasury have strong reservations against programmes based on public expenditure.

6. NOTES

Parts of this paper are based on Rosenow and Eyre [42] and Rosenow [17].

7. ACKNOWLEDGEMENT

We thank the three anonymous reviewers of this paper for their constructive and helpful comments and suggestions and Helen Colyer for the proofreading of this paper.

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