

Working Paper

Barriers and Success Factors for Decentralised Generation in the EU

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## 1 Barriers and Success Factors

Within DECENT, barriers and success factors for Decentralised Generation in the EU were identified through extensive case studies, expert interviews, and literature review.

### 1.1 Characterisation of Actors

The field of DG in the EU is characterised by a large variety in technologies and in regulatory, market, and societal frameworks. The large variety in framework conditions is reflected by strongly differing constellations of actors involved in DG development.

For example, the structures of the wind sector vary considerably between Denmark, Germany, and Spain, which are hosting the largest shares of wind power in the EU: While in Denmark the operators of wind turbines are usually set-up of neighbourhood-based co-operatives, in Germany wind power investors are typically organised by a number of wind development companies into investment funds-type limited partnerships, which draw their profitability to a considerable extent from effects of book losses and depreciation on the individual investor's income tax. In Spain however, usually neither neighbourhood nor other private individuals play an important role in wind power development: here large companies that are launched by traditional utilities industry, banks and public actors dominate the market, the major driver for public involvement being regional development promoted by settling wind industry.

Generally, it was found in DECENT that a very high share of DG operators and developers work as independent power producers (IPPs), or self-producers, and are NOT linked with the established utilities. (This was the case in approx. 75% of the case studies.) In parallel, an equally high share of projects studied is based on highly committed individuals or organisations that work hard in order to overcome the difficulties in the project development, or based on investors that are ready to renounce profit, and accept pay-back periods of ten years and longer. In addition, nearly 100% of the projects studied were financially benefiting from one or more types of public support schemes (mostly investment subsidies, fixed feed-in tariffs above market price, production subsidies, soft loans and/or depreciation schemes) or considerable private funding.

The overall picture for DG in the EU is therefore characterised by the fact that the economic framework conditions in EU member states are generally so weak (varying, of course, considerable from member state to member state and technology to technology) that DG investment is not attractive to "economically rational" actors which are bound to optimise return on equity and short-term profit. DG is therefore mainly developing in niches characterised by either an extraordinarily beneficial economic project environment (e.g. CHP in hospital) or/(and) ac-

tors/investors which have other criteria (or framework conditions) for their profitability considerations than large corporations.

When discussing barriers and success factors, and subsequently policy implications for DG in the EU, the specific characteristics of the different actor groups on the DG markets need to be kept in mind.

## **1.2 Identified Barriers and Success Factors**

In Table 1-1 an overview on the barriers and success factors identified is given. They are arranged in a matrix featuring the analytical dimensions used in DECENT and different aspects of DG development and operation.

Dimension aspects	Technological dimension	market & financial dimension	Policy & institutional dimen- sion	social & environmental di- mension
General		B1 Specific Difficulties of Small IPPs	B2 Uncertainty on (Support) Policy Development	S3 DG Values apart from the Energy Markets
Siting and Licensing	B4 Licensing Problems for Biomass Plants (Wood Waste) S4 Clear Definitions on Waste Categories and Licensing Conditions		B5 Spatial planning & licensing (for RES) S5 Integration of Potential DG Sites in Spatial Plans	B6 Local Resistance (RES) S6 Involve Local Actors
Grid Connection		B8 Market Power of Utilities	B7 Grid Connection Procedures S7a Clear Cost Allocation Rules S7b Socialisation of Grid Connection Costs	
Use of Grid			B9 Intransparent Grid Use Fees	

Dimension aspects	Technological dimension	market & financial dimension	Policy & institutional dimen- sion	social & environmental di- mension
Power Sales			<div data-bbox="1263 317 1644 395" style="border: 1px solid black; padding: 2px;">S10 Priority Dispatch</div> <div data-bbox="1010 411 1599 539" style="border: 1px solid black; padding: 2px;">B11 Balancing and Trading of Exported Power S11 Specialised Green Power Traders</div>	
Start-up and Operation	<div data-bbox="456 560 958 730" style="border: 1px solid black; padding: 2px;">B12 Biomass Fuel Supply S12 Involve Forestrial /Agricultural actors for Biomass Supply</div> <div data-bbox="434 735 958 810" style="border: 1px solid black; padding: 2px;">B13 Lack of Skilled Technicians (CHP)</div> <div data-bbox="405 826 815 906" style="border: 1px solid black; padding: 2px;">S14 Technological Innovation</div>			
Financing		<div data-bbox="846 938 1301 1082" style="border: 1px solid black; padding: 2px;">B15 Financing S15 Innovative Financing Concepts</div>		
Profitability		<div data-bbox="882 1129 1234 1273" style="border: 1px solid black; padding: 2px;">B16 Ratio of Gas and Elec- tricity Prices (CHP)</div>	<div data-bbox="1294 1118 1630 1297" style="border: 1px solid black; padding: 2px;">S17 Eligibility for Support Mechanisms B17 Lack of Tailored Sup- port Mechanism</div>	

Table 1-1: Overview on barriers and success factors for DG

### 1.2.1 Policy/ institutional dimension

#### **B2 Uncertainty on (Support) Policy Development**

In many EU Member States policies concerning the regulation of the power market, the transition to a liberalised market environment and/or support schemes for DG installations/ RES/ CHP are subject to an intensive political discussion and frequent change. The time horizons for active support policies is sometimes limited to few years. In addition, the introduction of new schemes or the expiry of time-limited schemes lead to policy gaps which increases uncertainty on the frame conditions of a planned DG development. Taking into account the size, flexibility, and financial strength of the developer, uncertainty and policy gaps can thus constitute important barriers to DG development.

#### **B5 Spatial planning & licensing (for RES)**

The spatial planning requirements determine what kind of licences or approval a DG developer needs in order to physically erect and operate the foreseen installation. These procedures vary strongly between DG technologies, EU member states, and often within a single Member state between different regions, or municipalities. The **transparency** of necessary procedures and the **certainty of approval** (under conditions) are crucial for the developers. The amount of **time, manpower, technical expertise, and financial resources** to be invested into the siting and licensing process can thus vary considerably.

For DG based on RES aspects like visual amenity, protection of local ecosystems, land use, preservation of landscape, historical heritage, monuments, etc. or other possible impacts on the neighbourhood are of relevance.

For (natural gas based) CHP installations such problems matter less, since they are anyway integrated in building structures where energy converters are placed (industry, hospital, housing etc.). As modern natural gas fired CHP engines usually comply with stringent air emission standards, for CHP installations usually noise might form a bottleneck for licensing, depending on the location.

Planning and licensing appear to be a barrier especially for hydro power and wind power; special problems occur for biomass plant firing waste wood (cf. special barrier).

For PV developments above 100 kW or in the MW size, siting can pose a serious problems, since most roofs built in the last two decades are not designed to carry high additional loads, and green-field developments can face licensing problems in order to prevent surface sealing and spatial consumption.

An example for this barrier is the Middelgrunden off-shore wind farm near Copenhagen, Denmark, where the planning process took three years due to inadequate legislation. Also in the Lastour wind farm project (Southern France) the necessary adaptation of the spatial plan posed major problems with inexperienced authorities.

The Tzschelln hydro plant case study (Eastern Germany) points up how small hydro development is endangered and prevented by a general negative attitude against small hydro in the administration of the German federal state of Saxony.

## **S5 Integration of Potential DG Sites in Spatial Plans**

Integration and thus pre-selection of potential sites for DG use, especially wind power, into spatial plans helps to avoid conflicts between DG use of sites and nature protection, or other uses. In Germany this tool proved successful since on one hand it enables local authorities to channel wind power development to preferred sites (and simultaneously to bar other sites) and on the other hand siting efforts for wind developers are considerably reduced.

The case study Keyenberg wind farm (Western Germany) can serve as an example of how a wind project benefits from such a scheme.

Similar approaches are possible for other renewable energies, too.

Additional support to DG developers can be given through public inventorying of data on exploitable natural potentials (which is partly done for wind and hydro power) or even heat demand (potentials for small-scale heating grids to be served by biomass or CHP).

## **B7 Grid Connection Procedures**

Here, the terms of physical connection of the generator to the grid shall be distinguished from the terms of use of grid services, once the generator is interconnected.

To form the basis for physical interconnection to the grid, DG developers have to agree with the grid operator / the utility on the technical terms of interconnection, on contractual matters including liabilities, and on the allocation of costs for feasibility studies, necessary grid reinforcements and line extensions. Such issues are covered by regulation in Member States to a different degree. Subject to uncertainty on the DG developer's side are sometimes the technical specifications regarded as necessary by the grid operator.

Technical issues which are disputed are e.g. capacity of grid, necessary upgrades, point of connection, interconnection voltage, line protection technology, reactive power behaviour and islanding options. While lack of grid capacity can prevent projects, cost allocations for other issues can enhance the DG developers costs considerably (cf. case studies Pozoblanco CHP (Spain), Lumijoki wind turbine (Finland), Lastour wind farm (France), St.Pancras CHP (UK) and other RES examples from Germany)

Additionally, missing access to local/regional load management data of the grid operator can impede the DG developer to optimise the choice of DG site (for RES)

## **S7a Clear Cost Allocation Rules**

In German legislation on RES a cost allocation rule is given: The costs for the line extension (power generator to grid connection point + transformer) have to be borne by the plant operator while a possible necessary grid upgrade is to be borne by the grid operator (and can be socialised among all grid users). This rule proved to be rather successful (cf. e.g. case studies Tzschelln hydropower, Keyenberg wind farm, WISTA PV, Silbitz biomass (all Germany)), however in practice (cf. barrier Market Power) disputes remained on cost allocation. A clearing office at the German government tries to find solution on such disputes.

### **S7b Socialisation of Grid Connection Costs**

In Denmark, grid extension for the connection of off-shore wind farms is considered a public good. Thus costs are borne by the grid operator. This cost allocation was a beneficial factor for the studied Middelgrunden off-shore wind farm (Denmark).

### **B9 Intransparent Grid Use Fees**

In a liberalised market environment the grid operators charge fees to power traders. Such grid use fees are subject to regulation in all Member States save Germany. These grid use fees and the procedures how they are regulated have a high impact on DG viability, in case the generator operates on a trading scheme. This is demonstrated in the Lumijoki wind case study (Finland). However all other studied projects that export power at all operate under a feed-in scheme, where the power is sold under regulated tariffs to the grid operator so that a trading operation as indicated above does not take place (examples from Austria, Denmark, France, Germany, Italy, the Netherlands, Portugal and Spain).

However, it is anticipated that the relevance of grid use fees for DG will rise with ongoing liberalisation and the replacement of fixed feed-in tariff schemes by green certificate schemes.

Second, during operation of the interconnected DG installation, regulated tariffs (or negotiated fees) will determine the costs that are associated with the **use of the grid infrastructure** both for **supply of electricity to the grid/** to customers and for the **demand of additional or back-up power** (mostly relevant for CHP).

### **S10 Priority Dispatch**

Electricity regulation can foresee that systems operators grant priority dispatch to eligible generators. With such a model, depending on the specifications the operator is paid the market price, or a higher premium price, while the power is passed on to all power traders as a Public Service Obligation, or to captive customers. Such schemes relieve the DG operator from the need to establish and maintain contacts to power customers and to balance production with demand.

All studied projects that are designed to export power (besides the Lumijoki wind turbine, Finland) are benefiting from priority dispatch (examples from Austria, Denmark, France, Germany, Italy, the Netherlands, Portugal and Spain).

### **B11 Balancing and Trading of Exported Power**

In a liberalised environment, DG operators that do not feed-in to the grid operator under a regulated scheme need to contract power customers, balance their production with customer demand, and (if applicable) trade their green (or CHP) certificates. Especially balancing production with demand is a difficult task for intermittent producers (RES besides biomass; CHP designed to heat load).

### **S11 Specialised Green Power Traders**

The co-operation with specialised intermediate agents like green power traders, certificate traders or associations of intermittent producers relieves IPPs with hardly any administrative capacity and little negotiating power from the need to put too many efforts into balancing and market communication. For example, the co-operation with a green power trader was a crucial success factor for the Lumijoki wind project (Finland).

### **S17 Eligibility for Support Mechanisms**

Within the EU Member States a broad variety of “financial” support mechanisms are in place or in preparation that are designed to **improve the economics** of a DG installation usually in order to account for the external environmental benefits. The shape of these support schemes is usually differentiated between RES and CHP and further between different technologies and installation sizes. Support schemes can include price-oriented instruments like **fixed feed-in tariffs, investment subsidies, production subsidies, fuel subsidies, soft loans, ecotax exemptions** or other **taxing/depreciation schemes**, or quantity-oriented instruments like **tender/fixed price systems** or **quota/green certificate systems**.

All studied projects are (or were) benefiting from one or more types of support mechanism:

For RES projects the financial support was usually crucial and (mostly in form of investment subsidy, high-price fixed feed-in tariff and/or soft loans) a major driver of the development. One project (Lastour wind farm, France) was realised under a tendering scheme, while quota/green certificate systems are not yet use.

For (natural gas) CHP projects the picture is more divers: those projects realised before the recent decline of electricity-gas price ratio were generally less dependent on direct public support; they were rather realised in an economical niche provided for by utilities’ tariff structures and own heat and power demand patterns. Other projects that were suffering from bad economics were realised only with the strong wish of the investors to install a CHP unit ignoring more economic alternatives.

### **B17 Lack of Tailored Support Mechanism**

When designing support mechanism the specific needs of the actors developing and investing in DG should be taken into account (cf. chapter 1.1). Problems encountered by project developers within the support mechanisms were:

- Long-lasting uncertainty on availability and amount of investment subsidies (e.g. Lumijoki wind, Finland),
- long-lasting uncertainty on availability of soft loans (German RES projects),
- small-sized developer/operator cannot make use of accelerated depreciation rules
- high efforts to handle tax refunds (e.g. Schonungen CHP, Germany)

Generally for the rather small-sized IPPs high transaction efforts, complicated regulation and lack of long-term clarity on the support conditions constitute a barrier within a support scheme.



## 1.2.2 Market/ financial dimension

### B1 Specific Difficulties of Small IPPs

Most operators and developers of RES installations are not the long-established utilities but new and comparably small-sized enterprises. This is due to the relative recency of these technologies and the well-known difficulties to operate them profitably, which attracted mostly environmentally committed individuals to engage and invest in RES DG projects (cf. also chapter 1.1). Compared to other market actors those developers have often disadvantages in knowledge, experience and capacity. Their activities are often restricted to local niches, which on one hand can be an advantage (successful co-ordination of local framework and actors); on the other hand, however, they don't have the possibility to flexibly position themselves in an integrating European market.

It should be realised, however, that NOT all RES developers/operators are small IPPs (e.g. case studies Madrid PV (Spain), El Perdon wind farm (Spain), Mortágua biomass (Portugal), Lelystad biomass (Netherlands)).

CHP installation are by definition (local use of heat) subject to strong local considerations, the operators/users of DG-CHP are usually in a weak negotiating position confronted with grid operators / utilities.

### B8 Market Power of Utilities

DG operators, which are in most cases IPPs are usually confronted with established players on the electricity market. Important market players to deal with are grid operators, fuel and technology suppliers, and (depending on the type of market structure for RES/CHP) traders, customers and/or ESCOs.

Market power used against IPPs is often reported in connection with grid connection and grid use issues and –where not regulated- feed-in tariffs. Grid companies (often only to a very limited degree unbundled from power generation and wholesale activities) can impose many unjustified problems on DG developers seeking interconnection. The amount of market power used is influenced on the way unbundling and market opening is realised in the respective Member State, and on the level of detail of regulation.

However, this barrier is limited neither to unjustified technical or financial requests to the DG operator seeking grid connection nor to failure of acknowledging values that the DG capacity and power might constitute to the grid. In addition the procedural behaviour of the grid operator to slow down, complicate, and boycott an interconnection application unofficially can lead to prevention of DG developments, especially if the DG developers lack funds, time and capacity to sue the grid operator/ utility.

Other fields where market power is used are e.g. access to end customers for traders, unjust valuation of power fed back to the grid, capacity charges or fuel supply (e.g. conditions of gas supply to CHP installations).

Policies of grid operators towards DG vary considerably from company to company and vary over time, too. While some grid operators / utilities seem to have a decided policy to impede third party DG development, others might simply lack experience.

Negative experience with grid operators was gained especially in the case studies Pozoblanco CHP (Spain), Ronse CHP (Belgium), St.Pancras CHP (UK), Schonungen CHP (Germany), Silbitz biomass (Germany); in addition very negative experience is reported from some other German utilities. In Spain, successful RES developments are characterised by the involvement of utilities in the developing consortium.

### **B15 Financing**

The relation between investment, fuel prices and (heat and )electricity prices are such that DG projects (besides specialised CHP applications) are in most cases economically viable only with support mechanisms. However, even with support mechanisms profitability of DG projects is in most cases rather low compared to alternative investment and not satisfying for “economically rational” actors (corporations) that try to maximise their profit. Financing concept thus rely often on committed actors that are ready to accept reduced profitability.

In addition to raised equity of committed investors banks have to be found for financing. Here, it is a problem that DG projects are still relatively new to the financing market in some EU member states. Developers that rely on project financing, and thus cannot borrow on their company assets, have additional problems providing loan security. Examples for financing problems are found in the case studies on Lumijoki wind plant (Finland), WISTA PV plant (Germany), Port Mort hydro plant (France), Harboøre biomass CHP and Boeschistobel land-fill gas CHP.

### **S15 Innovative Financing Concepts**

Financing schemes attractive to private investors have been successful both in Germany and Denmark (closed funds; cooperatives) supported by both taxation system and motivation for green or neighbourhood investment.

In the case studies Magliano hydropower (Italy), Lastour wind farm (France), and Port Mort hydropower (France) equity for financing was raised by the developer in Germany, where private investors for RES are relatively easy to attract.

Standardised financing concepts/contracts to decrease transaction costs for small actors are yet to be developed.

### **B16 Ratio of Gas and Electricity Prices (CHP)**

The changing ratio between natural gas and electricity prices in the last years has made operation of natural gas fired CHP hardly feasible. This appears to be the major barrier for CHP development presently, and has led already to the decommissioning of CHP plants. The CHP plants studied in the case studies were either developed way before the present decline of the ratio between gas and electricity prices (and are already written off) (e.g. Alkmaar CHP

(Netherlands), Ronse CHP (Belgium)) or operate in a specialised high price niche (Pozoblanco CHP, Spain) or are operated with very little or no expectation of pay-back to the investor (Bocholt fuel cell (Germany), Schonungen CHP (Germany), St.Pancras CHP (UK)).

### **1.2.3 Technological dimension**

#### **B4 Licensing Problems for Biomass Plants (Wood Waste)**

In most countries, solid biomass use relies on industrial waste wood, which triggers the discussion “waste or biomass?” While wood waste is attractive through the negative or neutral fuel price, it has its disadvantages through licensing difficulties and a bad public reputation of waste incineration. In addition the future development of prices for biomass waste wood fuel is relatively unknown. Licensing problems were encountered e.g. in the Lelystad biomass project (Netherlands) and in the Silbitz biomass project (Germany).

#### **S4 Clear Definitions on Waste Categories and Licensing Conditions**

Clear definitions on waste categories and licensing conditions help to overcome the licensing barrier for biomass plants based on waste materials: Although the Silbitz biomass projects (Germany) had its difficulties in obtaining the operation license, the process was facilitated through relatively clear definitions of waste categories in German legislation on eligibility for RES support and on conditions for an operation permit.

#### **B13 Lack of Skilled Technicians (CHP)**

In the process of installing and interconnecting small-scale or micro-CHP, a lack of skilled technicians used to deal with relatively new technologies can lead increased efforts and cost for starting-up the plant. This problem was encountered in the case studies Ronse CHP (Belgium) and St.Pancras CHP (UK), while in the Schonungen CHP project (Germany) the local presence of the technology provider avoided such problems.

#### **B12 Biomass Fuel Supply**

The use of biomass for power/heat production has a very large potential in the EU Member States. However, severe problems to be overcome in development and operation are posed in securing fuel availability and organising (and financing) fuel logistics. Biomass plants that use “fresh” biomass residues as fuel, have to cope with high fuel costs. Difficulties with biomass supply were e.g. encountered in the Mortágua biomass project (Portugal). Biogas installations base on a sound organisation of fermentation input, too (cf. Tyrol biogas case study (Austria)). Projects relying for cost reasons on industrial wood waste as fuel have high problems to secure long term fuel supply (cf. Silbitz biomass plant, Germany).

## **S12 Involve Forestrial /Agricultural actors for Biomass Supply**

The Tyrol biogas case study (Austria) shows, how early involvement of the local agricultural association contributed to the project's success. In contrary, the involvement of local actors had been neglected in the Mortágua biomass project (Portugal), which led to severe problems in fuel supply.

## **S14 Technological Innovation**

The use of information and communication technologies (ICT) can considerably help to lower operation and administration costs. For example, in the St.Pancras CHP project (UK) the use of telematic metering and a specialised software package made the successful implementation possible.

### **1.2.4 Social and environmental dimension**

## **S3 DG Values apart from the Energy Markets**

If it is possible to achieve a valuation of other DG related benefits (besides (green) power, heat, and grid services), this can prove very advantageous for DG development:

For many, mostly rural, DG developments, the systems border for project evaluation can be widened: The objective of the development is then more than supplying electricity to an anonymous power market. Additional objectives might be e.g. energy supply for businesses in remote areas (CHP, RES, cf. Pozoblanco CHP, Spain) or structural changes in agriculture (e.g. energy crops) based on a labour intensive "Biomass economy" (cf. Mortágua biomass (Portugal), Tyrol biogas (Austria), Harboøre biomass (Denmark)). Thus DG can form a means to deliver regional structural benefits. One example is wind power development in Spain (cf. El Perdon wind farm), which has a very broad political support as a means of regional development in structurally weak regions.

The positive image factor of an environmentally friendly DG installation is sometimes taken into account by operators. This is often the case for PV installations which would usually be uneconomic if only calculated as a electricity generator. If PV (or other DG) becomes part of a company's PR strategy, the systems border is widened and the installations turns economic. This process can seen e.g. in for the PV strategies of retail companies and service station operators in Europe. Similar examples can be found if PV is integrated e.g. into buildings and the module takes over a building's function, like roofing or façade.

## **B6 Local Resistance (RES)**

Despite of the broadly accepted environmental benefits of DG, local resistance can be strong. Reasons vary between technologies: source of air pollution closer to the people (CHP, biomass), danger of smell (biomass), noise (CHP, wind), ecosystem protection (hydro, wind), integrity of landscape (wind, green field PV) etc. However, major resistance against natural gas

CHP occurs hardly since such CHP installations are usually integrated in building structures which (acceptably) host energy converters anyway.

Local resistance can constitute a high barrier to be overcome in a development, since neighbourhood participation rights in spatial planning and licensing/siting processes have generally grown strong, and neighbourhood resistance might also be reflected in non-cooperation of local authorities.

No project failure due to local resistance was encountered in the case studies. However, reports of projects (esp. wind and hydro) prevented due to neighbourhood or environmentalist pressure group resistance are numerous e.g. in Germany and in the UK.

### **S6 Involve Local Actors**

Schemes to ensure financial involvement in DG developments or benefits to the neighbourhood can help significantly to reduce local resistance and foster local support.

Some examples for such schemes can be seen e.g. in Denmark (e.g. Vindinge wind project), where investors for wind parks should be based in the immediate vicinity/municipality of the site, Germany (e.g. Keyenberg wind farm), where some developers grant easier access to the financing scheme for local investor individuals, or in Spain (e.g. El Perdon wind farm), where certain regions mandate 40% of value-added to be gained within the respective region.

To involve environmental NGOs in development process proved also to be successful e.g. in Germany.