Cost and financing aspects of community renewable energy projects

VOLUME II: GERMAN CASE STUDY

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IEA-RETD
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Executive summary

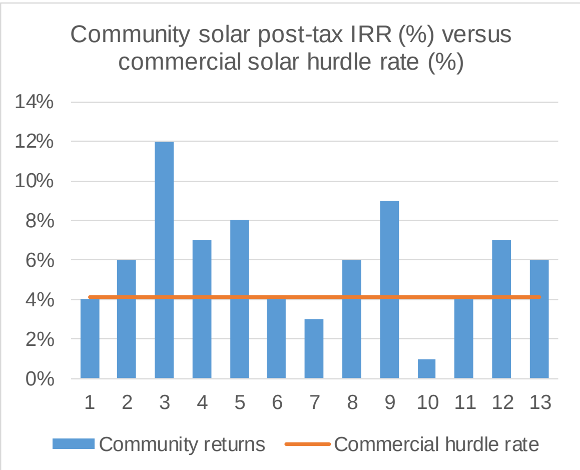
This German Case Study report presents the results of data collection and analysis of community and commercial wind and solar photovoltaic (PV) installations in Germany. It has been based on information available as at the end of May 2015 and does not refer to any policy changes that may occur after this date.

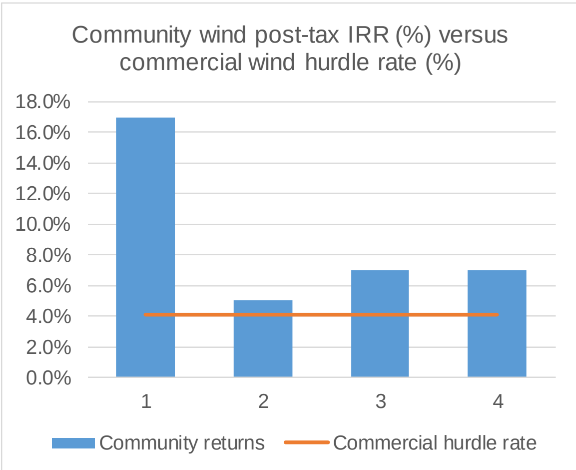
Whereas other countries have explicit policy support for community organisations, in Germany there is no explicit policy support (e.g. generous fiscal incentives) apart from at the regional level where there is regional political support for example in finding and providing suitable roofs for solar roof mounted solar installations, or suitable areas for wind projects. This is evidence that the community renewable sector is often competitive with commercial developers, and testimony to the maturity of the community renewable energy sector.

One reason why community projects are successful in Germany is because the definition of community if broad. For example, some countries define community projects as giving direct benefit to local communities, such as supporting households improve the energy efficiency of their properties or supporting local charities. However, in Germany community investors are often different, commonly a group of farmers or community members; but rather than the profits being used for community benefit activities, the profits are given to the investors. It is for this reason that community renewable energy projects pay German corporation and trade tax.

Cost Data Comparison

Through direct interviews and questionnaires we have data for 17 community projects, 13 being solar and four being wind projects. Using the data on costs and income we have calculated the post-tax pre-financing Internal Rate of Return (IRR) for each of the 17 wholly community owned projects shown below:





The fact that five solar projects had a post-tax hurdle rate lower than the rates a commercial developer would require is a signal that communities are often prepared to earn less than commercial developers for they are often undertaking their project for other non-financial reasons, including community support and meeting their environmental aspirations, or alternatively are using some of the electricity themselves offsetting high retail electricity prices. However, the four community wind projects meet or exceed the commercial hurdle rate of return, evidence they have been located in areas of strong wind speed.

On cost comparisons, for community and commercial projects of similar sizes there is evidence that community small scale (e.g. 30 kW) solar projects have lower cost for developing the project to the point of construction commencement. It may well be that development costs are lower for communities for simpler smaller rooftop PV projects given the ‘free’ professional time that shareholders, or other community members provide.

However, for larger scale solar projects and wind projects, the development costs are higher for communities. Nevertheless, development costs are a very small proportion of total costs. For example, if the community development costs are 50% cheaper than commercial development costs, the difference in project returns will be immaterial as development costs only make up around 2-4% of total project costs.

Regarding construction costs there is evidence that community solar projects and wind projects have higher construction costs, more than offsetting any lower development costs. This leads to the conclusion that overall community projects may be slightly more expensive to reach the commissioning point, but not significantly higher. As operating costs for solar and wind projects represent such a small percentage of total development and construction costs any slight differences in operating costs do not have a material impact on the profitability of projects.

Conclusions

Mindful of the limitations of the community survey size - four wind projects all above 2 MW, two larger (greater than 400 kW) rooftop PV projects, one large (5 MW+) ground mounted PV project and 10 smaller rooftop PV projects (average about 43 kW) - there is some evidence that larger community wind and solar PV projects (circa 500 kW+) have higher development and construction costs than commercial projects, although the differences are not significant. In particular, the solar projects interviewed were commissioned between 2011 and 2015, and there have been significant reductions in the prices of PV units as solar approaches grid parity.

Results from interviews show that in general the raising of capital and the financing of the RES projects has not posed a problem for the RES community led projects, in particular because communities and commercial ventures alike can access low cost loans of up to €25 million from the German Public Development Bank (KfW). Constraints, according to interview partners, were more of a political or administrative nature.

The guaranteed feed in tariff (FIT) in combination with the possibility of favourable KfW loans was and still is very important also for the development of community led RES projects as it gives greater certainty around revenue stream.

As policy recommendations the main one is that most of the interview partners fear that the current changes in the support schemes will most notably:

- Fixed FIT support will only be available for projects up to 100 kW from 2016 onwards (down from projects up to 500 kW), in effect worsening conditions for the development of the typical projects that cooperatives have built in the past, i.e. larger than residential but still nevertheless small compared to other commercial projects;
- For installation above 500 kW (and 100 kW from 2016) the market premium and direct market rules require new RES entrants to negotiate Purchase Power Agreements (PPAs) with distribution companies. This is particularly burdensome to communities, as communities often only do one project, and cannot learn from experience;
- The uncertainty surrounding planned tendering system, being introduced from 2017 onwards, which when tested for the first time for PV ground mounted installations did not result in any cooperatives or smaller players being selected. This was because they either offered too high a price or did not correctly complete the application forms.

Several interview partners pointed out that ‘de minimis’ thresholds or an obligatory financial and/ or conceptual participation of local citizens in shared ownership models may be a solution to keep the community sector alive.

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1 Introduction

This German case study is structured into four main areas:

- Firstly a short overview of the German renewable energy sources (RES) market is given focusing on community based RES activities. To do this a definition of community led RES projects is proposed;
- Secondly the costs faced by community based and commercial[1] RES projects are described and analysed. The information on costs for community projects was collected via interviews with RES communities, and the information on commercial projects has relied on a literature review. The numbers were then transferred into a financial model that shows how 'profitable' different projects are. This enables a comparison on the profitability of community versus commercial projects;
- Thirdly the responses to the seven research questions of this IEA-RETD study are provided that draw on the outcomes from the interviews with communities and RES sector specialists, and from wider literature research;
- The Case Study then provides overall conclusions targeted at policy makers.

This Case Study has been based on information available as at the end of May 2015 and does not refer to any policy changes that may occur after this date.

2 Background: The German RES market

Germany has a tradition of financial participation of communities and individuals in decentralised renewable energy, which is rooted in the environmental movements leading to the first RES installations, but also in the relatively stable Feed in Tariff (FIT) regime that was first introduced in the early 1990s and extended by the Renewable Energy Sources Act in 2000. These conditions allowed for a financial and organisational participation of local citizens in community energy projects and energy policy.

2.1 Definition of community led projects

Leuphana University uses different criteria to assess whether RES projects can be classified as "Bürgerenergie", which can be translated to citizen energy[2]. Furthermore, they differentiate between "Bürgerenergie" in the narrow and the wider sense. For a project to be defined as "Bürgerenergie" in the **narrow definition** it needs to fulfil following criteria:

- **Actors:** Private persons and/ or small agricultural businesses (along with other legal entities) invest individually or together into RES installations;
- **Form of participation:** actors invest equity in the project so have voting rights and rights of control;
- **Participation quota:** Citizens hold at least 50% of voting rights;
- **Regionality:** Investing company members come from or live in one region, although that region can cross administrative boundaries.

A **wider definition** of "Bürgerenergie" would include lower requirements towards the participation quota (minority participation) and the principle of regionality (community of interest rather than community of locality).

For the purpose of this German case study we will use the term of "community energy" and "community led projects" in the narrower and wider sense of "Bürgerenergie" mentioned above.

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[1] The use of the term "commercial" lies in the necessity of making a distinction between the different types of RES projects, acknowledging that community led projects are also "commercial" depending very much on the definition of community.
[2] Leuphana University. *Definition und Marktanalyse von Bürgerenergie in Deutschland - Teil I: Bürgerenergie. Definition & Operationalisierung*. 2013, p.26.

2.2 Possible legal forms for RES community based projects

The legal framework in Germany provides different business models enabling citizens to participate in the financing of RES projects. As mentioned in the definition above, citizen participation and co-ownership are usually connected to the provision of equity capital. Business models vary in the degree of co-determination, rights and liability conceded to participating citizens.

2.2.1 Energy cooperatives

Cooperatives (eingetragene Genossenschaften – eG) are used as a form of organization for photovoltaic systems, wind farms, district heating and power networks. The legal advantage of cooperatives is that many different actors, such as municipalities, citizens, and companies can participate[3].

In a co-operative system, citizens usually purchase co-operative shares to become a member or provide loans for particular projects or a combination of both, which are used to fund RES projects or to buy shares of larger shared ownership projects. The number and costs of shares are individually determined by the co-operative dependant on the project size and equity financial requirement[4]. The average financial contribution to energy cooperatives that are members in the German cooperative association Deutscher Genossenschafts- und Raiffeisenverband (DGRV) is €3,298 per member in 2014[5] and around €5,500 according to a survey of Leuphana University[6]. The share of equity used in finance is 54% on average, with the remainder being debt financed. However, the debt: equity ratios vary quite markedly, with for example 23% of cooperatives are 100% equity financed. Nearly two thirds of debt capital is drawn from cooperative banks[7].

Each cooperative member has only one vote, regardless of the level of shareholding. Therefore, the energy cooperative is considered a particularly democratic form. The boards of the co-operatives often work voluntarily and are represented by people who also occupy other duties in a community (e.g. mayors)[8]. Cooperatives need to have at least three members to be set up.

Members receive an annual dividend for their shares. The German cooperative association DGRV, reports an average dividend is around 4.26%[9]. Compared with a closed-end fund, cooperatives are less profit-oriented[10]. Members' liability is limited to their contributions.

As of the end of 2014, there were 973 registered energy cooperatives in Germany[11]. There is a real mix of RES technologies cooperatives chose. It is estimated that in 2013 63% of cooperatives use photovoltaics only, 15% use bioenergy only, 6% use wind energy only with the rest being technology combinations and grid and distribution investments[12]. However, the number of new energy cooperatives has been declining since 2011 for a number of reasons such as reductions, changes in other support mechanisms and changes on the financial requirements for cooperatives to comply with the German enactment of the EU Directive on Alternative Investment Fund Managers[13]. Nevertheless, since March 2015 German cooperatives have been exempted from complying with this EU Directive, which should stabilise the market.

2.2.2 Closed-end funds

For larger, therefore more expensive and often more complex projects, closed-end funds are often used in the legal form of GmbH & Co. KG. One or more people lead the business full-time, at the same time, many investors may be involved. Like cooperatives the liability of the management and investors is limited to their own capital contributions, but the model of closed-end funds separates the project

[3] Agentur für erneuerbare Energien (AEE). Gute Nachbarn – Starke Kommunen mit Erneuerbaren-Energien: Energie in guter Gesellschaft. 2015.
[4] Ibid.
[5] Deutscher Genossenschafts- und Raiffeisenverband e.V. (DGRV). *Energiegenossenschaften – Ergebnisse der Umfrage des DGRV und seiner Mitgliedsverbände*. Spring 2014.
[6] Degenhart, H., Nestle U. *Marktrealität von Bürgerenergie und mögliche Auswirkungen von regulatorischen Eingriffen*. April 2014.
[7] Deutscher Genossenschafts- und Raiffeisenverband e.V. (DGRV). *Energiegenossenschaften – Ergebnisse der Umfrage des DGRV und seiner Mitgliedsverbände*. Spring 2014, p.11.
[8] Haggett, C., Aitken, M., Rudolph, D., van Veelen, B., Harnmeijer, J. and Markantoni, M. *Supporting Community Investment in Commercial Renewable Energy Schemes: Final Report*. ClimateXChange. December 2014.
[9] Deutscher Genossenschafts- und Raiffeisenverband e.V. (DGRV). *Energiegenossenschaften – Ergebnisse der Umfrage des DGRV und seiner Mitgliedsverbände*. Spring 2014.
[10] Degenhart, H., Nestle U. *Marktrealität von Bürgerenergie und mögliche Auswirkungen von regulatorischen Eingriffen*. April 2014, p.33.
[11] Müller, J.R., Holstenkamp, L. *Zum Stand von Energiegenossenschaften in Deutschland – Aktualisierter Überblick über Zahlen und Entwicklungen zum 31.12.2014*. January 2015.
[12] Degenhart, H., Nestle U. *Marktrealität von Bürgerenergie und mögliche Auswirkungen von regulatorischen Eingriffen*. April 2014, p.9.
[13] European Parliament and Council. *Directive 2011/61/EU of the European Parliament and of the Council on Alternative Investment Fund Managers and amending Directives 2003/41/EC and 2009/65/EC and Regulations (EC) No 1060/2009 and (EU) No 1095/2010*. 8 June 2011.

development and management from equity provision with investors only being able to engage in extraordinary circumstances. However, often an advisory council connects the investors with the management[14]. Distribution of income among the shareholders is structured according to their investment.

The limited opportunities for shareholder to be active can be an advantage for citizens who prefer not being engaged in the business issues. Hence, citizen participation through closed-end funds is not always regionally confined (community of interest).

Due to the relatively large investment volumes, closed-end funds are the most common legal business model for citizen participation in wind farms in Germany[15].

2.2.3 Combination of cooperative and closed-end fund

Cooperatives can participate in a closed-end fund in three ways as described by Degenhart and Holstenkamp[16]:

- The cooperative purchases shares as an investor. In this model the cooperative is only involved as capital source, management is carried out by the general partner (GmbH);
- The cooperative purchases shares of the management. This enables the cooperative to participate in management;
- The cooperative buys out the management of a GmbH & Co. KG, therefore, becoming fully responsible for management. This legal structure might be useful in cases where cooperatives decide to purchase shares in existing projects or completely take over an existing project. It might also be a solution for two cooperatives that decide to create a project together.

2.2.4 Civil-law partnership

For small RES plants with investment volumes of a few €100,000 the civil-law partnership (Gesellschaft bürgerlichen Rechts - GbR or BGB-Gesellschaft) can be chosen as an organizational form, for example for citizen PV systems. It is an uncomplicated option, since for its set up an informal agreement suffices and authorised capital is not necessary. All shareholders (that could be as few as 2 people) represent and manage the GbR together and must provide all signatures. However, management is often delegated by proxy. The partners of the company have unlimited liability against their personal assets for all obligations of the GbR. This is the main disadvantage of this legal form. The risk can however be reduced by appropriate insurance and the choice of experienced business partners.

2.2.5 Shared ownership

Shared ownership in RES installations can have different forms. In Germany the most common one is shared ownership between local or regional public utilities and cooperatives, for example BioEnergie Jena eG. Cooperation between the four large utilities (EnBW, E.ON, RWE, and Vattenfall) and RES cooperatives or other community organisations were mentioned in interviews, however, none of these seem to have got past the planning stage yet.

Another form is the cooperation between municipalities or local administrations, and citizens in energy cooperatives. However, normally municipalities often only hold symbolic financial shares in energy cooperatives[17].

2.2.6 Other business models in Germany

Other participation models used in Germany are based on mezzanine or debt financing, such as profit participation rights or bonds. These models mainly provide financial participation in a project; other ways of participation are very limited. These models are therefore most suitable for investors who do not want to be active shareholders. Investors in these models often do not know which specific project they are contributing (e.g. silent partnerships). For these reasons these kind of financing models can

[14] Haggett, C., Aitken, M., Rudolph, D., van Veelen, B., Harnmeijer, J. and Markantoni, M. *Supporting Community Investment in Commercial Renewable Energy Schemes: Final Report*. ClimateXChange. December 2014.
[15] Wallasch, A.-K., Lüers, S., Rehfeldt, Dr. K. *Akteursstrukturen von Windenergieprojekten in Deutschland*. January 2015, p.13.
[16] Degenhart, H., Holstenkamp, L. Bürgerwindparks als genossenschaftliche Kooperationsprojekte – Eine Projektstudie. February 2013.
[17] Leuphana University. *Definition und Marktanalyse von Bürgerenergie in Deutschland - Teil I: Bürgerenergie. Definition & Operationalisierung*. 2013.

only be regarded as community energy in the wider sense, or depending on the specific model not even community energy at all[18].

2.3 RES development in Germany

The following analysis is based on data from EnergyMap (EnergyMap 2015). This database includes those installations registered under the Renewable Energy Sources Act, whether owned by individuals, communities, companies or renewable energy developers. Therefore, the data does not include old hydro power installations and might also deviate slightly from the official data published by the Working Group on RES statistics in Germany (AGEE-Stat). The advantage of the energy map database is the level of detail of installations and installation sizes.

The total number of RES projects was at around 1,540,000 installations in 2014. Figure 1 shows how the number of installations has developed over time. Figure 2 below shows that the majority of installations are small PV, with wind energy contributing the second largest amount of installations.

Figure 1: Total number of RES projects from 2002 to 2014

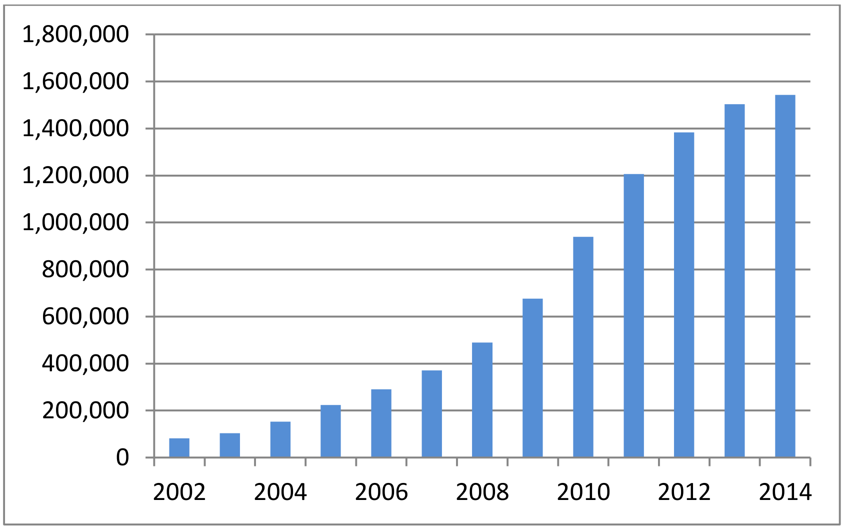
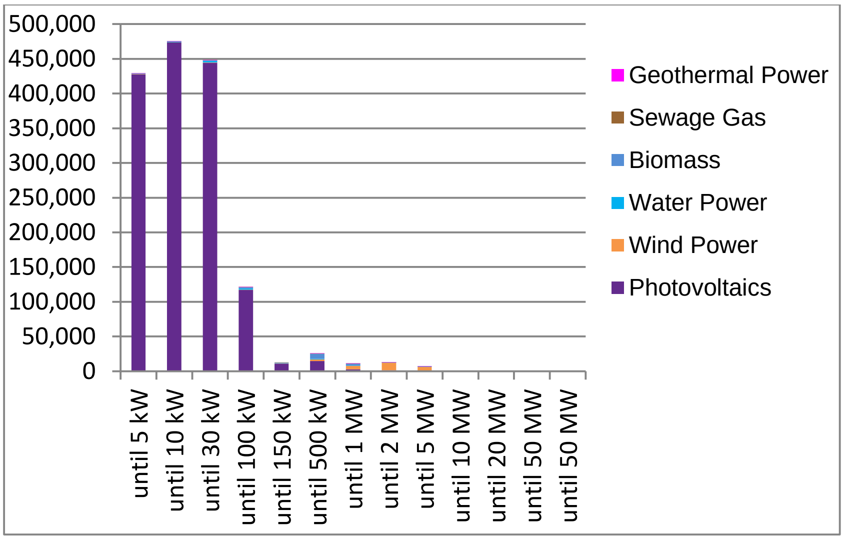


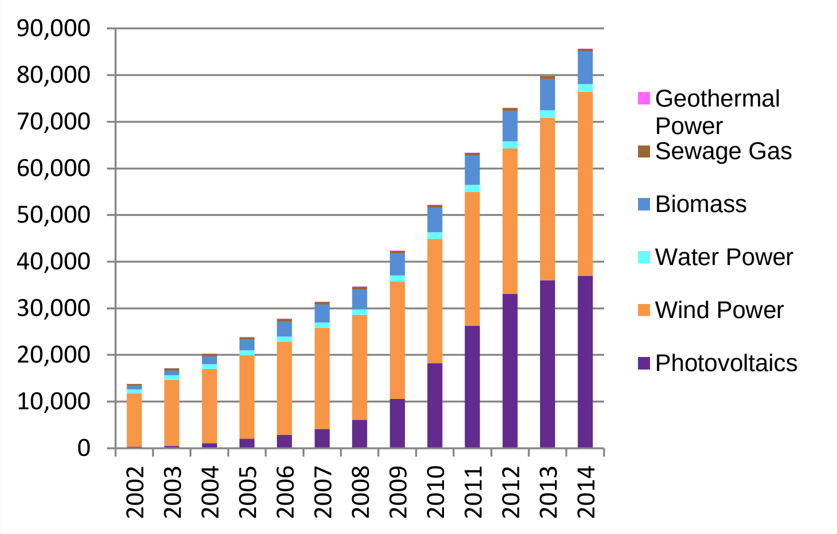
Figure 2: Number of RES installations in 2014, according to technology and installed capacity sizes



[18] Degenhart, H., Holstenkamp, L. Bürgerwindparks als genossenschaftliche Kooperationsprojekte – Eine Projektstudie. February 2013. Haggett, C., Aitken, M., Rudolph, D., van Veelen, B., Harnmeijer, J. and Markantoni, M. *Supporting Community Investment in Commercial Renewable Energy Schemes: Final Report*. ClimateXChange. December 2014.

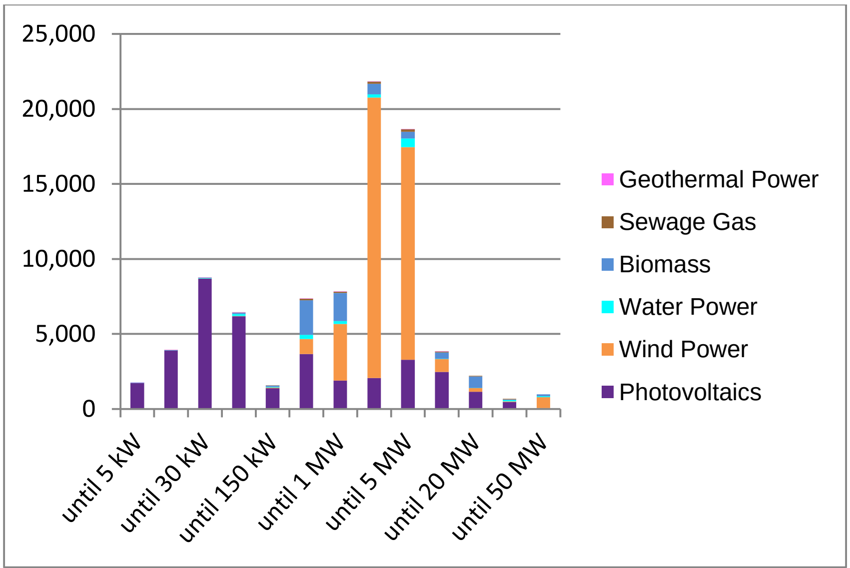
The total installed capacity of RES installations registered under the Renewable Energy Sources Act was nearly 86 GW. Figure 3 shows how the installed capacity has been growing over time and how it is distributed over the different RES technologies.

Figure 3: Installed capacity of RES from 2002 to 2014, according to technology in MW



According to Figure 4 the largest amount of installed capacity stems from wind power installations with some 40.5 GW of installed capacity[19], mainly in installations of 1-5 MW capacity. Photovoltaics (PV) are the second largest source in terms of installed capacity with nearly 38.2 GW[20]. PV installations are quite distributed over the different size clusters, but have a concentration between 5 kW - 100 kW per installation.

Figure 4: Installed capacity of RES in 2014, according to technology and installed capacity sizes in GW



According to an analysis carried out by Trend Research (2013), 9.2% of the installed capacity in RES[21] (6,687 MW) in 2012 could be attributed to the definition of community energy in the narrow sense. Further 11.6% (8,483 MW) can be considered community energy in the wider sense (minority participation or no regional confinement). The rest of the installed capacity belongs to private owners

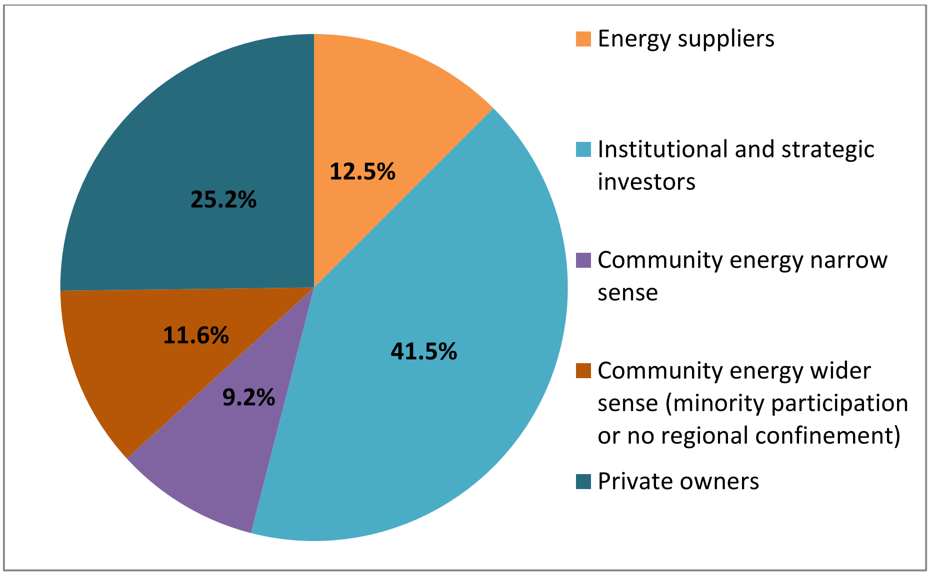
[19] Federal ministry for economic affairs and energy. *Time series for the development of renewable energies in Germany.* August 2015. http://www.erneuerbare-energien.de/EE/Navigation/DE/Service/Erneuerbare_Energien_in_Zahlen/Zeitreihen/zeitreihen.html

[20] Ibid.

[21] The total amount of installed capacity in this study slightly deviates from the source used in the figures above. The percentage values can therefore only be applied cautiously to the data in the above figures. Nevertheless, deviations are only marginal, so that the percentages still give a valid overview of the state of community energy in Germany.

(25.2%, 18,362 MW), energy suppliers (12.5%, 9,144 MW) and institutional and strategic investors (41.5%, 30,230 MW). Figure 5 depicts the ownership structure graphically.

Figure 5: Installed Capacity for RES total in Germany by ownership group, 2012



Whilst community energy projects (in the narrower sense) are 9.2% of total renewable capacity, in the onshore wind sector community projects (in the narrower sense) make up 20.4% (6,301 MW) of the installed wind capacity. In the other sectors, e.g. PV and bioenergy, community energy makes up less than 2% of those markets.

2.4 Policy support schemes for RES

The main support mechanism for RES generation has so far been a FIT introduced as part of the Renewable Energy Sources Act dating from 2000, which has been revised several times to adjust FITs to reflect cost-reductions, change the coverage of technologies as well as the coverage of different biomass resources. However, under the revision of the Renewable Energy Sources Act (EEG) of 2014 for projects greater than 500 kW there is a **market premium system** where plants are supported by a market premium for electricity they sell directly to energy supply companies. The support covers the difference between a rolling average wholesale price and the statutory support level. Support is usually paid over a period of 20 years plus a year for start-up. The premium will only be paid for electricity exported to the grid and purchased by a third party.

For power plants up to 500 kW in size the support system is still based on a FIT which the grid operator pays to the plant operator. From 1 January 2016 FITs will only be granted for new power plants with an installed capacity of up to 100 kW.

Support levels under both schemes are connected to technology-specific degression factors to account for cost reductions in their deployment. In addition, there are technology-specific deployment paths for each year until 2020. Onshore wind energy is supposed to increase by 2,500 MW (net) each year and photovoltaics by 2,500 MW (gross). Depending on over- or under-achievement of this predefined deployment corridor (2,400 to 2,600 MW), the degression rates will be adapted. Yearly installations for biomass are supposed to increase by 100 MW per year until 2020, offshore wind energy by 6,500 MW in total until 2020.

The operators of biogas plants commissioned after 1 August 2014 may claim additional support for providing capacity for on-demand use. The additional support can be received on top of and separately from the market premium or the FIT.

A key enabler of the RES project finance is the possibility to take out financing loans from the German Public Development Bank (KfW Bankengruppe). The KfW Renewable Energy Programme – Standard is the main support programme in this regard for renewable electricity in accordance with the EEG and gives **low interest loans** for investments in installations. It is a long-term and low-interest loan of up to €25 million per project, financing up to 100% of investment costs (without VAT). It features a fixed interest rate period of at least 10 years including a repayment-free start-up period. Effective interest rates per year start from 1.31% depending on the credit period, the repayment-free start-up period and the duration of the fixed interest rate period (KfW Renewable Energy Programme Standard). KfW loans are administered and disbursed by regular banks. Including local cooperative banks. As well as this KfW support, local cooperative banks are also active lenders in the sector.

From 2017 onwards, tendering is planned to be the main support scheme for RES expansion. The tendering system is different from FITs in that developers bid to supply electricity at a fixed price. This results in a lot of competition for capacity, with the winning bidders being those that bid most cheaply. In preparation, tendering has already been tested for ground-mounted photovoltaics. The Federal Government´s first solar park tender for 157 MW resulted received 170 bids, with 25 receiving support. Interestingly one bidder secured funding for several projects of approximately 62 MW (40% of the 157 MW). Of the 170 bids seven were from individuals, three from civil law entities and four from cooperatives, but none of these secured funding, mainly due to the higher prices they bid or errors in completing the application form[22]. However, from the list of granted projects it is not possible to determine whether some of the winning bids from close-ended funds could be counted as community energy according to the definition in Section 2.1. Further, some of the winning bidders have stated that they plan to sell part of the installation to communities once they have been developed.

At the moment it is unclear whether tendering will apply to all sizes and kinds of RES installations. This uncertainty as to what will happen is creating much confusion amongst smaller community developers.

Figure 6: Summary of key policies for RES

Financial incentives
Feed in Tariff up to 500 kW (falling to 100 kW)
Market premium above 500 kW (falling to above 100 kW)
Subsidised loans
Tendering (from 2017) but already being trialled

2.4.1 RES support for commercial projects

There are no special support systems in place for commercial companies. Large RES installations of more than 500 kW in 2015 and more than 100 kW from 2016 onwards will be supported by the market premium system. Furthermore, low interest loans from the KfW are available for commercial companies, too. From 2017 the tendering route will be used.

2.4.2 RES support for community based projects

Likewise, there are no special support systems in place for community organisations. However, small RES installations below 100 kW of installed capacity are still eligible for a fixed FIT from 2016 onwards (below 500 kW in 2015). The current support mechanisms give security of revenue for kW exported to the grid and allow small actors to acquire risk capital and bank loans. The low interest rate loans from KfW are a further support, which is especially used by small project developers.

The market premium system for above 500 kW with direct marketing to energy suppliers requires higher technical and commercial skills in project management, as communities need to negotiate with energy suppliers to find the best price to sell electricity at. This might increase costs for community developers, since these are often managed by volunteers, who might not have the necessary skills. Hence, appropriate staff needs to be hired or service contracts need to be concluded, increasing costs for community projects, particularly smaller projects[23].

[22] Solarthemen. *Little diversity in PV tenders.* http://www.solarthemen.de/index.php/2015/05/07/wenig-vielfalt-bei-pv-ausschreibungen/
[23] Degenhart, H., Nestle U. *Marktrealität von Bürgerenergie und mögliche Auswirkungen von regulatorischen Eingriffen*. April 2014.

3 Costs faced by RES projects

The costs faced by RES projects were collected on the basis of the interviews (for community led projects) and by using publicly available data bases (for commercial projects).

3.1 Commercial RES projects

Data on commercial projects is already available from a range of sources, covered in the **Appendix 7 of the Main Report** and replicated in below in Figure 7 (for wind) and Figure 8 (for solar projects less than 1 MW). The International Renewable Energy Agency (IRENA) German data is presented (converted into €s), along with reports from Leipzig Institute for Energy and the Centre for Solar Energy and Hydrogen Research Baden-Württemberg that were used by the German government for modelling FITs. Usefully the solar report by Hydrogen Research Baden-Württemberg gives the costs (€/MW) for different sizes of projects (30 kW, 500 kW and 5,000 kW) as economies of scale mean the costs per MW for larger projects are lower than for smaller projects.

Figure 7: Additional Germany data: Wind

	International German data (USD $)	International German data (€) at €1 = USD $1.15 exchange rate	Additional : German data (€)
Development costs (Currency/MW)	$200,000 [ˇ]	€173,900 [ˇ]	€68,000 [≈]
Construction costs ($/MW)	$1,799,000 [ˇ]	€1,564,350 [ˇ]	€1,499,000 [≈]
Operational costs (Currency/MW/ year)	$67,000 [ˆ]	€58,250 [ˆ]	€70,515 [≈]
Typical debt: equity ratio	70:30 [a]	70:30 [a]	80: 20 [≈]
Cost of debt (%)	5.5% [a]	5.5% [a]	3.8% [≈]
Length of loan (years)	13 [a]	13 [a]	15 [≈]
Cost of equity (%)	9.5% [a]	9.5% [a]	>8% [≈]
Tax rates (2015)	29.7% °	29.7% °	29.7% °
Post-tax weighted average cost of capital	5.6% *	5.6% *	4.1% * [!]

Sources:

[ˇ] IRENA. *Renewable Power Generation Costs in 2014*. January 2015. Table 4.3 has total installed costs ($/MW) for Germany. Further, Figure 4.1 of the IRENA report shows that development costs are typically 9%-13% of total project cost. An assumption of 10% is made.

[ˆ] IRENA. *Renewable Power Generation Costs in 2014*. January 2015. Table 4.4 has the Operations and Maintenance (O&M) costs for Germany.

[a] IEA Wind. *IEA Wind Task 26: Multinational Case Study of the Financial Cost of Wind Energy*. March 2011. Table 1.3.

° 2015 corporate tax rates are sourced from KPMG's Corporate Tax Rate Tables available at http://www.kpmg.com/Global/en/services/Tax/tax-tools-and-resources/Pages/corporate-tax-rates-table.aspx

[≈] Leipzig Institute for Energy. *Progress Report 2014 Wind power scientific report on behalf of the Federal Ministry of Economy and Energy.* July 2014. Available at: https://www.bmwi.de/BMWi/Redaktion/PDF/XYZ/zwischenbericht-vorhaben-2e,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf

* The post-tax WACC formula is {gearing x interest rate x (1 – tax) } + { (1- gearing) x equity return}

[!] The Leipzig Institute for Energy reports equity returns greater than 8%. An equity of return of 10% is assumed.

Figure 8: Additional Germany data: Solar (<1 MW)

	International German data for < 1 MW (USD $)	International German data (€) at €1 = USD $1.15 exchange rate	Centre for Solar Energy and Hydrogen Research Baden-Württemberg 30 kW	Centre for Solar Energy and Hydrogen Research Baden-Württemberg 500 kW	Centre for Solar Energy and Hydrogen Research Baden-Württemberg > 5 MW ground mounted
Development costs (Currency/MW)	$90,000 [˘ a]	€78,300 [˘ a]	€52,400 [≈]	€47,200 [≈]	€39,200 [≈]
Construction costs ($/MW)	$1,710,000 [˘ a]	€1,487,000 [˘ a]	€1,257,600 [≈]	€1,132,800 [≈]	€940,200 [≈]
Operational costs (Currency/MW/ year)	$36,000 [˘ *]	31.300 [˘ *]	€35,000 [˟]	€17,700 [≈]	€14,700 [≈]
Typical debt: equity ratio	N/A	N/A	62.5 : 37.5 [≈]	75 : 25 [≈]	75 : 25 [≈]
Cost of debt (%)	N/A	N/A	2.85% [≈]	3.05% [≈]	3.05% [≈]
Length of loan (years)	N/A	N/A	15 [≈]	15 [≈]	15 [≈]
Cost of equity (%)	N/A	N/A	7% [≈]	>8% [≈]	>8% [≈]
Tax rates (2015)	29.7% [°]	29.7% [°]	29.7% [°]	29.7% [°]	29.7% [°]
Post-tax weighted average cost of capital	N/A	N/A	3.9% [¬]	4.1% [¬ !]	4.1% [¬ !]

Sources:

˘ IEA. *Technology Roadmap. Solar Photovoltaic Energy*. 2014 edition. Total cost of installation is provided for Germany (Table 2).

a Based on Ricardo Energy and Environment studies development costs make up approximately 5% of the total cost of an installation. This covers feasibility work, planning permission and other related development costs.

* The international operating costs were sourced from a UK report by DECC. *Electricity Generation Costs 2013*. July 2013, p. 66. The DECC report states operation and maintenance costs are approximately 2% (per year) of total cost for installing large scale solar PV installations. Operation and maintenance costs include inverter replacements (approximately every 7-10 years), ongoing installation project management, insurance, cleaning and basic repairs.

° 2015 corporate tax rates are sourced from KPMG's Corporate Tax Rate Tables available at http://www.kpmg.com/Global/en/services/Tax/tax-tools-and-resources/Pages/corporate-tax-rates-table.aspx

≈ Centre for Solar Energy and Hydrogen Research Baden-Württemberg. *Progress Report 2014 Solar power scientific report on behalf of the Federal Ministry of Economy and Energy*. May 2014. Figure 14 (p. 25) and Table 4 (p. 27). Available at: https://www.bmwi.de/BMWi/Redaktion/PDF/XYZ/zwischenbericht-vorhaben-2c,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf Further, the report assumes solar operating costs are 1.5% of total development and construction costs.

˟ Operational costs for small scale (c.30 kW) projects are estimated by the Fraunhofer Institute to be €35,000/MW per year. Fraunhofer Institute. *Strомgestehungskosten Erneuerbare Energien.* Studie. November 2013. Retrieved from: http://www.ise.fraunhofer.de/de/veroeffentlichungen/veroeffentlichungen-pdf-dateien/studien-und-konzeptpapiere/studie-stromgestehungskosten-erneuerbare-energien.pdf

¬ The post-tax WACC formula is {gearing x interest rate x (1 – tax) } + { (1- gearing) x equity return}

! The Fraunhofer Institute reports equity returns for 500 kW+ projects of 8%. An equity of return of 10% is assumed.

It is noticeable that the German Leipzig Institute for Energy and the Centre for Solar Energy and Hydrogen Research Baden-Württemberg reports have lower development and construction costs for wind energy and solar PV than the international IEA and IRENA data. The Leipzig institute for energy operating costs for wind are higher per than the IRENA report whilst the Fraunhofer institute solar operating costs for a 1 MW array are lower than the IEA report. The higher wind operating costs may be because the IRENA wind dataset relies on older data, or is for a different, unspecified, size of RES facility. Furthermore, the data from the Centre for Solar Energy and Hydrogen Research Baden-Württemberg is based partly on assumptions, for example, yearly operating costs are 1.5% of the total investment costs.

3.2 Community based RES projects

Cost data for community based RES projects were gathered via stakeholder interviews in Germany.

3.2.1 Interview process and initial results

A number of sector level organisations such as the Renewable Energies Agency (Agentur für Erneuerbare Energien) and the Alliance for Citizen Energy (Bündnis Bürgerenergie e.V.) were initially contacted to obtain a list of community energy companies. Additionally, we used our own contacts and contacts from the German Onshore Wind Energy Agency (Fachagentur für Windenergie an Land – FA Wind). We focused on and solar projects. In total we contacted 20 community energy organisations, five project developers, four associations and community institutions and one representative from science.

We were successful in speaking directly to representatives of six community organisations and two project developers, some of which have developed a number of different projects. Two community organisations provided us with data by filling in the questionnaire and sending it back via email.

Regarding the wind sector only three of the contacted 12 community energy organisations and project developers were willing to participate. The reasons why the other ones declined were manifold; time constraints being mentioned in most of the cases. Other reasons were a wind project being abandoned due to political constraints, and a project only being in the planning or construction phases, therefore lacking the relevant data. In general the commercial project developers were quite reluctant to provide data in the needed level of detail, even when we promised to anonymise their information.

The interviews were held with each of the community groups after they had received the questionnaire. However, not all of the interviewees for the written submission provided us with the necessary data for the financial model. However, in total we gathered data for 13 solar projects and four wind projects, summarised in Figure 9.

Figure 9: Summary kW capacity of the 17 community projects

	Project Scale (kW)	Number of projects
Wind – 4	1,500 – 5,000	4
Solar Roof – 12	<50	7
	50 – 500	4
	500 – 1,500	1
Solar Ground – 1	> 5,000	1

The projects were commissioned at different points in time, with the split of the 17 projects being shown in Figure 10.

Figure 10: Commissioning dates of the 4 wind projects and 13 solar projects

	2010	2011	2012	2013	2014	2015
Wind	0	0	2	1	1	0
Solar	0	4	3	2	3	1

We were unable to collect data from shared ownership projects.

3.3 Comparison of community energy and commercial cost data

3.3.1 Based on project data and literature review

In this section a comparison of cost data from the interviews with community energy projects and commercial data is made. When interviewing organisations and asking commercially confidential information about costs and revenues there is always the chance that organisations report higher or lower numbers to lower their annual profits. Whilst this sometimes happens when organisations respond to Government questionnaires, we have no reason not to believe the numbers provided by the German community groups meaning that although the dataset is quite small the results are still highly meaningful.

However, it must also be acknowledged (as shown in Figure 10) that the community cost data was collected over a number of years, whereas the from Leipzig Institute for Energy and the Centre for Solar Energy and Hydrogen Research Baden-Württemberg datasets are more recent (2014 and late 2013 respectively). In particular solar costs have fallen significantly in recent years. Also, the Leipziger Institute for Energy and the Centre for Solar Energy and Hydrogen Research Baden-Württemberg also include their own assumptions.

The ten smallest community roof mounted projects had an average capacity of 43 kW (see Figure 11). It therefore made most sense to compare these 10 projects to the commercial data supplied by the Centre for Solar Energy and Hydrogen Research Baden-Württemberg for 30 kW plants. Also presented in Figure 12 is the data for two community projects (446 kW and 1,348 kW) compared to a 500 kW plant and the community 5,915 MW ground mounted project compared to the 5,000 kW+ for commercial projects.

Figure 11: Development, construction and annual operational costs (€/MW) for solar roof projects

	Capacity (kW)	Development cost (€/MW)	Construction cost (€/MW)	Annual operational cost (€/MW)
Roof 1	6	-	1,758,333	38,667
Roof 2	39	50,929	1,209,575	38,630
Roof 3	17	51,412	1,510,235	34,824
Roof 4	113	50,000	1,468,752	33,858
Roof 5	58	50,276	1,476,862	34,052
Roof 6	47	49,532	1,454,681	33,511
Roof 7	446	49,944	1,467,105	33,816
Roof 8	49	12,245	2,448,980	12,102
Roof 9	59	10,169	1,016,949	11,119
Roof 10	18	33,333	1,666,667	22,611
Roof 11	22	27,273	1,363,636	19,636
Roof 12	1,348	157,203	1,414,837	12,455
Average roof	**185**	**45,193**	**1,521,384**	**27,107**
Average roof excluding 7 & 12	**43**	**33,517**	**1,537,467**	**27,901**

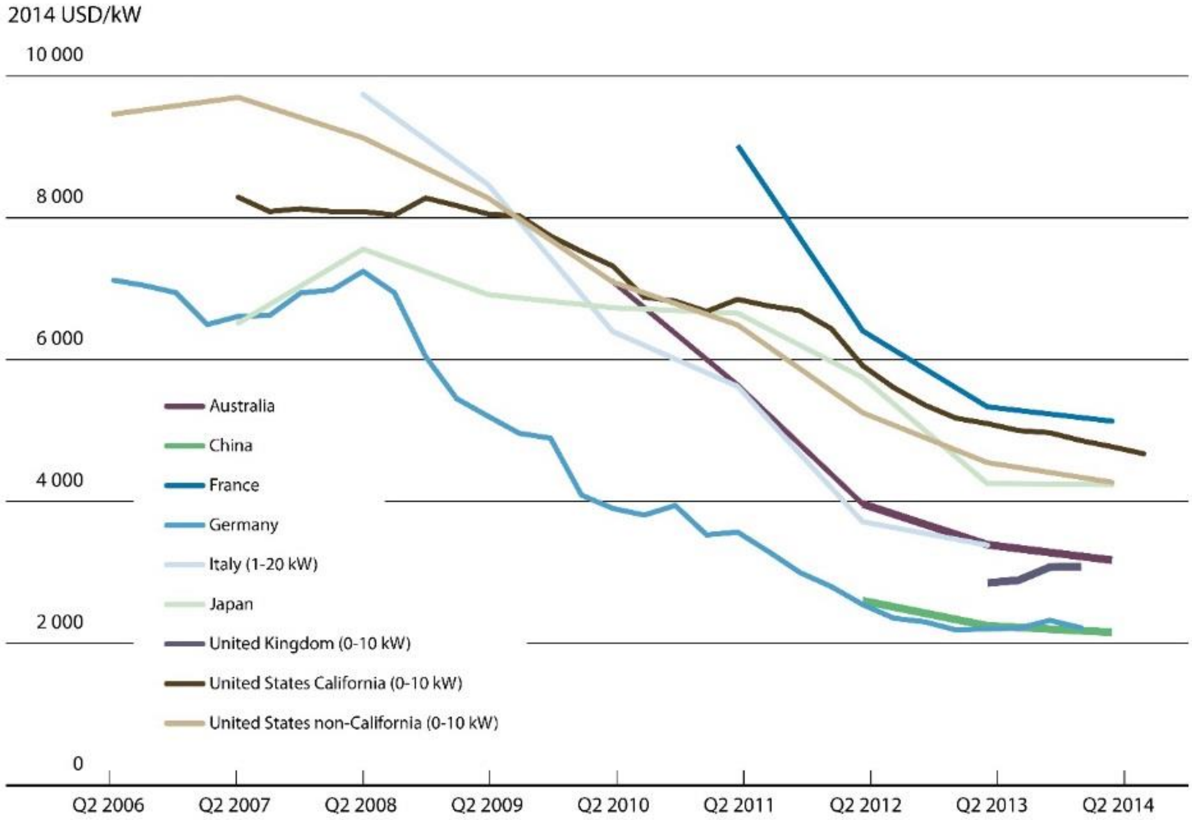
Focusing on the smaller (c.30 kW) projects, commercial development costs are 56% higher than the interviewed community development costs, commercial construction costs are 18% lower than the interviewed community construction costs, and commercial operating costs are 25% higher than the interviewed community operating costs - see Figure 12.

Figure 12: Comparison of costs (€/MW) for community projects and commercial projects - PV

	Community			Commercial and community projects (from Figure 8)		
	Average for 10 smaller community solar roof projects	Average for two larger solar roof projects	One community ground mounted project	30 kW	500 kW	>5 MW ground mounted
Capacity (kW)	43	897	5,915	30	500	5,000
Development cost (€/MW)	33,517	103,574	183,952	52,400 ▲56%	47,200 ▼54%	39,200 ▼79%
Construction cost (€/MW)	1,537,467	1,440,971	1,655,498	1,257,600 ▼18%	1,132,800 ▼21%	940,200 ▼43%
Annual operational cost (€/MW)	27,901	23,136	25,733	35,000 ▲25%	17,700 ▼23%	14,700 ▼42%
Annual operational cost as percent of total project cost	1.8%	1.5%	1.4%	1.5%	1.5%	1.5%
Development cost as percent of total project costs	2.1%	6.7%	10.0%	4.0%	4.0%	4.0%

This anomaly in construction costs may be partly explained by the fact that different community solar projects were completed between 2011 and 2015, over which time there have been significant reductions in the costs of solar panels. This is shown in Figure 13, with German costs of residential PV systems shown by the blue line. Nevertheless, considering the four small scale solar roof PV systems that were commissioned in 2014 and 2015 the average construction cost was €1,447,800 which is still 13% higher than the from Leipzig Institute for Energy report.

Figure 13: Average total installed cost of residential solar PV systems in different countries – 2006-2014 ($/kW)



Source: IRENA. *Renewable Power Generation Costs 2014*. 2015, p.88. Figure 5.10 drawn from Irena Renewable Cost Database; CPUC, 2014; GSE, 2014; IEA PVPS, 2014; and Photon Consulting, 2014.

The average development, construction and operating costs were significantly lower for the 500 kW scale commercial projects and the 5,000 kW+ ground mounted projects. However, the results for the larger scale projects are not considered sufficient given the sample of one or two community projects. For there can be many reasons costs are higher – location, unusual rental agreements, the fact that two of the projects were in 2011 and 2013, etc.

As the four community wind projects were of a similar size (2,000 kW to 4,600 kW) the wind projects are also comparable with the data collected by Leipzig Institute for Energy. As shown in Figure 14, depending on the commercial cost literature source, community development costs are either higher or lower than commercial development costs. Construction costs for the two commercial data sources are slightly lower than the interviewed community projects, and community operating costs are significantly below the commercial literature data.

Figure 14: Comparison of costs (€/MW) for community projects and commercial projects - Wind

	Average for four community wind projects	IRENA	Leipzig Institute for Energy
Capacity (kW)	3,125	N/A	3,000
Development cost (€/MW)	98,040	173,900 ▲77%	68,000 ▼31%
Construction cost (€/MW)	1,580,910	1,564,350 ▼1%	1,499,000 ▼5%
Annual operational cost (€/MW)	41,110	58,250 ▲ 42%	70,515 ▲ 72%
Annual operational cost as percent of total project cost	2.4%	3.4%	4.5%
Development cost as percent of total project costs	5.9%	10.0%	4.3%

3.3.2 Based on interviewees' assessment

In order to check the messages that (a) community wind projects have higher construction costs, but lower development and operating costs, and (b) small scale (circa 30 kW) community solar projects have higher construction costs, but lower development and operating costs, we asked communities to estimate how different the costs would have been for a commercial project of exactly the same kW capacity and exactly the same load factor (i.e. generating exactly the same MWh of electricity).

The results from the eight communities and two project developers who responded to this question are presented in Figure 15. The number of responses for each option is shown in red.

Figure 15: Community views of comparable costs for commercial projects

				No answer	Overall
The time from concept to commissioning would have been:	Quicker 2	Similar 4	Slower 2	2	Similar
Development costs would have been	Higher 7	Similar 2	Less 1	0	Higher
Capital costs would have been	Higher 2	Similar 4	Less 2	2	Similar
Installation/ construction costs would have been	Higher 3	Similar 6	Less 0	1	Similar
Substation/ BoP costs would have been	Higher 1	Similar 8	Less 0	1	Similar
Grid connection costs would have been	Higher 0	Similar 9	Less 0	1	Similar
Loans would have been	Cheaper 0	Similar 5	Dearer 3	2	Similar
Equity finance would have been	Cheaper 4	Similar 1	Dearer 3	2	Cheaper
The amount of the loan would have be	More 4	Similar 3	Less 0	3	More
Commercial management cost	Higher 9	Similar 0	Less 1	0	Higher

The main messages from the respondents in Figure 15 are that most costs will be similar, which is evidence of how mature the community energy sector is in Germany. The only areas where there are perceived to be differences are:

- Development costs would have been higher, possibly because many communities benefit from free volunteer time. This is borne out by the evidence from the smaller scale (c. 30 kW) solar projects. Another reason could be that communities – especially regarding larger projects – only step in at a later stage, for example when the wind installations already have permissions and enter into a shared ownership model. For example, some of the interview partners reported that they were offered preferential conditions regarding the development costs to be paid as a part of the overall costs. A reason for this was that often commercial developers saw having local citizen involvement as a way to increase acceptance of the installations.

  In the questionnaire we sent to communities we explicitly asked communities to estimate how many days of professional time were given freely. Communities responded to these questions, with estimates that ranged from 5 days to 65 days. To these numbers we applied appropriate daily rates, which we valued at €150 a day, unless the community gave us other information. The results for solar and wind are shown in Figure 16 which illustrates that with simpler small scale solar projects free professional time can be significant. However, with larger wind projects the value of 'free' time is less, and this could be why the development costs for community wind are higher than commercial wind development costs;

Figure 16: Importance of 'free' professional time as a proportion of invoiced development costs

The following tables show:

- The value of free time, given by members of the community group,
- The value of invoiced development costs (e.g. for legal advisers, wind studies, project management, etc).

	Solar												
Capacity (kW)	6	39	17	113	58	47	446	49	59	18	22	1,348	5,915
Free time (€)	9,750	9,750	-	-	-	-	-	1,950	1,950	1,800	1,800	750	750
Priced costs (€)	-	2,000	874	5,650	2,916	2,328	22,275	600	600	600	600	211,926	1,088,074
Free as percent of priced	No priced cost	488%	0%	0%	0%	0%	0%	325%	325%	300%	300%	0%	0%

	Wind			
Capacity (kW)	3,400	2,300	2,005	2,500
Free time (€)	-	67,500	4,286	6,429
Priced costs (€)	70,000	900,797	200,000	190,000
Free as percent of priced	0%	7%	2%	3%

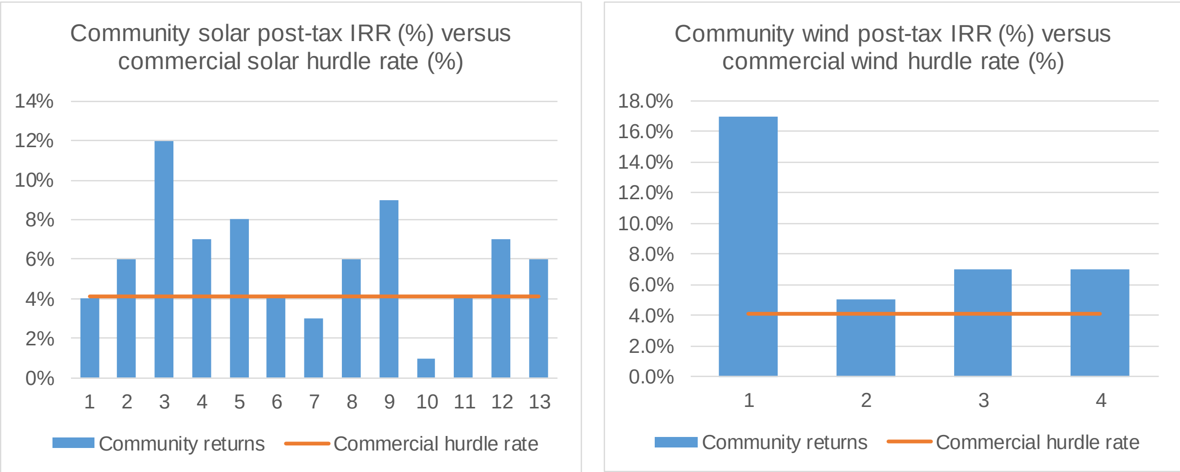
- Equity finance would have been cheaper. This goes against the general consensus that communities will commonly have lower equity hurdle rates than the commercial at 8% plus. However, the responses could be due to a misunderstanding of this question. Some respondents might have interpreted equity finance as equity share;
- Management costs refer to the cost of running the projects which would have been higher for commercial projects, as here this is usually carried out by paid professionals, while in community energy projects volunteers take over this task. One interview partner pointed out that commercial projects tend to set these costs quite high in order to reduce the reported profits and the trade tax rates respectively. This conclusion is indeed drawn out by the evidence that both community wind and small scale (c.30 kW) solar projects have lower operational costs than commercial projects.

3.4 Results from financial modelling

Based on the values in Figure 7 and Figure 8 drawn from the Leipzig Institute for Energy report and the Centre for Solar Energy and Hydrogen Research Baden-Württemberg report the approximate hurdle post-tax IRR for commercial projects are calculated as about 4.1% for wind and solar.

The results from the modelling shown are shown in Figure 20 and Figure 21 in Appendix 2, with the post-tax Internal Rates of Return (IRRs) for each of the 18 projects shown in Figure 17. As all community RES projects have to pay corporate tax and trade tax[24], community and commercial projects can be directly compared.

Figure 17: Community wind and solar post-tax IRRs versus commercial hurdle rates



It is noticeable that the post-tax IRRs for eight of the 13 solar projects (highlighted in light blue in Appendix 2) pass this hurdle and all community wind projects pass, or meet the 4.1% target, meaning they would be attractive to commercial developers. However, this does not mean that they would have been developed by commercial developers, as commercial developers are interested not only in the IRR returns, but also in the size of projects, and prefer larger projects to smaller projects.

Importantly three of the solar projects have returns (4.0% versus 4.1%) similar to commercial returns, but two have lower returns than commercial developers require. This shows that community developers will often be prepared to accept lower returns, especially if the project meets the environmental aspirations of the group, or the project allows communities to avoid having to purchase electricity from electricity supply companies.

Due to the size of the sample it was also possible to compare the post-tax pre-finance project IRRs over the years the project was commissioned in, as shown in Figure 18. The results do not show any clear picture for wind projects, but a discernible reduction in anticipated returns for solar projects commissioned in 2014 and 2015. This is likely to be driven by the continually falling FIT rates as solar projects get closer to grid parity.

Figure 18: Post-tax pre-finance project IRRs for the 13 solar projects and 5 wind projects

	2010	2011	2012	2013	2014	2015
Wind			5% 9%	17%	7%	
Solar		12% 7% 8% 6%	4% 9% 6%	11% 11%	6% 1% 6%	4%

[24] Cooperatives are capital companies which obliges them to pay corporate tax (Körperschaftsteuer) and trade tax (Gewerbesteuer). Closed-end funds (GmbH&Co.KG) are partnership companies. Trade tax and corporate tax have to be paid on the profit on the level of the general partner (GmbH). Profits distributed to the limited partners (KG) are taxed with the income tax.

4 Responses to research questions

4.1 Cost components for different ownership options (community-led, shared ownership and fully commercial)

As shown in Figure 19, all models of ownership (community-led, shared ownership and fully commercial) will have similar costs to develop and operate projects, with the exception that:

- Community organisations will often have costs involved in community engagement;
- The exact split between costs faced by communities and commercial companies in shared projects will depend on the exact project arrangements. However, indications are that with shared ownership options the community will often be brought in later into the project, so will not incur the initial feasibility costs and planning permission costs. It is also likely that in shared ownership projects the communities' project/commercial management and other advisory costs will be lower. For shared ownership projects, interview partners reported that their main cost will be around planning new RES projects and getting them operating.

Figure 19: Different costs faced by different ownership models

	Community	*Shared community involvement*	*Shared commercial involvement*	*Commercial*
Development costs				
• *Initial feasibility*	✓	×	✓	✓
• *Planning permission preparation*	✓	×	✓	✓
• *Project management costs*	✓	✓	✓	✓
• *Other advisory*	✓	✓	×	×
• *Community consultation*				
Construction costs	✓	✓	✓	✓
Operations costs	✓	✓	✓	✓
Taxation costs	✓	✓	✓	✓

Communities often benefit from 'free' volunteer time, so delving into the actual costs by accounting for the 'free' volunteer time will affect the total costs, as shown in Figure 16.

4.2 External factors that can affect the costs of community-led and shared ownership projects

There are no particular government incentives for community led RES projects as opposed to commercial RES projects, for they all can receive FITs and they all pay tax. However, at the regional level there can be regional political support and support in finding and providing suitable roofs for roof mounted PV installations. In many cases the municipality is also involved in the project via a cooperative share and/or share of the loan.

However, as explained in Section 2.4 (page 6) FITs will only be available for sub 100 kW projects after January 2016. As community projects tend to be of a smaller scale to commercial projects this will mean more community projects can still access these secure revenue streams.

However, for RES installations above 100 kW accessing the market premium market may prove expensive. This is because although the market premium has allowed developers/ companies to actually realise higher revenues than with FITs if they can negotiate deals with electricity suppliers at above average wholesale price, the system is very complex and requires commercial and legal expertise. If communities are only undertaking one project this in effect creates a high barrier to entry, as commercial developers, once they have understood how the system works, will utilise their concept for the second, third, fourth or tenth bid.

This complexity was identified by nearly all interviewees as one of the main threats to community energy projects, since it involves participating in a very complex mechanism, directly competing with large developers. Community projects are afraid this might increase uncertainty and project development costs in a way that will make it very hard for them to participate.

The same applies to the planned obligatory tendering for at least medium to large RES projects. At the point of writing this report it is not known whether the tendering process will apply to smaller RES projects. Interview partners highlighted that a community led project in general cannot bear a long and costly development and tendering phase especially if the risk of failure of the whole project is high (for example if a RES project developer would already need to submit the installation´s planning permission to the tendering authority to be accepted to the tendering process). This has been evidenced by the failure of cooperatives to be selected in the Government’s first 157 MW tender for solar developments.

4.3 Constraints and related cost/ financing implications that only apply to community-led and/ or shared ownership projects

In general, cooperatives have a long tradition especially in rural areas in Germany and are seen as an effective instrument for the regional development.

As suggested there are no specific constraints with regard to the financing conditions that apply only to community-led RES projects. The great majority of the interviewed persons from community led PV installations did not have any difficulties in raising risk capital for the development phase nor the construction and operational phases. Many small community PV projects are 100% equity financed. Several interview partners said that they even had more funds than they could re-invest, and have had to temporarily stop admitting new members to the cooperative.

Interview partners reported that gaining (cooperative) members willing to bring in their competences and funds turned out to be quite easy if the process was well structured in a participatory way. Regarding the wind sector, communities tend to form partnerships with commercial developers, so have less involvement in the development phase as the permits will normally have been secured.

In case equity is not sufficient banks, such as KfW or local cooperative banks, provide finance for the development and construction phase. Banks are not reluctant, as the future income streams generated from the FIT are relatively secure. Also with direct marketing, revenues are still very predictable, once an appropriate marketer has been contracted. This, however, could change if tendering is made obligatory for all types of RES projects because of the higher insecurities involved (e.g. risk of a project not being chosen after a costly development phase) and communities being unprepared to put these development costs at risk.

4.4 Whether some of the cost components are invariably higher for community-led and/ or shared ownership projects

Regarding construction costs, all interviewed community-led projects were dearer than the commercial data from the literature for PV and wind, although for wind the cost differences were not material. This is despite the fact that community interviewees’ believe they should have been similar. Allowing for the fact that some of the solar projects were commissioned on different dates between 2011 and 2015 with earlier projects having higher construction costs does not change the message.

Based on this, it can be suggested that construction costs are actually slightly higher for community wind and solar projects, possibly because the community is not able to negotiate such good terms with RES manufacturers and installers. However, this may be because communities tend to just do one deal, whereas commercial developers may be able to get better deals if they regularly place multiple orders.

It is important to note that several interview partners highlighted that the RES projects in question would not have been realised by “commercial” companies; therefore making the results of the comparison at least questionable at this specific point. Reasons for this were on the one side political requirements and on the other side the complexities of external coordination with multiple stakeholders.

4.5 Whether some of the cost components are invariably lower for community-led and/ or shared ownership projects

As can be seen from Figure 15, interviewees often mentioned that they perceived development costs in commercial projects to be higher. This can be explained by the fact that the amount of voluntary work is much lower or zero in commercial companies. Furthermore, planning as well as initial feasibility costs are estimated to be lower due to reduced time needed to find suitable land and/or roofs due to well established contacts to local citizen and administration.

This prediction that development costs for small community scale solar projects are lower is indeed borne out by the evidence, although for larger more complex solar projects and for the four wind projects this was not the case. This is likely to be because, even with 'free' volunteer time, wind projects are much more costly to develop, requiring more planning permissions, and have more of a learning curve meaning that commercial developers who build a few wind farms get more efficient at reducing development costs.

The belief that operational costs are lower is mainly to be attributed to the estimation of the amount of commercial management costs. Interview partners pointed out that "commercial" companies tend to set these costs quite high in order to reduce the profits and the trade tax rates respectively. In actual fact operating costs for the community small scale solar and wind projects did have lower operating costs, giving support to this hypothesis. It could also be that communities are able to negotiate lower rental arrangements for the roofs or land they use.

4.6 Cost projections to 2020

The main cost for renewable energy projects are the construction phase costs. The IEA estimate that roof mounted solar projects' construction costs are forecast to decrease by 18.6% in real terms between 2015 and 2020[25].

There is no available data on operational expenditure costs, but they are likely to remain flat in real terms. Operational costs will include land rentals, insurance, cleaning and replacing inverters every 7-8 years. So whilst the costs of inverters will fall, it is likely that the other operating costs will remain similar, giving an overall similar cost profile.

For onshore wind projects, the IEA forecasts capital expenditure costs will drop at an annual nominal rate of 2.2%, due to a consistent reduction of wind turbine prices[26]. A report by KIC InnoEnergy estimates that operational costs are expected to fall by about 6% between 2014 and 2025. Therefore, an assumption is made that between 2015 and 2020 annual wind farm operational costs will only fall by 3% in total. This small reduction in costs is due to advances in maintaining wind turbines, although other operational costs (e.g. insurance, rentals, etc.) are likely to remain flat[27].

The one area that may change will be the development costs, both with the additional costs involved in direct marketing, and if tendering is needed for small scale projects. The rising costs are due to the complexity in bidding for work against large scale commercial developers, and also the need for planning permissions and other permissions to be secured before tendering. If the community is not successful then it will have lost all the money involved in developing the project. Securing risk capital for the development phase is costly, and banks are less likely to lend for such work. Therefore, if communities are unsuccessful with one project they will need to try to recoup their losses on a second project, but that becomes difficult as the higher the price tendered the less the chance of being selected for the second tender.

[25] IEA. *Technology Roadmap – Solar Photovoltaic Energy.* 2014, p. 23 (Figure 11).
[26] IEA. *Technology Roadmap – Wind Energy*. 2013.
[27] KIC InnoEnergy. *Future Renewable Energy Costs: Onshore Wind*. 2014.

4.7 Opportunities to reduce community-led and/ or shared ownership costs

Since interview partners in general did not mention facing particularly higher or additional costs in comparison to commercial RES projects, most of them denied having considerable cost reduction opportunities. Some interview partners, however, reported that there may be cost reduction potential in negotiation of deals to use roofs for rooftop PV or land for wind turbines. But this will depend on the goodwill of property and landowners.

One interview partner mentioned that they would have tried to get all their RES projects exclusively financed per equity capital as this would have contributed to an overall cost reduction. In fact this was not possible due to time constraints.

5 Conclusions

Mindful that the conclusions need to be tempered by the fact that community solar costs were gathered for projects that were commissioned at different times between 2011 and 2015 and data from only four community wind projects was obtained (and therefore the costs could be different because of location, unusual rental agreements, and fact that for PV panels in particular costs have fallen over the five years commissioned project cost data was gathered over, etc.) the three main findings of this case study are as follows:

1) Although there is varying evidence that development costs and operating costs for community projects are lower than the costs incurred by commercial developers, this only seems to apply for small scale (30 kW) solar projects. For large solar and wind projects development costs are higher, although the operating costs are lower.

   It may well be that development costs are lower for communities for simpler smaller rooftop PV projects given the 'free' professional time that shareholders provide, but even if the development costs are 50% cheaper than commercial development costs, the difference in project returns will be immaterial as development costs only make up around 2-4% of total project costs.

   Regarding construction costs there is evidence that community solar projects and wind projects have higher construction costs, more than offsetting any lower development costs. This leads to the overall conclusion that community projects may be slightly more expensive to reach the commissioning point, but not significantly higher. As to the operating costs, as the operating costs represent such a small percentage of total development and construction costs any slight differences do not have a material impact on the profitability of projects.

   This conclusion that there are similar or only marginally higher costs is shown by the profitability calculations of community wind and solar projects. All the wind projects were at or above the hurdle rate commercial developers would expect, but for the solar projects returns for five of the 13 community projects were lower than that commercial developers would expect. This is because community shareholders will often be prepared to accept lower returns, and often the solar projects are done for other reasons apart from making high returns, e.g. allowing communities to avoid having to purchase electricity from electricity supply companies, or meeting the environmental aspirations of communities;

2) None of the interviewees mentioned the raising of capital and the financing of the RES projects as being problematic in Germany.

   Most of the community led RES projects have a high share of equity. Interview partners pointed out that they did not have problems to find community members willing to invest money in buying shares, with the expected return being lower than in commercial RES projects. Moreover, debt finance can be obtained quite easily from KfW. This is because KfW will lend up to €25 million to community or commercial developers, and is often prepared to lend at very high gearing (debt: equity) levels, reaching at times even 100% debt. Further the interest rates KfW lend at can be as low as 1.31%. KfW loans have proved so popular that they have supported 48% of the installed RES capacity and 82% of the wind RES capacity (average 2010 – 2012)[28].

   Constraints, according to interview partners, were more of a political or administrative nature, e.g. planning rules preventing RES projects in certain places, arduous permission procedures, and strict nature conservation requirements.

   Concerning the representativeness of the data, community RES respondents were from the Old West German States as opposed to the Newly Formed East German States. Regarding the RES sources and technologies, there is a clear overrepresentation of solar rooftop (12), compared to only one PV ground mounted and four wind installations[29];

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[28] EUWID. *KfW-Programme finanzieren Ausbau der Erneuerbaren in Deutschland zur Hälfte*. EUWID – Neue Energien. Issue 51/52.2013, 18 December 2013. EUWID

[29] In the process of selection and contacting community led projects and project developers we paid attention to a well-balanced regional and technology distribution.

3) The guaranteed FIT in combination favourable KfW loans was very important for the development of community led RES projects.

   A simple support scheme like the FIT in the EEG (2000) has been seen as essential for giving greater certainty of revenues and risks, as well as enabling bank loans to be secured.

   Most of the interview partners fear that the 2014 changes in the support scheme (market premium and obligatory direct marketing, and “own consumption” regulations) and future changes in the support schemes (planned obligatory tendering) will increase the administrative burden (and therefore costs) and also increase the chance that their bid is not accepted, resulting in the development costs having been ‘wasted’. As communities tend to be risk averse this will reduce the number of cooperative projects, already evidenced by the failure of any cooperative (or smaller project) to secure some of the 157 MW solar park tender (see Section 2.4).

   Several interview partners pointed out that an obligatory financial and/ or conceptual participation of local citizens as part of the tendering conditions might be a way to encourage shared ownership solutions, resulting in cost effective RES installations, but also RES installations with some community ownership.

Appendices

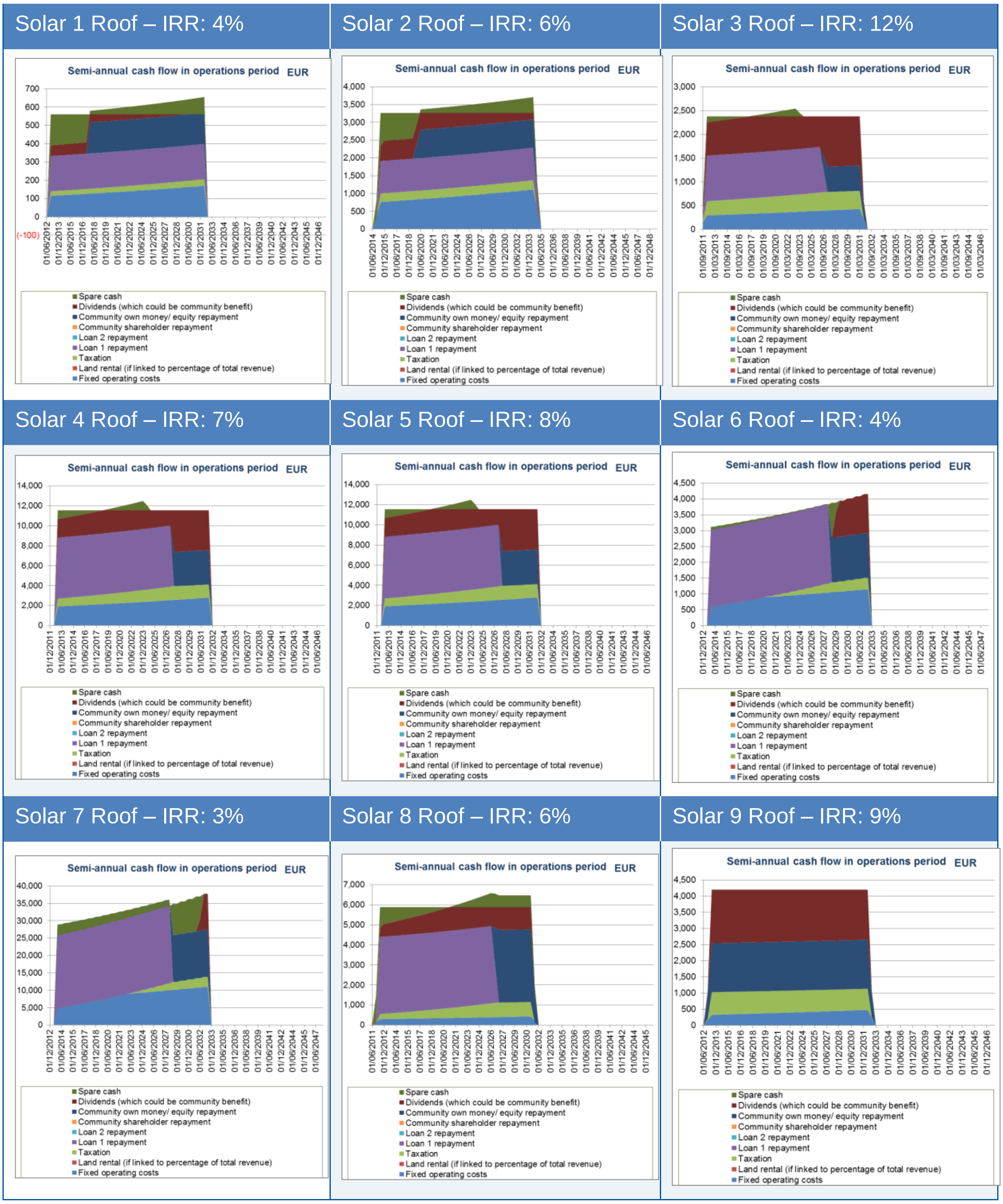
Appendix 1 – Glossary

DGRV	Deutscher Genossenschafts- und Raiffeisenverband
EEG	Erneuerbare-Energien-Gesetz (Renewable Energy Sources Act)
eG	eingetragene Genossenschaften
FIT	Feed-in Tariff
GbR	Gesellschaft bürgerlichen Rechts
GW	Gigawatt
IEA	International Energy Agency
IEA-RETD	International Energy Agency – Renewable Energy Technology Department
IRENA	The International Renewable Agency
IRR	Internal Rate of Return
KfW	The German Public Development Bank
kW	Kilowatt
kWh	Kilowatt hours
O&M	Operations and Maintenance
MW	Megawatt
MWh	Megawatt hours
PV	Photovoltaics
RES	Renewable Energy Sources
WACC	Weighted Average Cost of Capital

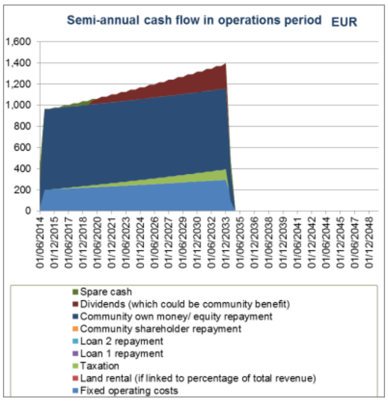
Appendix 2: Results from financial modelling

Figure 20 and Figure 21 indicate that community dividends were expected in each case, shown in the purple areas (■) in the charts, although in many cases the dividends are heavily back-ended. **Section 2.2.2 of the Main Report** explains how to interpret the results. As well as the graphs the post-tax Internal Rate of Return (IRR) is presented. Light blue boxes (■) indicate returns at or above the commercial hurdle rate.

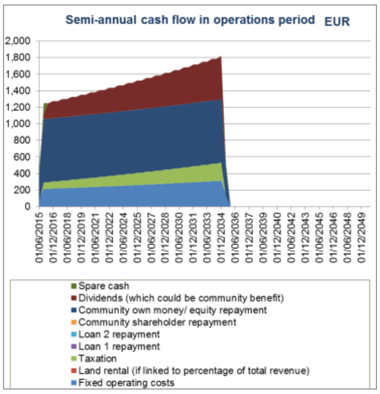
Figure 20: Results for the 13 community solar projects



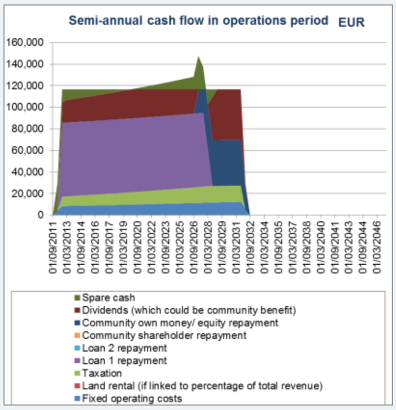
Solar 10 Roof – IRR: 1%



Solar 11 Roof – IRR: 4%



Solar 12 Roof – IRR: 7%



Solar 13 Ground – IRR: 6%

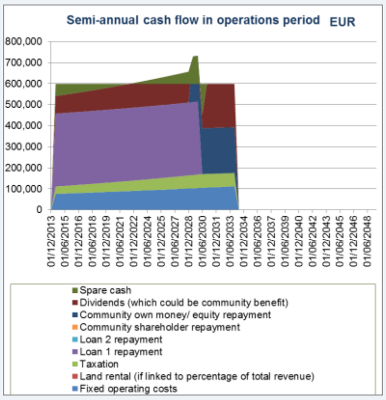
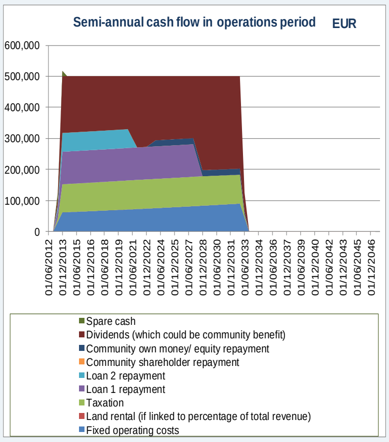
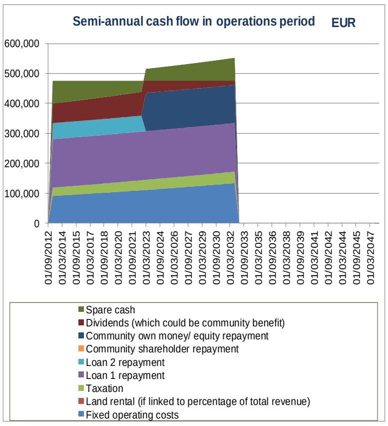


Figure 21: Post-tax pre finance IRRs for the four community wind projects

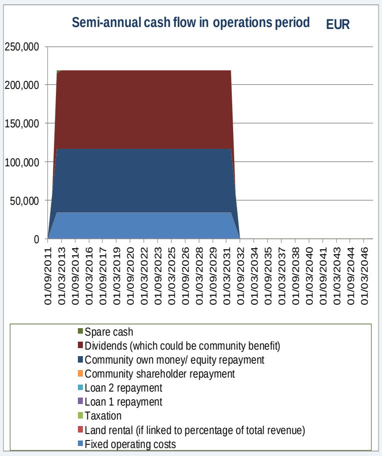
Wind 1 – IRR: 17%



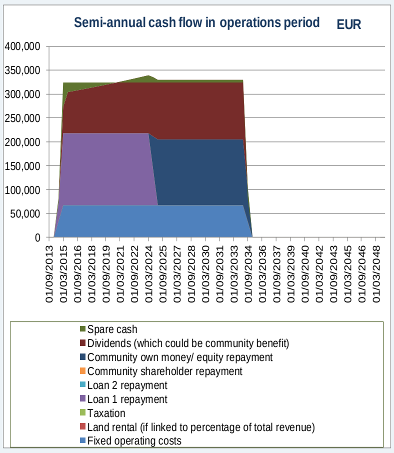
Wind 2 – IRR: 5%



Wind 4 – IRR: 9%



Wind 4 – IRR: 7%



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