A European Project Supported by the European Commission within
the Sixth Framework Programme for Research and Technological
Development

fenix

'… a step towards the future of
electricity networks'

Contract Nº: SES6 - 518272

FENIX Contractual Framework (D 3.2.6)

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Document information

Document ID:	Task 3_2_6_Sep08_FENIX_report_Poyry_DRAFT_v1_0
Date:	August 2008
Issued by:	Pöyry Energy Consulting
Work Package / task:	WP3/2.3
Status:	Draft
Dissemination level:	Public
Distribution:	Public

Document history

Version	Date	Modification	Author
1.0	Aug 2008	Draft for Comment	Elis, Soor, Warham
2.0	Nov 2008	Final	Soor, Elis, Bradbury & Woodhouse

Approvals

Version	Name	Company	Date
1.0	Dafydd Elis	Pöyry Energy Consulting	August 2008
2.0	Stephen Woodhouse	Pöyry Energy Consulting	November 2008

Abstract

Following on from the development of the FENIX regulatory framework, this document describes contract models that will need to be developed between the various parties. It is of little benefit if the regulatory structure is set but the companies are unable to realise the value of DER, or protect themselves commercially if DER is absent. The purpose of this phase of the work is to develop contract models to regulate the inter-relationships between TSO, DSO, VPP and DER operators.

CONTENTS

Terminology and Acronyms

The following list sets out explicitly the definition of some of the key concepts discussed in this paper and their acronyms. For convenience, we have reproduced here the definition of the terms CVPP and TVPP found in the Fenix Glossary (version 0_2), but where we have used other terms from the Glossary in this document, we have striven to use them as defined in the Glossary.

British Electricity Trading & Transmission Arrangement

In 2005, the NETA were extended to the whole of Great Britain (England, Wales and Scotland), and became known as the British Electricity Trading & Transmission Arrangement (BETTA).

Commercial Virtual Power Plant (CVPP)

A CVPP is a VPP with an aggregated profile which includes cost and operating characteristics for the DER portfolio, it does not include distribution network location/constraints.

Services/functions from a CVPP include trading in the energy market and balancing of trading portfolios

The operator of a CVPP can be any third party/BRP with market access; e.g. an energy supplier.

Distributed Energy Resource (DER)

The FENIX definition of DER encompasses all energy resources in the distribution network including; generation units, controllable loads and electricity storage systems. FENIX DER include resources that are both dispatchable and/or predictable, as well as those that are inflexible an/or intermittent.

Distributed Asset Owner (DAO)

An entity that owns distribution network assets. Conceptually, this is distinct from the Distribution System Operator (DSO), who is responsible for operating those assets, although in many countries both functions are fulfilled by the same company. When discussing current GB arrangements, for example, the term DNO refers to the entities that own and operate the distribution networks: there is no DSO/DAO distinction in GB.

Distribution Ancillary Services (DAS)

Distribution Ancillary Services (DAS) are services procured by the DSO in order to maintain the stable operation of the distribution system. These include services that maintain appropriate operating voltage levels and managing power flows along the low-voltage network.

Renewable Energy Guarantee of Origin (REGO)

Renewable Energy Guarantees of Origin (REGOs) are issued by the British electricity regulator, Ofgem. They were introduced in 2003 in the UK, and one REGO is issued to accredited renewable generators for each kWh generated.

Renewable Obligation Certificate (ROC)

Certificate issued to accredited renewable generators under the UK Renewables Obligation. A Renewables Obligation Certificate (ROC) is issued for each MWh of renewable generation. Suppliers must present a number of ROCs corresponding to a pre-defined proportion of their total volume supplied in each year, or pay a fee (the buy-out price) for any shortfall in ROCs presented.

Levy Exemption Certificate (LEC)

Industrial and commercial energy users must pay a tax –the Climate Change Levy – on the energy they consume. Electricity generated from renewable sources is exempt from this tax. The regulator, Ofgem, issues Levy Exemption Certificates (LECs) to renewable generators for each unit they generate. LECs are tradable and are of value to suppliers, so that they are an additional stream of revenue for renewable generators.

New Electricity Trading Arrangements (NETA)

NETA are the arrangements introduced in 2001 for trading electricity in England and Wales. At its heart is a balancing mechanism that operates over half-hour periods, with Futures and Forwards markets supporting trade before real-time and imbalance settlement mechanisms for dealing with imbalances ex-post.

Technical Virtual Power Plant (TVPP)

A TVPP is a VPP with an aggregated profile which includes the influence of the local distribution network on DER portfolio output.

Services/functions from a TVPP include system management for DSO and TSO and ancillary services.

The operator of a TVPP requires detailed information on the local network; typically this will be the DSO.

Transmission System Operator (TSO)

The Transmission System Operator (TSO) is the entity responsible for operating the transmission system, including managing power flows along transmission lines and maintaining system stability with real-time balancing.

Transmission Asset Owner (TAO)

The TAO is an entity that owns transmission network assets. Conceptually, this is distinct from the Transmission System Operator (TSO), who is responsible for operating those assets, although in many countries both functions are fulfilled by the same company.

Transmission Ancillary Services (TAS)

Transmission Ancillary Services (TAS) are services procured by the TSO in order to maintain the stable operation of the transmission system. These include services that maintain appropriate operating voltages and frequencies, manage power flows along transmission lines, and support network recovery after black-outs.

FENIX CONTRACTUAL FRAMEWORK (D 3.2.6)

Executive Summary

Introduction

The Fenix concept can be conceptualised as a set of commercial relationships between a number of entities. These entities include among others Distributed Energy Resources (DERs), Virtual Power Plants (VPPs), wholesale energy markets, the Distribution System Operator (DSO) and the Transmission System Operator (TSO). In their interaction with each other, all the Fenix parties will seek to maximise their revenue, minimise their costs, and manage their exposure to risk, while operating within legal and regulatory limits.

In order to allow the Fenix concept to operate successfully, these commercial relationships will have to be underpinned by a robust set of contracts, defining the relationship between parties and their obligations to one another.

Purpose of deliverable

This deliverable describes the work undertaken in task 3.2.3 to outline the requirements for a Fenix contractual structure. Real-world implementations of the Fenix concept will vary, depending on specific legal, regulatory and commercial climates. With this in mind, this paper aims to set out a high-level, functional, contracting framework that could give effect to a Fenix arrangement, rather than a detailed set of contracts for a specific situation.

Approach

The practical realisation of the Fenix concept, where it occurs, will be a new development within existing electricity markets. Analogously, the contractual frameworks underlying Fenix are also likely to develop from existing contractual frameworks.

This report takes the current electricity market arrangements in Great Britain as its starting point. Great Britain was chosen because as a relative mature liberalised market, but of the relevant principles discussed in the report apply would to any liberalised electricity sector. It examines how existing contracts would need to be modified in order to enable to support a Fenix-type arrangement, and what new contractual arrangements would need to be defined.

In developing contract models to regulate the inter-relationships with TSO and DSO, DER operators and VPPs, the deliverable addresses a number of pertinent issues, including the following key ones:

- Identification and evaluation of TSO and DSO services that may be provided by VPPs, including definitions of the time scale of appropriate contracts (annually/monthly/daily or spot market);
- Consideration of procurement and trading arrangements including the mechanisms for service delivery monitoring;
- Development of non-delivery arrangements and benefits of a secondary market for ancillary services; and
- Consideration of the interaction and relationship between ancillary services provided (or used) at transmission level and those provided (or used) at distribution level via VPPs.
- Cost-reflectivity in markets as a means of promoting equality and transparency and minimising distortions.

The report also describes the contractual framework of the Northern and Southern demonstrator projects that are being realised as part of the Fenix project, in order to illustrate how a contractual structure for a practical Fenix scheme would look. Finally, the report presents functional outlines of contracts for three specific types of DER, in order to illustrate the type of contract that a DER might sign in order to participate in a CVPP portfolio.

The Fenix contractual structure

The contractual structure required for Fenix can be represented diagrammatically in Figure 0.1.

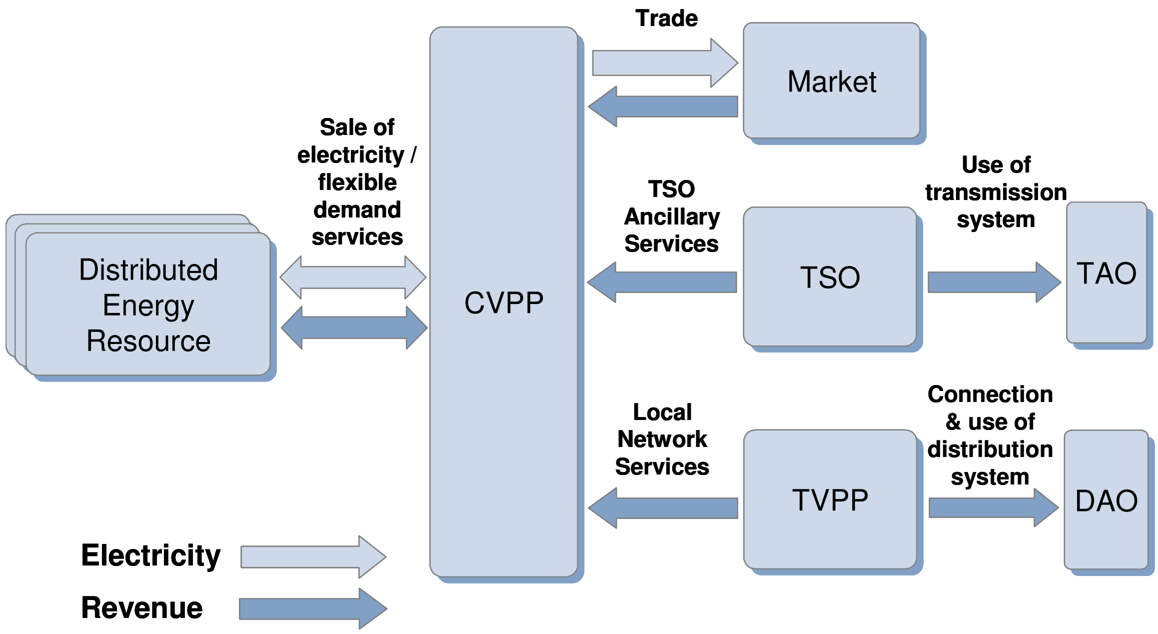

Figure 0.1: Fenix contractual structure

Of the relationships shown in this diagram, this report concentrates on five that would require substantial changes to the status quo. These are: the relationship between DER and CVPP, the relationship between CVPP and TVPP, the relationship between CVPP and TSO, and the relationship between TVPP and DAO. As discussed in Chapter 7, the TVPP and DAO may well be functions of the same legal entity, and so while the relationship between the two is shown here to represent the symmetry between the TSO/TAO relationship and the TVPP/DAO relationship, this may be an implicit relationship within an organisation rather than an explicit contractual agreement.

The key features of the relationships that are relevant to Fenix are outlined in the following paragraphs. The relationship between TSO and TAO is not affected by the Fenix concept and is therefore not discussed further in this report.

CVPP-DER

The relationship between the CVPP and DER in a Fenix future would be more dynamic and interactive than the present relationship between suppliers and DERs.

Specifically, a contractual relationship will need to exist between the DER and the CVPP that allows for:

- Metering of power flow to the CVPP by the DER or to the DER by the CVPP;
- Calculation of Use of System and any other DER charges;
- An agreed protocol for communications between the CVPP and DER;
- Submission of bids and offers to the CVPP by the DER (before real time);
- An arrangement to account for differences between planned and realized volumes (such as a balancing mechanism with system buy- and sell-prices in each trading period);
- Dispatch (generators) or shedding (loads) of the DER by the CVPP (in real time); and
- Billing and payment.

CVPP-TVPP

The relationship between the CVPP and TVPP is a pivotal one for the Fenix concept.

The CVPP and TVPP will need to develop a contractual arrangement that allows for:

- Calculation of connection and use of system payments;
- Communication of requirements and availabilities in advance of delivery and in real time;
- Metering;
- Billing;
- Payment to CVPP for constraint-related additional generation costs;
- Payment to TVPP for Use of System;
- Process for commencing supply to DER; and
- Process for transferring supply of DER to another CVPP.

CVPP-market

One of the two areas where Fenix has the potential to add value is the sale of aggregated DER output on wholesale energy markets.

To enable this, the contractual relationship between the CVPP and the market must allow for:

- Communication of bids and offers to central dispatch system;
- Metering of the CVPP's output;
- Billing and payment; and
- Dispatch of the CVPP by the central system.

CVPP-TSO

The other area where Fenix can create value is in allowing DER to offer ancillary services to the TSO.

The contractual arrangements between the CVPP and the TSO will need to include provisions for:

- Definition of the CVPP's service provision capability;
- Notification by the CVPP of its service provision availability;
- Agreement on substitution of ancillary service provision by on CVPP for provision by another CVPP or conventional generator;
- Specification of the conditions under which the system operator may call on the CVPP to provide the service in the contract;
- Arrangements for metering, testing, and payment; and
- Penalties for the CVPP in cases of failure to deliver TAS as agreed.

TVPP-DAO

The TVPP, which actively manages a section of a distribution network, and the DAO, which owns the network assets, must establish a contractual relationship that allows the DAO to receive from the TVPP the costs of building and maintaining the distribution network.

The contract defining the TVPP - DAO relationship must include the following elements.

- Payment of connection charges to the DAO;
- Payment of Use of System charges to the DAO; and

- Billing and metering arrangements to determine the magnitude of connection and use of system charges due to the DAO.

1. Introduction

1.1. The FENIX objectives that we address

The Fenix project has described in some detail the concept of aggregating Distributed Energy Resources (DER) using Virtual Power Plants (VPP). Work Package 3 has concentrated on the commercial and regulatory aspects of Fenix. The deliverables arising from tasks 3.2.1 and 3.2.2 described the Fenix concept from an economic perspective and examined the regulatory requirements for Fenix to exist.

As well as a commercial incentive and an appropriate regulatory environment, successful implementation of the Fenix concept will require an appropriate contractual structure. Such a structure must accommodate the needs of:

- Customers in general;
- DER – distributed generation, storage and responsive demand;
- Commercial VPPs (CVPP) – large suppliers, independents and innovators;
- Technical VPPs (TVPP) – providing network management services through DER;
- Transmission System Operators/Independent System Operators (TSO/ISO); and
- Distribution Asset Owners/ Distribution System Operators (DAO/DSO).

This deliverable describes the work undertaken in task 3.2.3 to outline the requirements for a Fenix contractual structure. Realisations of Fenix will vary from one situation to another, depending on specific regulatory and commercial climates. With this in mind, this paper aims to set out a contracting framework that could give effect to a Fenix arrangement, rather than a definitive, specific, set of contracts. The contractual aspects described within the paper are limited to functional elements that relate to the implementation of the Fenix concept. The emphasis of the report is on the functional requirements for Fenix contracts; other elements commonly found in commercial agreements (e.g. confidentiality, credit cover, force majeure) have not been discussed as they will be specific to individual states.

1.2. Aim of Contractual Framework Task

Following on from the development of the FENIX regulatory framework (Task 3.2.2), this document describes contract models that will need to be developed between the various parties. It is of little benefit if the regulatory structure is set but the companies are unable to realise the value of DER, or protect themselves commercially if DER is absent. The purpose of this phase of the work is to develop contract models to regulate the inter-relationships between TSO, DSO, VPP and DER operators.

In developing contract models to regulate the inter-relationships with TSO and DSO, DER/VPP operators, a number of pertinent issues have been addressed including the following key ones:

- Identification and evaluation of TSO and DSO services that may be provided by VPPs, including definitions of the time scale of appropriate contracts (annually/monthly/daily or spot market);
- Consideration of procurement and trading arrangements including the mechanisms for service delivery monitoring;
- Development of non-delivery arrangements and benefits of a secondary market for ancillary services;
- Consideration of the interaction and relationship between ancillary services provided (or used) at transmission level and those provided (or used) at distribution level via VPPs; and
- Cost-reflectivity in markets as a means of promoting equality and transparency and minimising distortions.

The report also describes the contractual framework of the Northern and Southern demonstrator projects that are being realised as part of the Fenix project, in order to illustrate how a contractual structure for a practical Fenix scheme would look. Finally, the report presents functional outlines of contracts for three specific types of DER, in order to illustrate the type of contract that a DER might sign in order to participate in a CVPP portfolio.

1.3. The Fenix contractual structure

The structure of the contractual relationships between Fenix parties (CVPPs, TVPPs, and DERs, for example) will reflect the functional relationship between the parties. Figure 1.1 shows the proposed Fenix contractual structure.

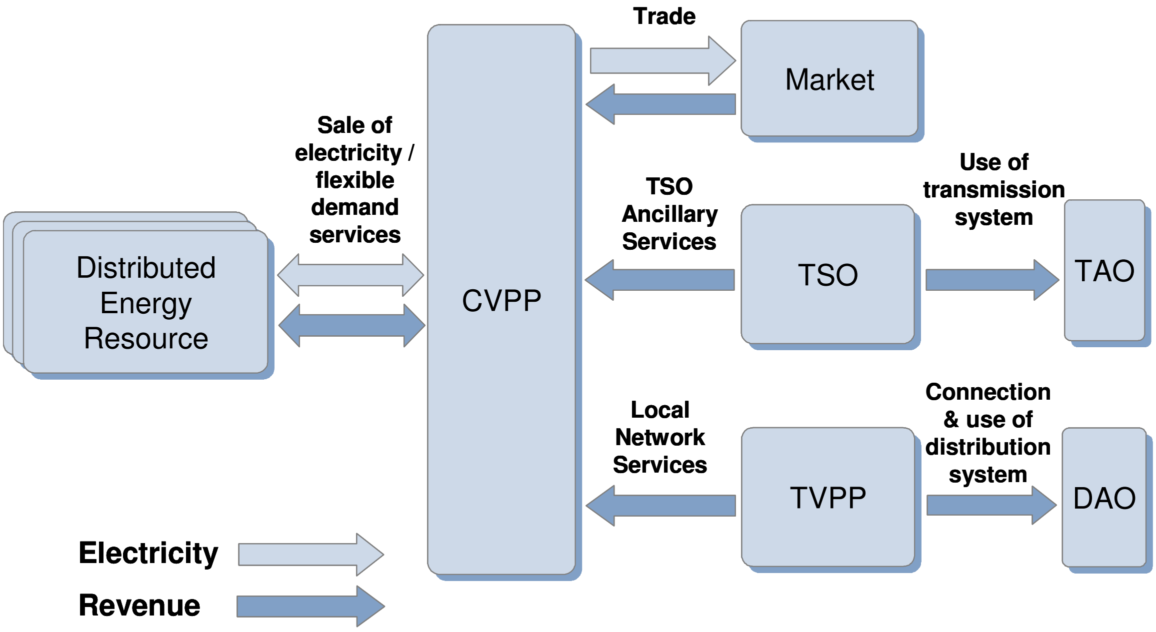

Figure 1.1 Fenix contractual structure

The key contractual relationships that have been identified within this structure are as follows.

- DER – CVPP;
- CVPP – TVPP;
- CVPP – Market;
- CVPP – TSO; and
- TVPP – DAO

The relationship between the TSO and the TAO is already well-defined in the GB market and is not affected by the Fenix concept. It is therefore not discussed further within this report..

In defining the Fenix contractual structure, it has been assumed that DSO, DAO, TSO, and TAO are natural monopoly activities performed by entities whose behaviour is primarily driven by regulatory incentives. In all other areas, we have assumed that competition is possible between actors and that their behaviour is chiefly driven by competitive forces.

1.4. The evolution of the Fenix contractual structure

It is likely that many aspects of the Fenix contractual structure will develop out of the contractual structures that currently exist in member states. In order to understand the way in which DER contracts with other parties at the moment, the authors examined the current contractual relationships that exist in the British electricity market.

This was done by studying contracts being used by the key parties in the current GB arrangement and by face-to-face interviews and discussions with National Grid (the TSO) and discussions with representatives from EdF Energy's DNO business (EdF Energy's Networks branch) and vertically-integrated supply business (EdF Energy's Customer and Energy branches).

1.5. Background to GB Legislative Framework

This report takes the electricity market of Great Britain as a starting point. This provides a coherent and consistent framework within which to examine the contractual arrangements for Fenix.

The GB market is considered to be a front-runner with major reforms dating from 1989 and almost continual reform taking place since that time. It is not that the GB situation is felt to be perfect; rather that most of the problems have been encountered and addressed, if not completely solved. This report is published in the hope that it will prove useful to practitioners in many Member States.

Figure 1.2 shows the legislative framework of the UK liberalised market. The licences are the primary documents that set out the obligations of major parties within the market: large generators, transmission asset owners, system operator, distribution operators and suppliers. However even licence-exempt actors such as DER are subject to many of the same regulations through various, often mandatory, contractual relationships. The technical and commercial codes referenced in the licences can also have signatories that do not require a licence.

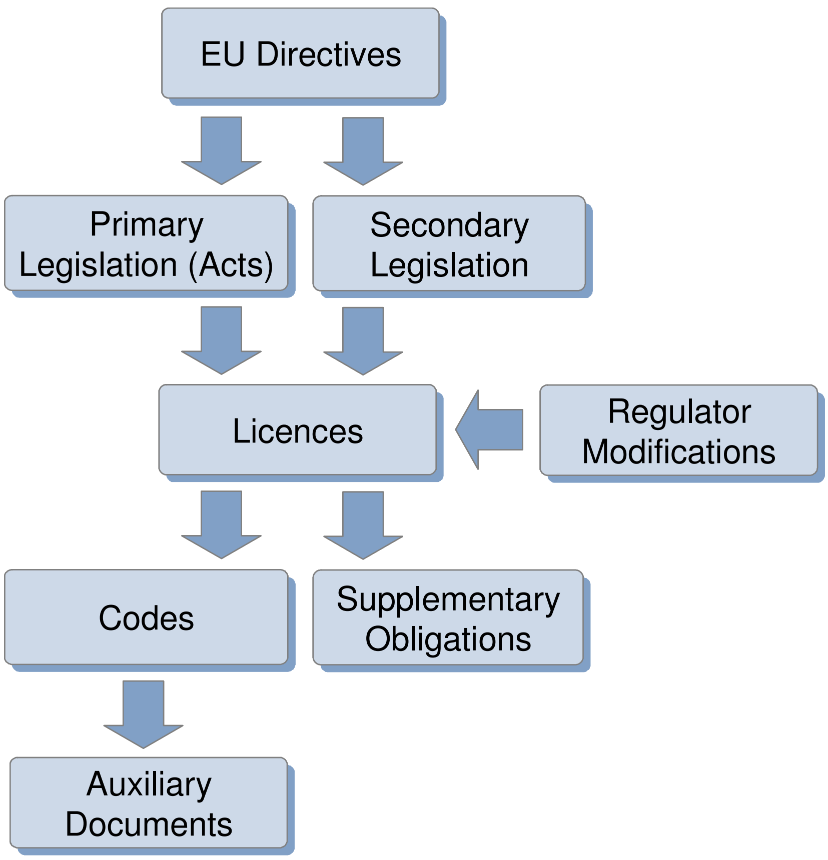

Figure 1.2 Path of legislation in GB market

Primary Legislation (Acts)

The *Electricity Act 1989* was the act that first initiated the process of liberalisation in the GB market and many of its clauses still apply although often modified by subsequent Acts.

The *Utilities Act 2000* created a single regulator for gas and electricity markets, Ofgem, with the objective to "to protect the interests of consumers, wherever appropriate, by promoting effective competition". The New Electricity Trading Arrangements (NETA) were also implemented under this Act, removing the previous pool system and replacing it with wholesale market arrangements. Independent distribution (not linked to a supply business) became a licensable activity, with class or individual exemptions by the Secretary of State and prevented a legal entity holding both a supply and distribution licence.

Standard licence conditions for all licence holders to harmonise requirement and aid transparency were introduced and these, along with any other licence condition, can be modified by the regulator. Finally, the Renewables Obligation replaced Non Fossil Fuel Obligation and required suppliers to source a specified proportion of their supply from renewable generator or pay into a buy-out fund.

The *Energy Act 2004* allowed for the creation of a single wholesale electricity market of England, Wales and Scotland, known as the British Electricity Trading & Transmission Arrangement (BETTA).

The *Climate Change and Sustainable Energy Act 2006* contains a range of measures designed to promote new and existing technologies. The Act allows the Secretary of State to require that export from microgeneration is acquired by supplier and/or distributors. As a result of this, suppliers are currently discussing a standardised approach to avoid compulsory conditions. Reports discussing the potential for dynamic demand and energy efficiency must be produced and reforms of the renewable obligation allow smaller generators to use agents and avoid the requirement for 'sale and buyback' contracts in order to claim Renewables Obligation Certificates (ROCs).

Secondary Legislation (including Statutory Instruments)

The Electricity Safety, Quality and Continuity Regulations 2002 laid out a range of requirements and minimum standards for equipment connected to the electricity network. These have been implemented in various codes and technical documents.

The Renewables Obligation Order 2002 implemented the provisions of the Utilities Act regarding the renewables obligation. There have been a number of subsequent orders to refine the order and consultation over more fundamental reform, see below.

The Electricity (Class Exemptions from the Requirement for a Licence) Order 2001 exempted certain parties from the requirement to hold a licence. Generators with declared capacity under 100MW, distributors not distributing more than 2.5MW and supplier not supplying over 5MW (2.5MW to domestic customers) were able to operate without possessing a licence.

Licences

Transmission, Distribution, Supply and Generation are licensed activities within the GB market. The licences set out the full obligations for each participant and were originally introduced in the Electricity Act 1989. The requirements range from becoming a party to the various codes that govern the technical and commercial environment to obligations to serve all customers without discrimination. They consist of 'standard conditions' which apply to all licensees except in mitigating circumstances and special conditions, specific to each party.

Implementing major changes to licence obligations would require primary legislation.

The *Distribution Licence* grants permission to "distribute electricity for the purpose of giving a supply of electricity to any premises". There are a number of duties which are imposed on distributors by the Electricity Act and further legislation.

The *Supply Licence* is required for parties that wish to sell electricity to industrial commercial or domestic customers. Obligations such as minimum quality of supply and metering provision are included within this document.

Codes

There are several codes that apply to the GB market which cover the full spectrum of technical requirements and commercial arrangements. Becoming party to each of these is mandatory for some participants in the market, covered by licence conditions/contractual arrangements but is optional in some cases; unlicensed generators in the Balancing and Settlement Code are an example. Only the codes relevant to DER and associated operation are included.

The *Distribution Code* (DCode) details the technical requirements and processes associated with connection to along with use and operation of the distribution networks. Although there is no legal requirement to do so, all GB distribution operators use an identical document. Anyone connecting to or using the system is required to become a signatory to the DCode, although for small consumers this requirement is conducted through a supplier.

The *Balancing and Settlement Code* (BSC) contains the commercial market and balancing mechanism arrangements for the wholesale market under NETA and subsequently BETTA.

There have been several modifications to the BSC that had a significant effect on DG in the wholesale market.

The *Distribution Connection and Use of System Agreement* (DCUSA) is a recent development to standardise connection and use of system arrangements in the GB distribution networks.

1.6. Report structure

Chapter 2 of this report describes the routes to market currently available to different types of DER, considering individually the markets for power, transmission-level ancillary services, and distribution-level ancillary services. It then compares these with the routes to market for the same DERs under a Fenix arrangement, highlighting the greater degree of market access created by Fenix compared to the current arrangements.

Chapters 3 to 7 discuss each of the contractual relationships described in section 1.3. For each relationship, the report describes the current corresponding arrangement in Great Britain. Each section then proceeds to describe the requirements for a contractual agreement between the parties that would allow a Fenix arrangement to function, and gives an outline functional description of such a contract.

- Chapter 3 describes the DER – CVPP relationship;
- Chapter 4 describes the interface between the CVPP and TVPP;
- Chapter 5 describes how the CVPP relates to the market;
- Chapter 6 describes the relationship between the CVPP and TSO; and
- Chapter 7 describes the TVPP – DNO relationship.

Chapter 8 discusses the contractual structure of the Northern Scenario, beginning with the contractual relationships underlying the reference case and then the additional contractual relationships and contractual features required in order to realise each of the Case Studies. Chapter [XXX] discusses the contractual structure of the Southern Scenario.

Chapter 9 presents outline contracts for three specific types of DER: micro-CHP, controllable demand, and a small-scale storage device.

The report makes use of the current British market arrangements throughout in order to represent the present arrangements for DER, and makes use of actual contracts formed under these arrangements as a starting point for the development of Fenix contracts. A References section at the end of the report summarises the main documents used in describing the current market in Great Britain, and the appendices that follow present functional summaries of key current GB contracts. These are:

- APPENDIX A – Functional Summary of Short Term Operating Reserve Standard Contract Terms (For Non-Balancing Mechanism Participants)
- APPENDIX B – Functional Summary of The Firm Frequency Response Tender Rules And Standard Contract Terms (FFR)
- APPENDIX C – Functional Summary of a Reactive Market Ancillary Services Agreement
- APPENDIX D – Functional Summary of Distributed Generation Power Purchase Agreement (PPA)

- APPENDIX E – Functional Summary of a Grid Trade Master Agreement (GTMA)
- APPENDIX F – Functional Summary of the Distribution Connection and Use of System Agreement (DCUSA)
- APPENDIX G – Functional Summary of GB National Terms of Connection (NTC)
- APPENDIX H – Functional Summary of a Domestic Supply Agreement
- APPENDIX I – Functional Summary of a Top-Up and Spill Agreement
- APPENDIX J – Functional summary of Spill Agreement for Micro-CHP Operators
- APPENDIX K – Functional Summary of the Balancing and Settlement Code.

2. Routes to market for DER under Fenix

The Fenix concept would allow DER to participate more actively in markets that they currently participate in only to a limited extent or are unable to access at all. Specifically, these are markets for energy (the wholesale electricity market), and for the provision of ancillary services at the transmission and distribution levels. These markets are all structured very differently, but all of them are underpinned by contractual frameworks. Where Fenix creates new routes to market or strengthens existing ones, new contractual arrangements will need to be developed. This chapter considers the routes to market for different types of DER under the status quo and under Fenix in order to highlight the differences and identify areas where new contractual features need to be created.

2.1. Access to the market for electricity

The design of electricity markets varies between countries. The following section uses the structure of the market for electricity in Great Britain as an example. It explains how DER currently gains access to this market by contracting with suppliers or aggregators, and outlines how Fenix creates an additional route by which DER can reach the market.

2.1.1. Existing wholesale electricity market arrangements

The GB wholesale electricity market in its current form is known as BETTA (British Electricity Trading and Transmission Arrangements). It is made up of arrangements by which parties trade electricity between themselves. The main features of the wholesale energy market include the forward and futures market, the short-term spot market, the balancing mechanism and ex-post imbalance settlement. Although the market is open to all players, in practice the active participants tend to be larger independent generators, suppliers, and aggregators. Smaller users or producers of electricity are absorbed in the portfolio of these large participants.

The forwards and futures market enables parties to contract for electricity up to several years in advance. These are over-the-counter (OTC) transactions where the agreement between a generator and supplier is completed by a broker. These agreements generally adhere to a standard structure, such as the Grid Trade Master Agreement (GTMA) that allows the trades to be registered under the central market accounts, but the two parties involved are able to negotiate the commercial terms of the contract to meet their own requirements.

As the delivery period approaches, participants begin to supplement their long-term forward contracts with positions on the spot market, which in Great Britain is run by APX POWER UK. The UKPX power exchange allows trade in contracts ranging from half an hour to a week in length. This allows parties to 'fine tune' their contracted positions in the weeks leading to actual delivery. Unlike the OTC forward contracts, the power exchange allows anonymous trade of standard products with the price exchange as the counter party.

On the day before delivery, all market participants must submit a Final Physical Notification (FPN) for each half-hour settlement period to the Balancing Mechanism, which is operated by the system operator (National Grid). This represents the intended physical position of the participant.

Because of uncertainties about the future and unforeseen events such as faults in generating plant, some parties' actual generation or demand will differ from their intended physical position in each settlement period. The system operator manages this by buying or selling energy in real time from participants who have indicated that they would be willing to lengthen or shorten their physical position. For each settlement period, two energy imbalance prices are calculated. These are known as the system sell price (SSP) and the system buy price (SBP). These prices are then applied to any deviation from a party's FPN with the SSP being paid to participants who are long compared to their FPN and the SBP paid by participants where there is a net deficit. The SSP and SBP are calculated ex-post based on the cost and revenues to the System Operator of buying and selling imbalance power.

Figure 2.1 shows diagrammatically these electricity trading arrangements over various time frames around delivery. The forwards and futures market can be used to trade years or months in advance of delivery, trades can be executed on the spot market trades up to Gate Closure which is an hour before the start of the traded period, and balancing mechanisms are then used to account for any difference discussed above until the traded period, after which the settlement process starts.

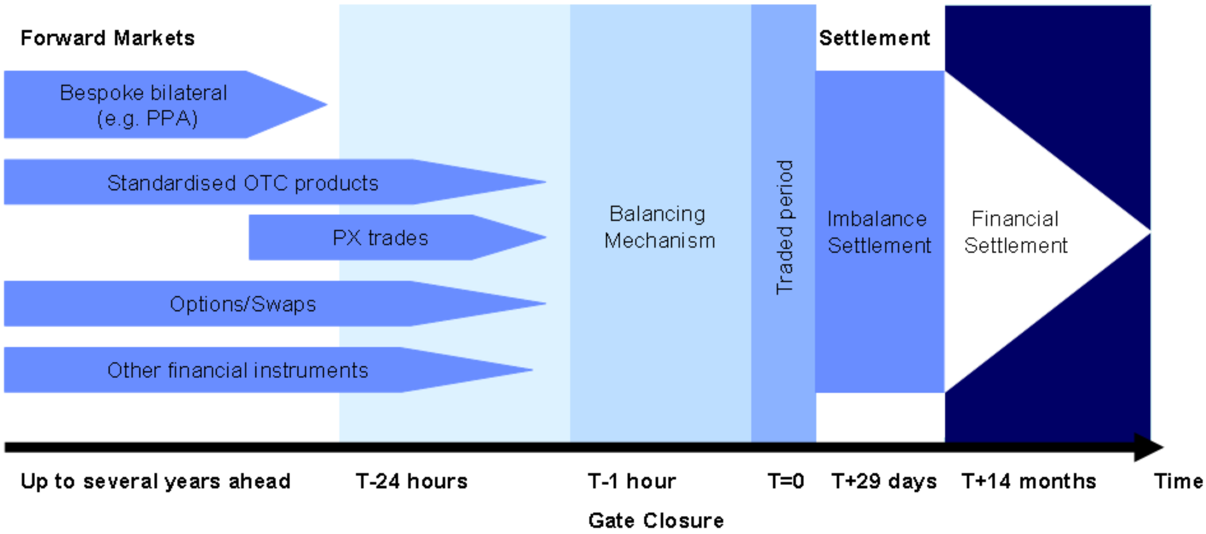

Figure 2.1: Representation of BETTA arrangements for buying and selling electricity.

2.1.2. Existing routes to the electricity market for Distributed Generators

Small plants, including most DG, do not participate directly in the wholesale market. There is a minimum threshold for electricity traded on the spot and forward markets, so that smaller generators are not able to trade directly in this way. Also, the costs of trading the output of a small plant tend to be prohibitive compared to the additional value achieved. Therefore, smaller generators often sell their entire output to a single supplier or aggregator under a contract usually lasting several years.

Contracts with suppliers vary in complexity. The simplest are top up and spill contracts where energy imported is charged at the same rate as energy exported, which are typical for microgenerators. Larger generators will sign a Power Purchase Agreement (PPA) with a supplier. These may offer a fixed tariff for all energy produced, or a varying Seasonal Time Of Day (STOD) tariff with higher prices at peak and in winter, or a floor price and a share of any upside above this floor in each settlement period, based on prices formed in the spot market. Different generators will opt for different contract types, according to their appetite for risk, complexity, and return. This is usually determined by the generator's size and ownership structure. For small- and micro-scale DG, the metering cost implied by different contract types is also a material consideration. A common feature of supplier contracts is that they tend to limit a generator's exposure to movements in the wholesale electricity markets for the duration of the contract, as well as reducing exposure to imbalance risks through being part of a supplier's portfolio of generation and passing the costs and risks of trading to the supplier.

Alternatively, small generators can contract their output to an aggregator who will trade it on their behalf. Under this arrangement, the generator avoids the costs and risks of trading out its own output and mitigates some of its imbalance exposure by being part of the aggregator's portfolio, but can be exposed to all the risks and rewards of wholesale price movements.

There are other routes by which DG can sell their output to electricity consumers, including unlicensed supply where the generator contract directly with the consumer. The vast majority of DG, however, contract with either a supplier or a generator in contracts similar to those described.

2.1.3. Participation in the electricity market for controllable demand under existing arrangements

Currently, there is little demand-side participation in the British wholesale electricity market. Most domestic and other small consumers are not Half-Hourly metered, and therefore have no information about intra-day price variation. These consumers' demand patterns are profiled for the purposes of settlement and in this sense they do not participate actively in the market. Large demand sites (larger than 100kW) are Half-Hourly metered and some such consumers enter into bilateral agreements with their suppliers to behave responsively when the supplier asks them to curtail their demand.

2.1.4. Routes to the electricity market for DER under Fenix

A Fenix-type aggregator (CVPP) would allow for a third route to market for DER, in addition to the current options of a supplier or aggregator-style contract. The CVPP would fulfil the same role as an existing supplier or aggregator from the perspective of limiting a DER's exposure to fluctuations in wholesale market prices and taking responsibility for trading out the DER's position.

In addition to these functions, the CVPP would also be able to interact with the DER and influence its physical behaviour. This additional function creates additional value by dispatching small DG at optimal times and allowing the use of small-scale storage and more active management of demand sites.

By comparing the routes-to-market available to different types of DER under Fenix to the options available under current arrangements, it is possible to see how Fenix creates value by allowing DER to access markets that they are currently unable to reach.

Table 2.1 summarises existing routes to market for different types of DER. These are contracting with a supplier, contracting with an aggregator, and direct participation in the wholesale market. Where a given route is not available to any technology, this has been noted. Alongside the existing options, the table shows the route to market offered by Fenix and a summary of the benefits that this entails.

<table>
<tr><th></th><th colspan="3">Current arrangements</th><th>Fenix</th></tr>
<tr><th></th><th>Supplier contract</th><th>Aggregator contract</th><th>Direct market participation</th><th>CVPP contract</th></tr>
<tr><td>Large Controllable Demand</td><td>Supply contract. Tariff is time-varying and billing is based on Half-Hourly metered demand. Further bilateral contract may be drawn up to specify terms of control and payment where demand is responsive.</td><td rowspan="2">[Not currently possible]</td><td rowspan="2">[Not currently possible]</td><td rowspan="2">Unit provides operational parameters to the CVPP, possibly in the form of demand curtailment costs and quantities during defined periods. CVPP indicates when demand should be curtailed, and passes back a proportion of the value created.</td></tr>
<tr><td>Small Controllable Demand</td><td>[Not currently possible]</td></tr>
<tr><td>Landfill Gas</td><td rowspan="3">Power Purchase Agreement. Contract has a simple structure. Supplier takes all the generated volume. Generator usually receives a flat price or a Seasonal Time of Day tariff. Imbalance risk, costs of trading, any renewable generation incentives, and embedded benefits are reflected in the price paid by the supplier.</td><td rowspan="3">Power Purchase Agreement. Aggregator trades the generator's output. Aggregator passes back to the generator a high percentage of the revenue associated with the electricity sales, any renewable generation incentives, and embedded benefits, together with imbalance costs incurred. Aggregator retains a fee to cover the costs of its trading operation.</td><td>[Not currently possible]</td><td>Generator provides operational parameters to the CVPP which indicates when the unit should generate. CVPP passes portion of revenues to the generator.</td></tr>
<tr><td>Large Wind</td><td>Trading of output using forwards/futures and power exchanges. Generation site invests in IT, communications, and staffing for a trading function. Full exposure to fluctuations in wholesale electricity prices, imbalance risk, and trading risk.</td><td rowspan="3">Wind generator indicates costs of reducing generation to the CVPP. Where imbalance costs are higher than this, and the CVPP is long on electricity, CVPP calls on the wind generator to reduce its output to help balance the CVPP's position.</td></tr>
<tr><td>Medium Wind</td><td rowspan="2">[Not currently possible]</td></tr>
<tr><td>Small Wind</td><td>'Top-up-and-spill' agreement. Energy exported is purchased by the supplier at the same price as it is bought. Pricing is flat, with no seasonal or time-of-day variation.</td><td>[Not currently possible]</td></tr>
</table>

<table>
<tr><th></th><th colspan="3">Current arrangements</th><th>Fenix</th></tr>
<tr><th></th><th>Supplier contract</th><th>Aggregator contract</th><th>Direct market participation</th><th>CVPP contract</th></tr>
<tr><td>Large CHP</td><td rowspan="2">Power Purchase Agreement. Contract has a simple structure. Supplier takes all the generated volume. Generator usually receives a flat price or a Seasonal Time of Day tariff. Imbalance risk, costs of trading, any CHP incentives, and embedded benefits are reflected in the price paid by the supplier for the electricity.</td><td rowspan="2">Power Purchase Agreement. Aggregator trades the generator's output. Aggregator passes back to the generator a high percentage of the revenue associated with the electricity sales, any CHP incentives, and embedded benefits, together with imbalance costs incurred. Aggregator retains a fee to cover the costs of its trading operation.</td><td>Trading of output using forwards/futures and power exchanges. Generation site invests in IT, communications, and staffing for a trading function. Full exposure to fluctuations in wholesale electricity prices, imbalance risk, and trading risk.</td><td rowspan="3">CHP provides operational parameters to the CVPP, determined by its heat load. CVPP indicates to the CHP when it should generate. CVPP passes back to the generator a percentage of the increased revenue associated with the electricity sales, along with any CHP incentives, and embedded benefits</td></tr>
<tr><td>Medium CHP</td><td rowspan="2">[Not currently possible]</td></tr>
<tr><td>Micro CHP</td><td>'Top-up-and-spill' agreement. Energy exported is purchased by the supplier at the same price as energy bought from the supplier. Pricing is flat, with no seasonal or time-of-day variation.</td><td>[Not currently possible]</td></tr>
<tr><td>Large Storage (Pumped Storage)or Medium Storage</td><td rowspan="2">[Not currently possible]</td><td rowspan="2">[Not currently possible]</td><td>Trading of output using forwards/futures and power exchanges. Generation site invests in IT, communications, and staffing for a trading function. Full exposure to fluctuations in wholesale electricity prices, imbalance risk, and trading risk.</td><td rowspan="2">Unit provides operational parameters to the CVPP. CVPP indicates when to store and discharge, and passes back a proportion of the value created.</td></tr>
<tr><td>Small Storage</td><td>[Not currently possible]</td></tr>
</table>

Table 2.1: Routes to the electricity market for different DER types under the current market arrangements and under Fenix

2.2. Access to the market for transmission-level ancillary services

As well as accessing wholesale electricity markets, Fenix would allow DER to participate in providing transmission-level ancillary services. This section outlines the current arrangements for procuring ancillary services in the GB market, and how Fenix could allow DER to participate in this market.

2.2.1. Current arrangements for accessing the market for transmission-level ancillary services

There is only one purchaser of transmission-level ancillary services (TAS) in Great Britain, and this is the System Operator (National Grid). National Grid has developed a number of standard contracts for generators that provide TAS. These can be divided into three categories: provision of frequency response, reserve, and reactive power; the first two relating to balancing and the latter to voltage control. They also maintain contracts for Black Start and Fast Start through long-term Commercial Services Agreements with generators. National Grid contracts for these services in regular tendering rounds, and continuously revises its contracts in the light of discussion with providers and potential providers of TAS.

As a general rule, small DER do not participate in the provision of ancillary services to the TSO. National Grid tends to contract with large plant, although it is possible in principle for an aggregated portfolio of smaller generators to provide ancillary services such as reserve.

2.2.2. Routes to the market for transmission-level ancillary services under Fenix

Under a Fenix-type arrangement, the CVPP would be able to offer the aggregated output of its portfolio of DER to the TSO in order to provide ancillary services. By and large this would represent access to a market that DER are not able to access under current arrangements.

Such provision of ancillary services relies on real-time communication and control between the CVPP and DER, and the contractual arrangements between the two would need to accommodate this.

Table 2.2 shows the routes to the ancillary services market under current arrangements and under Fenix, for selected types of DER.

	Current Arrangements	**Fenix**
	Direct provision to SO	Provision via CVPP
Large CHP	Contracts with TSO to provide reserve.	Provides operational parameters to the CVPP. CVPP contracts with the TSO to provide ancillary services. These ancillary services may include reserve, frequency response, black start, and reactive power provision. CVPP passes back to the unit a proportion of the value achieved from the contract with the TSO. (Several methods can be used to pass on this value, including a fixed price, a floored contract with a ceiling, or a direct pass-through of a percentage of the revenue received.
Medium CHP	May contract with TSO to provide reserve.	
Micro CHP	[Not currently possible]	
Landfill gas	[Not currently possible]	
Large wind turbines	[Not currently possible]	
Small wind turbine	[Not currently possible]	
Large scale storage (pumped storage)	Large plants provide a range of ancillary services to SO, especially reserve.	
Small scale storage	[Not currently possible]	
Controllable demand	There are some demand controllable sites, heating or cooling systems that can be temporarily switched off to unload the grid (reserve),	Provides operational parameters to the CVPP. CVPP contracts with the TSO to provide ancillary services. These ancillary services may include reserve and frequency response. CVPP passes back to the unit a proportion of the value achieved from the contract with the TSO.

Table 2.2: Routes to the transmission-level ancillary services market for different DER types under the current arrangements and under Fenix

2.3. Access to the market for distribution-level ancillary services

Markets for distribution-level ancillary services are not widespread or well-developed. This is mainly due to the nature of the regulatory regime for distribution networks, which often provides little incentive to operate lean active networks. This section discusses the example of the arrangements in Great Britain for provision distribution-level ancillary services, and how DER would be able to contribute these kinds of ancillary services through a Fenix arrangement.

2.3.1. Current arrangements for provision of distribution-level ancillary services

There is currently no distinction between DSO and DNO in Great Britain. This is largely because the distribution networks are largely designed as passive networks capable of operating without constraints, rather than being actively managed systems relying on demand reduction and/or distributed generation to manage power flows.

This is the result of the regulatory environment in which DNOs exist, particularly effect of Rate of Return regulation on DNOs' investment decision-making, which implicitly discourages the construction and operation of lean networks. This is discussed in more depth in the Fenix 3.2.5 deliverable ("Fenix regulatory framework").

DNOs have entered into informal arrangements with generators for network management, but this is unusual and arrangements are highly context-specific.

2.3.2. Provision of distribution-level ancillary services under Fenix

Given an appropriate regulatory framework, a Fenix arrangement would allow DER to provide ancillary services to the distribution network, which would allow the TVPP (operator of the distribution network) to benefit from avoided or deferred investments in network upgrades as new demand and generation connected. Table 2.3 summarises the contractual relationships involved in providing such services under current arrangements and under Fenix.

<table>
<tr><th></th><th>Current Arrangements</th><th>Fenix</th></tr>
<tr><td></td><td>Direct provision to DSO</td><td>Provision via TVPP</td></tr>
<tr><td>Large CHP</td><td>May in some circumstances provide reactive power to assist with voltage support, and/or agree to curtail output to manage power flows.</td><td rowspan="6">Provides operational parameters to the TVPP. TVPP communicates with the generator in real time, asking it to turn up or turn down or to change its reactive power characteristics in order to manage flow and voltages on the network.

TVPP passes back to the unit a proportion of the value achieved through avoided or deferred capital investment. (Several methods can be used to pass on this value).</td></tr>
<tr><td>Medium CHP</td><td>[Does not currently occur]</td></tr>
<tr><td>Micro CHP</td><td>[Does not currently occur]</td></tr>
<tr><td>Landfill gas</td><td>[Does not currently occur]</td></tr>
<tr><td>Large wind turbines</td><td>May in some circumstances provide reactive power to assist with voltage support, and/or agree to curtail output to manage power flows.</td></tr>
<tr><td>Small wind turbine</td><td>[Does not currently occur]</td></tr>
<tr><td>Large scale storage (pumped storage)</td><td>[Does not currently occur]</td><td rowspan="2">Provides operational parameters to the TVPP. TVPP communicates with the unit in real time, asking it to increase or turn up or turn down its generation or demand or to change its reactive power characteristics in order to manage flow and voltages on the network.

TVPP passes back to the unit a proportion of the value achieved through avoided or deferred capital investment. (Several methods can be used to pass on this value).</td></tr>
<tr><td>Small scale storage</td><td>[Does not currently occur]</td></tr>
<tr><td>Controllable demand</td><td>[Does not currently occur]</td><td>Provides operational parameters to the TVPP. TVPP communicates with the unit in real time, asking it to increase or reduce its demand in order to manage flow on the network.

TVPP passes back to the unit a proportion of the value achieved through avoided or deferred capital investment. (Several methods can be used to pass on this value).</td></tr>
</table>

Table 2.3: Routes to the distribution-level ancillary services market for different DER types under the current arrangements and under Fenix

3. DER - CVPP

3.1. Introduction

Distributed Energy Resources (DER) encompass electricity generation connected to the distribution network, whether at low or high voltage, responsive electricity demand ranging from a domestic consumer avoiding peak consumption using intelligent devices or a large retail installation allowing chillers to be controlled remotely, and dispersed electricity storage.

A Commercial Virtual Power Plant (CVPP) is defined here as the aggregation of DER in order to access both the electricity market and commercial ancillary services as well as to engage in activities related to the active management of networks. In Great Britain, a CVPP would be obliged to be a licensed supplier if it was to supply more than 5MW to customers.

The relationship between consumers and suppliers is already well established contractually as are Power Purchase Agreements (PPA) for suppliers to contract for the output of generation, so the emphasis here is to identify supplementary contract elements that are considered to be necessary to govern the activities proposed within the FENIX Project.

3.2. Activities

The CVPP will be engaged in trading electricity bidirectionally with DER, accepting bids and offers from DER and issuing instructions to them in order to balance its position in the electricity markets. This will require a development of the current agreements between supplier and customer and between supplier and DER. In a situation where the CVPP is not a supplier, the CVPP will have to enter into a relationship with a supplier. In this case the CVPP would need to sign a PPA with a supplier.

3.3. Current GB situation

A number of different contractual arrangements have been developed for generators connecting to distribution networks in GB. The differences between them largely reflect the diversity of DG; from small domestic generators in the order of a few kW to distribution-connected wind or hydroelectric projects many tens of MW in size.

3.3.1. Domestic Supply

Domestic customers in Great Britain enter into a supply contract with a supplier. Suppliers generally have a set of standard terms and conditions that describe both parties' basic obligations to each other, specifically: prices, billing, metering and payment (see APPENDIX H for a detailed functional summary of a GB domestic electricity supply contract).

The customer's agreement with the supplier also establishes a relationship between the customer and the DNO by including the National Terms of Connection (NTC) as a condition of the supply contract. The NTC is a standard document that has been adopted by all DNOs. It defines the basic obligations of the DNO and the customer (see APPENDIX G for a detailed functional summary of the GB NTC).

3.3.2. Microgeneration

Domestic customers who have installed a microgenerator may sign an agreement with a supplier, with the supplier agreeing to purchase all the energy produced by the microgenerator. Such an agreement details the metering requirements and methods of billing and payment. Typically, metering equipment in such installations is basic and payment is related to the volume of generation only, without an element of time-differentiation.

Alternatively, domestic consumers with microgeneration may simply notify their supplier/network operator under the "fit and notify" or "inform and fit" rule. This may be a preferred solution where the size and operation of the generation are such that export from the site is rare and insignificant and can therefore be neglected. This does not preclude the generation being metered and receiving renewables certificates.

3.3.3. Long-term PPAs

Larger distributed generators, such as commercial windfarms, typically sign an agreement with a supplier to sell the energy generated and any certificates arising from their renewable status. Usually suppliers will agree to take energy whenever it is generated, without seeking to control the generator's output at any time. Such power purchase agreements (see PPA functional summary in APPENDIX D) can vary in duration and may be based on a flat rate per unit of generation or on a time-differentiated tariff that rewards generation at times of peak demand. Even where the generator has little control over the time of generation, the supplier will generally insist on a seasonal time of day (STOD) tariff in order to incentivise maintenance to be performed off-peak and to avoid exposure to differentials between a single tariff and the balancing market price.

In this type of arrangement, the generator must also establish a connection agreement with the appropriate DNO. Recently a standard agreement, the Distribution Connection and Use of System Agreement (DCUSA) has been introduced in order to standardise the relationships between DNOs and users of the distribution networks. This agreement defines arrangements for metering, payment of Use of System charges, and technical obligations on the generator (compliance with the Distribution Code). One of the criticisms of DCUSA however is that it obliges all parties to accede to the Balancing and Settlement Code and the Connection and Use of System Code. While this is logical for supplier and network operator parties, it seems excessive and unnecessary for the vast majority of DG.

3.4. Requirements for Fenix

The relationship between the CVPP and DER in a Fenix future would be more dynamic and interactive than at present. As well as agreements similar to the ones described in section 3.3 above, the CVPP will need to exercise control over the DER – either by having some kind of direct technical control over the DER or by using price signals to influence their behaviour - in order to provide ancillary services to the TSO and DSO and to ensure that its power trading position is balanced and profitable.

Specifically, a contractual relationship will need to exist between the DER and the CVPP that allows for:

- metering of power flow to the CVPP by the DER or to the DER by the CVPP;
- calculation of Use of System and any other DER charges;
- an agreed protocol for communications between the CVPP and DER;
- submission of bids and offers to the CVPP by the DER (before real time);
- an arrangement to account for differences between planned and realized volumes (such as a balancing mechanism type of arrangement with system buy- and sell-prices in each trading period).;
- dispatch (generators) or shedding (loads) of the DER by the CVPP (in real time);
- billing and payment.

The precise form of any contact will depend on the DER concerned: this could be for example a CHP microgenerator, a household supply, or a wind farm, and each type will have its own needs. The billing and payment arrangements for a wind generator will be very different to a domestic customer's. Chapter 9 outlines some of the contract structures that might apply to different types of DER.

The contract closest to that required for a CVPP-DER relationship would be a "Top-up and Spill" agreement (see functional summary in APPENDIX I). This is a contract between a Supplier and a site which has generation and demand which might require "top-up" imports of electricity when generation does not meet its demand or to cover generator outages and may "spill" or export to the network at times of high generation or low demand. In a Fenix future, of course, control would potentially be more active.

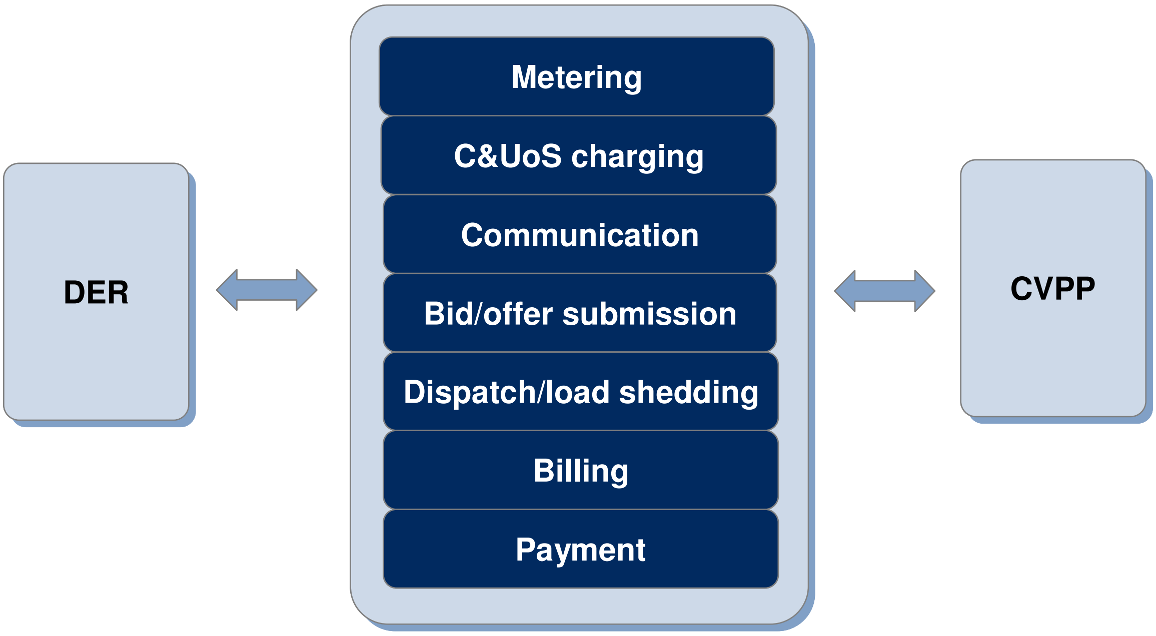

Figure 3.1 Contractual Requirements DER - CVPP

3.5. Functional requirements for the contractual relationship

The following outlines the contractual requirements for a contractual relationship between DER and a CVPP as illustrated in Figure 3.1.

3.5.1. Price and products

- DER owner agrees to sell to the CVPP electrical energy produced (this could be the entire output or only excess power) and all attributes associated with the entire generation output (e.g. REGO, ROC, LEC) at agreed prices (specified in a Schedule: single price, seasonal time-of-day (STOD) price, or market-linked half-hourly prices) and as the DER is expected to be a customer of the supply company under GB rules, DER buy any required electrical energy from the CVPP at agreed prices.

3.5.2. Metering

- DER owner or CVPP responsible for appointing an agent to install and maintain appropriate metering facilities at the equipment.
- Meter to be maintained to an agreed standard by agent, complemented by a system for switching between CVPPs.
- DER owner or CVPP responsible for managing metering data or arranging for an agent to do so.

3.5.3. Connection and Use of System Charging

- DER owner to pay connection fee, calculated using a standard regulator-approved methodology.
- CVPP to charge for Use of the System, using a standard methodology, according to the DER's location and the time at which it imports/exports to the network.
- The benefits of DER location and characteristics should be reflected in the charges which can be negative. Some sharing of benefits may be advisable depending on the risks taken by each party.

3.5.4. Communication

- DER and CVPP to communicate using a mutually agreed electronic communications system.

3.5.5. Bid/offer submission

- A **bid** is a price at which the bidder is willing to buy electricity (either by reducing generation or increasing demand) and an **offer** is a price at which the bidder is willing to sell electricity (either by increasing generation or reducing demand). The procedure, at a high level, can be described as follows:
  - DER to indicate to the CVPP its availability and price by an agreed time.
  - DER to inform CVPP if appears that it will be unavailable for any period due to technical problems or other unplanned circumstances.
- While explicit, dynamic, bid/offer submission may be appropriate for large DER, for small DER this kind of mechanism could be unwieldy and irrational from a commercial perspective. A bid/offer system can accommodate the needs of different kinds of DER by arranging for DER to submit:
  - a static bid at a price that varies according to the time of day (e.g. domestic micro CHP);
  - an estimated availability day-ahead and a more certain estimate one or two hours ahead of real-time (e.g. small wind generator); or
  - a more complex availability pattern with availability limited to a specific number of hours per day (e.g. heating/cooling loads).
- As an alternative to bids and offers, it might be appropriate to implement a system where DER was controlled directly by the CVPP according to agreed operating parameters, with the value of the service being shared between the DER and the CVPP.

3.5.6. Dispatch/Load shedding

- CVPP to issue instructions to dispatch generation and shed load. DER must respond to these instructions within an agreed period of time.
- Alternatively, response can be automatic by agreement through the linking of control systems or through trip/start signals from a smart meter and/or Fenix box.

3.5.7. Billing

- CVPP to calculate and issue statements to the DER based on metered data and agreed performance standards (this could include, for example, variable time-of-day pricing, availability payments, and payment for ancillary-service-related services).

3.5.8. Payment

- Payment is to be made in an agreed manner at an agreed time.

3.5.9. Electricity Storage

- Small-scale electricity storage is not widely used currently, with most storage technologies not commercially viable except in some niche applications. With increased levels of intermittent generation projected across Europe in future and advances in storage technologies, it may be that storage technologies may become economically viable and begin to play a part in CVPPs' portfolios. Storage would be under direct control by CVPP by agreement to defined parameters with value sharing based on relevant time-of-use prices. Some examples of future storage technologies might be:
  - Vehicle battery storage could be used provided CVPP guaranteed to leave it fully charged at agreed times;

- Uninterruptible Power Supply storage could be used provided CVPP guaranteed to ensure agreed autonomy capability at all times; and
- Dedicated battery storage could be used at CVPP discretion subject to agreed parameters.

3.5.10. Penalties

- CVPP to calculate penalties payable by DER for non-delivery and/or partial delivery based on metered data, evidence to commitments and published cost-reflective prices.

3.5.11. Agency

- DER is to nominate CVPP as its agent for all generation attributes associated (e.g. REGO, ROC, LEC).

3.5.12. Transfer of supply of DER to another CVPP

A procedure must be outlined to allow for the seamless transfer of supply of a DER to another CVPP.

3.6. Microgeneration; specific issues for domestic supply

As stated in section 3.3 above, domestic customers in GB have a deemed contract with their local DNO (or IDNO) according to NTC and also they are not required to enter into a separate microgeneration contract with their Supplier under "fit and notify" rules. It would therefore appear necessary to make the following modifications to the standard terms and conditions that apply.

3.6.1. Modification to standard terms and conditions of supply

- The Supplier (CVPP) is willing to offer terms to the Customer (DER) for purchase of electrical energy produced and associated attributes, however this will require a separate contract and advanced metering.
- In the absence of a separate contract, the Customer (DER) cedes its ownership rights to excess electrical energy produced.

3.6.2. Modification to NTC

- In the event that the local network becomes actively managed, the Supplier (CVPP) is willing to offer terms to the Customer (DER) for flexibility in generation and consumption, however this will require a separate contract and advanced metering.

4. CVPP - TVPP

4.1. Introduction

The Technical Virtual Power Plant (TVPP) is used here to describe the aggregation of Distributed Energy Resources (DER) in order to support the network through offering ancillary services and to provide balancing services. The TVPP may be an application or module running at the Distribution System Operator (DSO) control system or, possibly, a legally independent entity. If the TVPP is also the DSO, then the latter ought to be unbundled/ring-fenced from the Distribution Asset Owner (DAO) to ensue that regulatory incentives can be properly aligned with desired behaviour.

The relationship between the TVPP and the CVPP is a pivotal one within the Fenix concept. The use of DER to provide ancillary services at the distribution level (e.g. managing thermal constraints and contributing to security and quality of supply) and to provide commercial (transmission-level) ancillary services requires a functional relationship between the TVPP and the CVPP that allows an optimal compromise to be reached between the CVPP's desire to dispatch a particular set of DER and the TVPP's responsibility to manage the network using the locational information it has about the DER.

The interaction between the CVPP and the TVPP will also be crucial in ensuring that network constraints are treated optimally. CVPPs will always attempt to dispatch the least expensive DER, while TVPPs will constrain the export/import of DER to accommodate network limitations. The difference between the unconstrained electricity price and the price after constraints have been applied represents the cost of network constraints, which will be key to the DSO/DNO's network investment decisions. This is discussed further in chapter 7 on the TVPP-DNO relationship.

Many aspects of this relationship will be new, particularly due to the more active role that the DSO will be playing in evaluating DER bids and offers in the light of network constraints.

4.2. Distribution Ancillary Services

Distribution Ancillary Services (DAS) include a variety of elements that contribute to distribution networks' Security of Supply, Quality of Supply, Voltage Management and Power Flow (Thermal Capacity) Management. The DAS that could support these requirements are less easily defined than transmission ancillary services largely because the requirements listed above are presently satisfied through deterministic design methodologies rather than by services provided by DG.

Such services could include:

- Islanded operation (for Security of Supply, subject to Distribution Code derogations);
- Reactive power provision (for voltage support);
- Real power provision (for voltage support and/or power flow management).

These services are in some ways analogous to existing Transmission Ancillary Services (TAS), and it may well be possible to use TAS as a starting point for forming models for DAS contracts as follows.

- Islanded operation possibly based on a Black Start Contract;
- Reactive power provision based on the functional summary of a Reactive Market Ancillary Services Agreement in APPENDIX C;
- Real power provision based on the functional summary of a Short Term Operating Reserve Standard Contract (STOR) in APPENDIX A; see also Fast Frequency Response (FFR) in APPENDIX B, which serves a similar purpose (modulation of power output) which would be directly relevant for controlling frequency in islanded mode.

4.3. Activities

The CVPP and TVPP will be engaged in real-time communication, exchanging information about constraints on the network, bids and offers from generators (and from DER in general, including storage and responsive demand) and requirements for ancillary services. These activities will be supported by appropriate metering and billing systems.

4.4. Current GB situation

The relationship between suppliers and DNOs under the current GB arrangements is governed by the new Distribution Connection and Use of System Agreement (DCUSA) (see functional summary in APPENDIX F). This agreement sets out terms for connection and use of system charging, metering data and equipment, arrangements for energisation, de-energisation, and re-energisation, and network performance standards.

The DCUSA is an interesting contract from a Fenix perspective as it seeks to normalise the relationships between Suppliers (CVPPs), DNOs (in future TVPPs) and distributed generation (DG, or in future DER) and provide a context in which the contract can evolve over time.

Organisations wishing to become licensed suppliers are required to fulfil administrative testing requirements before they are permitted to commence trading. New entrants are required to obtain relevant licences and become parties to core industry agreements such as the Balancing and Settlement Code (BSC) and the Master Registration Agreement (MRA) which require extensive systems and procedures tests.

The MRA in particular provides a governance mechanism to manage the processes established between electricity suppliers and distribution companies to enable customers to move from one supplier to another. This necessitates onerous data transfer requirements and relationships with every other supplier and every DNO. Indeed Ofgem state in their Application Handbook for Electricity Supply Licences that a licensed electricity supplier must become party to 20 to 60 separate contractual agreements.

4.4.1. Connection

The DCUSA includes a copy of the National Terms of Connection (see APPENDIX G), a set of standard terms and conditions for customers connecting to distribution networks in GB which is managed by the Electricity Networks Association (ENA). This establishes a relationship between the DNO and the customer through the supplier. In their current form, the National Terms of Connection allow the customer to import electricity up to the maximum design capacity of their connection. They also implement Engineering Recommendation P2/6, which allows customers to connect microgenerators (less than 16A per phase) to the network and notify the DNO at the time of connection ("Fit and Notify" or "Inform and Fit").

4.4.2. Use of System

The DNO agrees to convey power injected onto its network between entry and exit points, provided injections of power are not in excess of what has been agreed between the DNO and the generator/importer of energy. It also requires there to be in place a connection agreement, and to have appointed a meter operator, data collector, and data aggregator. The user of the distribution system must pay Use of System charges, which include charges for use of the system and any metering-related services provided by the DNO.

4.4.3. Billing and payment by settlement class

The DNO issues daily statements to all major users such as suppliers indicating their use of system charges as soon as is reasonably practicable. Because of the way charges are calculated, these may need to be amended at a later date and the difference paid into a reconciliation account.

4.4.4. Metering

The user of the distribution system must arrange for the installation of metering equipment and provision of metering data to the DNO. It must also provide data for equivalent meters which reflect unmetered supply and consumption (an example of an equivalent meter would be that a meter is not installed at a boundary point and the data that would have been measured is deduced by summing, adjusting or extrapolating data from other meters). In GB this presently includes certain classes of DG and virtually all domestic supplies.

4.5. Requirements for Fenix

The CVPP and TVPP will need to develop a contractual arrangement, as illustrated in Figure 4.1, that allows for:

- Calculation of connection and use of system payments;
- Communication of requirements and availabilities in real-time;
- Metering;
- Billing;
- Payment to CVPP for constraint-related additional generation costs;
- Payment to TVPP for Use of System;
- Process for commencing supply to DER; and
- Process for transferring supply of DER to another CVPP.

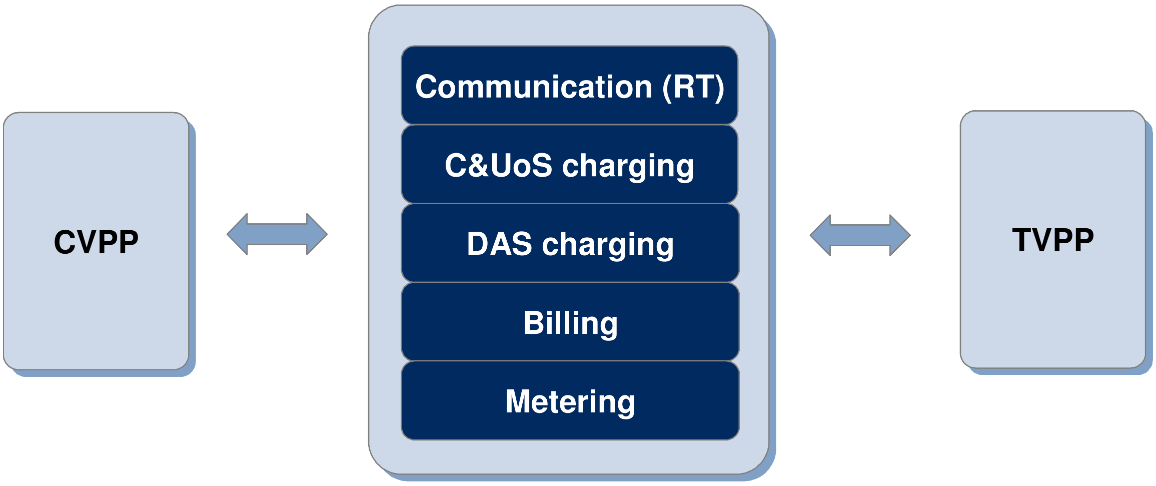

Figure 4.1 Form of CVPP - TVPP relationship

4.6. Functional Summary

4.6.1. Communication

CVPP and TVPP to communicate using a mutually agreed electronic system.

4.6.2. Use of system payments

TVPP to calculate charges for use of the system, based on an agreed methodology.

4.6.3. Provision of information

CVPP to decide its desired generation and demand schedule for the DER in its portfolio. This will be an optimal schedule from the CVPP's perspective, based only on non-locational information about the DER and knowledge of its position in the wholesale energy market and Transmission Ancillary Service market. CVPP to inform the TVPP of its desired schedule a specific amount of time before real-time. TVPP to issue a permitted dispatch list to the CVPP based on network constraints.

4.6.4. Metering

Meter data to be provided to TVPP and CVPP by independent data aggregator.

4.6.5. Payment to CVPP

CVPP to calculate additional cost of generation due to forced substitution of plant demanded by the TVPP. This additional cost is met by the TVPP. This implies a regulatory framework where there is a financial incentive (and therefore a commercial rationale) for the DSO to manage network constraints actively rather than investing in new assets to remove constraints. Where the TVPP is not the DSO, then this constraint-management revenue will come to the TVPP from the DSO, which in turn will need to be able to justify this expenditure because of the way it is incentivised by the regulator.

4.6.6. Payment to TVPP

TVPP to calculate Use of System charges using a pre-defined methodology.

4.6.7. Billing

CVPP to calculate and issue statements to the DER based on metering data and prices. Payment to be made in an agreed manner at an agreed time.

4.6.8. Penalties

With regard to penalties for non-delivery of agreed services by the DER, these should be purely cost-reflective and not punitive.

4.6.9. Transfer of supply of DER to another TVPP

A procedure must be outlined to allow for the seamless transfer of supply of a DER to another TVPP (if applicable).

5. CVPP – Market

5.1. Introduction

In order to realise value from electricity generated, a power plant must sell energy. Market arrangements for trading electricity vary from country to country, and a generator's output may be traded in several markets (e.g. forwards, day-ahead, spot).

5.2. Current GB situation

The trading of electricity in Great Britain is governed by the British Electricity Trading and Transmission Agreements (BETTA). These arrangements are based on bilateral agreements between buyers and seller, and are implemented both by bilateral 'Over the Counter' trades and through power exchanges.

The arrangements are defined in the Balancing and Settlement Code. All licensed generators and suppliers are required to become parties to the BSC. The BSC arrangements group generation and demand into Balancing Mechanism Units (BMUs) that import and export electricity from the transmission and distribution networks. A trading party is responsible for the import and export of each BMU. A generation unit will register as a Balancing Mechanism Unit (BMU) or a part of a BMU.

Trading parties buy and sell volumes of electricity by notifying a central agent of the transaction. The agent then effects the trade by adding the appropriate volume of energy to one party's account and subtracts it from the other's. Any imbalance in a party's position in real time is dealt with through the Balancing Mechanism. Parties that are long on electricity can sell their power at the system sell price, while parties that are short must buy at a system buy price.

5.2.1. Grid trade master agreements

A contractual agreement that relates to the trading of electricity across the network in GB is termed a Grid Trade Master Agreement (GTMA, see functional summary in APPENDIX E). These are used by generators and suppliers to trade electricity ahead of real-time. They reconcile the financial transaction associated with the buying and selling of energy to the buyer and seller's energy account in the Balancing and Settlement Code (the central mechanism for trading electricity in the GB market). A contract is signed between two counterparties to provide a framework for any future trading between the two. Actual trades can be agreed verbally or by other means of communication including electronic trading systems and are binding on both parties with the GTMA defining the terms and conditions.

5.3. Requirements for Fenix

Although market arrangements will vary from one country to another, all liberalised electricity systems will have some mechanism for allowing energy to be sold by generators and bought by suppliers.

The main difference between the current situation in most countries and the Fenix model is that while large transmission-connected generators can participate in markets, smaller generators, particularly when distribution-connected, tend to be frozen out. This is usually because of a lack of appropriate metering and data collection technology.

Another possible hurdle for developing a Fenix model out of current trading arrangements is the requirement for treating several sources of generation and demand as a single trading entity. This may be required from sites that are geographically dispersed.

There will need to be a contractual relationship between the CVPP and the market that allows for:

- Communication of bids and offers to central dispatch system;
- Metering of the CVPP's output;
- Billing and payment; and
- Dispatch of the CVPP by the central system.

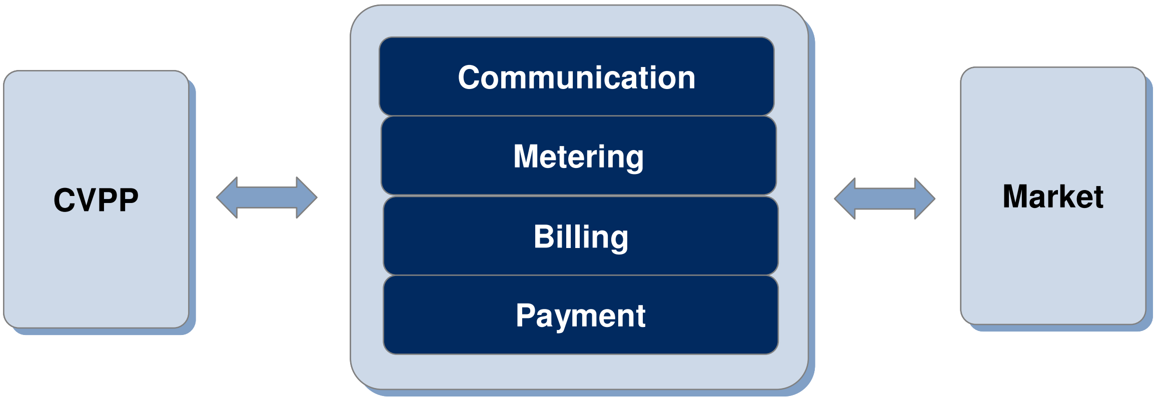

Figure 5.1 Form of CVPP - market relationship

5.4. Functional Summary

The form of contract between the CVPP and the market will be highly dependent on the market in which the CVPP will be operating. The following outline is one possible structure for such a contract, as illustrated in Figure 5.1.

5.4.1. Communication

CVPP to communicate with the market operator using the market operator's communication system.

5.4.2. Bids and offers

CVPP to inform the market operator of its bids and offers according to the requirements of the market operator.

5.4.3. Metering of the CVPP's output

Data aggregator to be appointed to pass the CVPP's metering data on to the market operator for verification. (Data from individual DER could be sent directly to the market operator but the volumes of data could overwhelm central systems.)

5.4.4. Billing and payment

CVPP to calculate and issue statements to the DER based on metering data and prices. Payment is to be made in an agreed manner at an agreed time.

5.4.5. Dispatch of the CVPP by the central system

Market operator to inform the CVPP a certain time before real-time how much generation it will require.

6. CVPP - TSO

6.1. Introduction

The ancillary services required by the Transmission System Operator (TSO) are well-established. Examples of key services are: balancing, voltage stability, and black start. The way in which TSOs currently contract for these services, and the conditions of those contracts, varies from country to country. From the Commercial Virtual Power Plant's (CVPP's) perspective contributing to these services may require the provision of real power and reactive power (or the equivalent changes in demand), sometimes in a specific geographical area.

6.2. Transmission Ancillary Services

Transmission-level ancillary services (TAS) contribute to security and quality of supply in several ways. Although there is no single widely-agreed definition, they usually refer to those services that allow the system operator to:

- maintain the stability of the transmission system by ensuring real-time balancing of generation and demand; and
- keep system voltages at an appropriate level by the provision of reactive power.

Such services are required in order to deal with unexpected plant outages, manage network capacity constraints, and cope with second-to-second fluctuations in demand.

Ancillary services provided to system operators include:

- fast start: the ability to begin generation at short notice and increase output significantly in a short period of time;
- reserve: the ability to increase generation in real-time at the request of the TSO;
- frequency response: the ability to respond dynamically to changes in system frequency, by shedding load or increasing generation when the frequency is low, and increasing demand or turning down generation when frequency is high;
- black start: the ability to start generating on a blacked-out section of the network (without a reference frequency); and
- reactive power: provision of leading or lagging reactive power in order to enable network voltage control and, possibly, loss minimisation.

6.3. Current GB situation

The contracts are designed to put a strong disincentive on providers to fail to provide a service, with a strict regime of penalty and exclusion for providers. As well as the commercial provision of ancillary services, generators that are subject to the Balancing and Settlement Code and the Connection and Use of System Code are obliged to provide some types of TAS (frequency response services, for example, are provided partly by generators under this type of obligation). This does not apply to the majority of DG as the BSC and CUSC are not obligatory for small and medium-sized distribution-connected generators.

Among the most important balancing services that NG currently contract for are:

- Fast Frequency Response (FFR, see the functional summary in APPENDIX B);
- Short-Term Operating Reserve (STOR, the functional summary in APPENDIX A);
- Fast Reserve;
- Reactive Market Ancillary Services (see the functional summary of a Reactive Market Ancillary Services Agreement in APPENDIX C);
- Fast Start and Black Start.

6.4. Requirements for Fenix

The concept of the Virtual Power Plant implies that from the system operator's perspective, a CVPP ought to appear as any conventional power plant when providing ancillary services. CVPPs would be technically capable of offering a range of ancillary services simultaneously. It is even possible that with the correct mix of DER it would be possible for a CVPP to offer greater flexibility in providing ancillary services (e.g. by achieving higher ramp rates) than other ancillary service providers. In the GB market, the TSO limits the number of ancillary services that a plant can offer at once in order to avoid the possibility of calling for two or more different and conflicting ancillary service provision behaviours from a plant simultaneously. This is not a problem in the same way for a CVPP, so given the appropriate contractual framework (and underlying technical and commercial understanding of the CVPP concept on the TSO's part), the CVPP may be in a stronger position than conventional plant to offer several ancillary services simultaneously, because the portfolio of DER that it controls may be less subject to common-mode failures and because it might dedicate subsets of its units to providing different services simultaneously.

Although the framework provided by current TAS provision arrangements may well be sufficient to allow CVPPs to offer TAS, some modifications of current contractual structures might be needed in order to allow several DER at differing geographical locations to provide TAS as a single entity.

There may also be a need for system operators to adopt different methods of evaluating ability to provide ancillary services, as the specific DER providing a service through the CVPP may vary from one occasion to the next.

Specifically, a contractual relationship will need to exist between the DER and the CVPP that allows for:

- Tendering/bidding for TAS provision contracts in a way that is fair to CVPPs;
- Communication of instructions from the TSO to begin service provision;
- Metering of CVPP's output at times of service provision; and
- Billing and payment.

As well as these basic requirements, it may also be desirable to include mechanisms for testing the CVPP's ability to provide ancillary services, and the consequences of inability to provide ancillary services.

With regard to penalties, these should be purely cost-reflective and not punitive. This is necessary in order to encourage the participation of VPPs and secure the lowest total cost of supply of ancillary services. In particular it is neither appropriate nor optimal for a TSO to mete out punishment in order to avoid inconvenience.

In any case, CVPPs will tend to adjust the level of service they contract for in order to cover for the probabilities of some DER not being available. Cost-reflective penalties for non/partial provision would provide CVPPs with incentives to adjust declared volumes optimally whereas punitive rates could lead to excessive reductions or even withdrawal from the market.

The CVPP – TSO contractual relationship is as shown in Figure 6.1.

Figure 6.1 Form of CVPP - TSO relationship

6.5. Functional Summary

6.5.1. Service provision capability

Contact to set out the technical capability of the CVPP to provide ancillary service. Owing to the dynamic nature of the CVPP, this may be defined differently at different times in the day or year. The specific information provided will of course depend on the service being offered.

6.5.2. Service provision availability

Specification of the periods during which the CVPP is able to offer this service, the cost at which it is prepared to do so, and other information relating to availability, for example the potential for flexibility in providing the service or limits on the frequency with which the service may be provided within a given period.

6.5.3. Substitution

If the provider foresees that a contracted site may become unavailable during some or all of a contracted period, it may substitute the site for another, provided it is connected to the same Grid Supply Point or by agreement with the TSO at a different grid supply point GSP. Even if no problem is foreseen, the provider may still request to substitute the contracted site for another at any GSP.

6.5.4. Utilisation

Specification of the conditions under which the system operator may call on the CVPP to provide the service in the contract, and of any circumstances in which the CVPP may decline an order to provide.

6.5.5. Metering, testing, and payment

Arrangements for metering the CVPP's output during the period, for testing the CVPP's ability to provide the service, and and for making payments to the CVPP. Payment may be made for service provision and for availability.

6.5.6. Penalties

Cost-reflective penalties will be charged by the TSO for non-delivery or partial delivery of contracted services by the CVPP, these shall be calculated on the cost of replacement of the quoted services by the cheapest means available in the required timescales.

7. TVPP – DAO

7.1. Unbundling

Distribution System Operator (DSO) is a party with responsibility for operation of a distribution network and is used here as distinct from network ownership and akin to an independent system operator (ISO) at the distribution level. The TVPP may be an independent agent (specialising in distribution ancillary service provision and offering aggregated services to DSOs) or may be the same legal entity as the DSO.

Among the possibilities identified by the WP 3.2.2. deliverable, and arguably a concept implied in Fenix, is that of a more active role for the DSO. As noted in section 4.2.1. of deliverable 3.2.1., active management of distribution networks is beginning to be considered seriously as a means of accommodating and taking advantage of increasing DER penetration.

The main feature of the change from a DNO approach, where the emphasis is on building a passive distribution network capable of delivering centrally-generated power to customers at all times, to a DSO approach, where the emphasis is on operating a system that is constrained but uses DER to manage those constraints.

The key concepts in such an unbundling are the following.

- The independent distribution system operator is a higher risk activity than asset ownership with passive operation so incentives will be required as rewards.
- As with the transmission system, system operator independence is considered to be necessary to ensure that the least-cost action is always taken, whether use of DER services or investment in the network.

7.2. Requirements for Fenix

The Technical Virtual Power Plant (TVPP) will need to pay charges to the Distribution Asset Owner (DAO) for investments in network assets and maintenance of those assets. Under a regulatory regime where DAOs could compete to build new parts of the network and DSOs were separate entities, the DSO would be able to tender for each connection, with competition between DNOs driving costs down. Alternatively, the DNOs may be monopolistic entities having defined exclusive service areas with their prices or returns fixed by a Regulator.

Connection and Use of System revenues would flow from the DER and to the DSO (and, for connection, on to the DAO), probably via the CVPP and TVPP/DSO. The costs of using the system would be determined by the DSO, and could be locational and time-dependent. Exactly how these costs are determined depends of course on the regulatory environment that exists for the DSO. In Great Britain, for example, the regulator has let it be known that it is in favour of cost-reflective pricing in use of system charging, and that "postage stamp" (non-locational) UoS is not cost-reflective. This has had the effect of encouraging British DNOs to consider locational UoS charging.

The possibility of realising savings on network expenditure by operating a lean, constrained network rather than adopting a traditional, centralised, oversized, approach to network design depends on the connection pricing methodology.

A shallow connection charging methodology would mean that DER would pay for the assets required to connect it to the network, but that any deeper reinforcement would be a decision for the TVPP based on the cost of the deep upgrades compared to the cost of managing the constraints. While a shallow charge would reduce costs to the consumer by providing an incentive to minimise network investment costs (as long TVPPs were appropriately rewarded), in itself it would not offer generators any incentive to connect where the network is strong. This could be dealt with by varying Use of System charges locationally, based on the costs of dealing with constraints and/or network upgrades.

A deep connection charging methodology would tend to create a large up-front cost for connection as it would include the shallow costs plus joint-use assets and general reinforcements. This would represent a barrier to entry for DER but it would have the effect of making such costs explicit and incentivising bilateral negotiations for a leaner network and active management.

Before April 2005 in GB, demand and generation customers were charged in a different manner with generators paying connection charges for all works required to integrate them into the distribution network (deep charging) and demand customers paying more limited connection charges plus use of system charges (shallow connection charging). From 1 April 2005 a common connection boundary has been introduced across generation and demand. New generators will pay shallower connection charges but will begin to pay use of system charges (GDUoS). Locational charging for demand and generation is also being implemented. Economic charging would imply equal and opposite locational charges for demand and generation.

The form of TVPP - DAO relationship is shown in Figure 7.1.

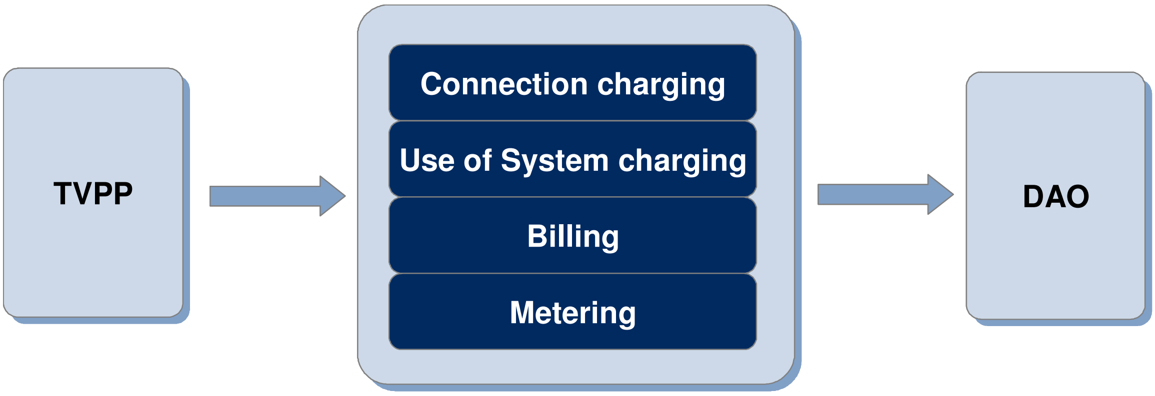

Figure 7.1 Form of TVPP - DAO relationship

8. Contractual framework for the Northern Scenario

The Fenix project includes two demonstrator projects, a Northern Scenario based in Great Britain, and a Southern Scenario based in Spain. This section describes the contractual framework for the Northern Scenario, starting with the Reference Case (with contractual relationships comprising only of contracts currently in existence), and then for each Case Study a description of any additional contracts or contractual features required for that case study, based on the descriptions in Chapters 3 to 7.

8.1. Reference Case

Figure 8.1 illustrates the current situation in the Northern Wholesale Electricity Market. There is currently no CVPP present and the DER can operate in the market via an Energy Supplier in the Supplier Volume Allocation (SVA), or register directly or through a third party in the Central Volume Allocation (CVA). A more detailed description of the current situation in the GB market is given in section 2.1.1.

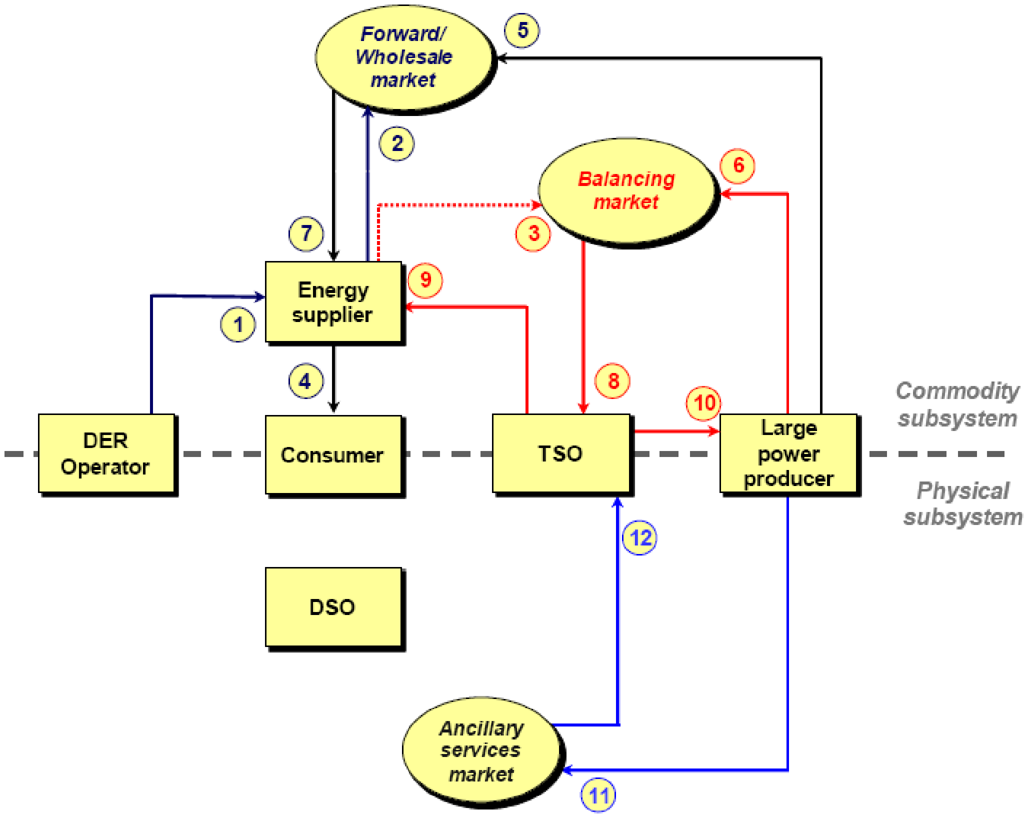

Figure 8.1: DER market participation under current circumstances[1]

1: DER & Energy Supplier

The DER offers the energy supplier electricity in return for a payment. This is done through a power purchase agreement (PPA) or a top-up and spill agreement. The contract lays out the requirements for the generator including guidelines on accreditation, licences, terms and conditions for sale and purchase, and procedures for payments. The agreement also discusses the management of metering equipment, data collection and generation forecasting. A detailed functional summary of a PPA or top-up and spill contract that might be used in this context can be found APPENDIX D and APPENDIX I respectively.

[1] Figure reproduced from original in Deliverable 3.1 'Northern and Southern Scenarios'

2,7: Energy Supplier & Forward/Day-Ahead Market

The forward and day-ahead markets allow parties to arrange contracts for electricity up to several years ahead of delivery. They include over the counter agreements negotiated with a broker and activity on a centralised power exchange. The underlying contract for all these activities is the Grid Trade Master Agreement (GTMA), which is used to effect changes in the buyer and the seller's account when any volume of electricity is bought or sold. The agreement sets up a 'close-out netting' mechanism whereby if counterparty failure occurs, the risk of pre-settlement exposure is reduced. A more detailed functional summary of the GTMA is found in APPENDIX E.

3: Energy Supplier & Balancing Market

As any party's actual generation and demand will tend to deviate from its agreed position, the balancing market is used to balance the system in real time. The Balancing and Settlement Code (BSC) is used to outline the procedures and rules for electricity balancing and settlement in GB. It identifies standards and procedures that Parties must adhere in order to be recognised as a BSC Party and have the right to participate in the balancing market. Two energy imbalance prices known as the system sell price (SSP) and the system buy price (SBP) are calculated each half hour, and parties to the BSC must pay the system buy price or are paid the system sell price if they are short or long on electricity. A more detailed functional summary of the BSC can be found in APPENDIX K.

4: Energy Supplier & Consumer

Electricity is supplied to the consumer under a contracted price using a Domestic Supply Agreement. The contract outlines the charges and payment schedules the supplier and consumer must comply with. Details regarding which supplier and consumer data will be accessible to its counterparty are given, along with guidelines for the supplier accessing the consumer's property. Notification times of any changes to the contract are given, and the supplier's responsibilities are outlined. A more detailed functional summary of the Domestic Supply Agreement is found in APPENDIX H.

5: Large Power Producer & Forward/Wholesale Market

In the forward market, a large power producer would often trade the output out itself. Again, this is done through a combination of Over The Counter forward contracting and participation in exchanges as delivery approaches. As with the supplier's interaction with wholesale markets, the underlying contract for all these activities is the Grid Trade Master Agreement (GTMA), which is used to effect changes in the buyer and the seller's account when any volume of electricity is bought or sold. The agreement sets up a 'close-out netting' mechanism whereby if counterparty failure occurs, the risk of pre-settlement exposure is reduced. A more detailed functional summary of the GTMA is found in APPENDIX E.

6: Large Power Producer & Balancing Market

This contract is again defined by the Balancing and Settlement Code, in a manner identical to the contract between energy supplier and the balancing market. The BSC outlines the procedures for trading on the Balancing Market and states the rules and regulations to which the Parties participating in the Balancing Market must adhere to. Large power producers can avoid selling their entire output before Gate Closure, as they often have the resources to take a risk on the Balancing Market with some of their output. A more detailed functional summary of the BSC can be found in APPENDIX K.

8: Balancing Market & TSO

No explicit contract exists between the TSO and the balancing market: the TSO is the entity that creates the balancing market and acts as a broker in real time, buying energy from and selling energy to the system as required. The TSO does not profit from this activity, and therefore the net flow of revenue from the TSO to the participants in the Balancing Mechanism is zero. A more detailed functional summary of the BSC can be found in APPENDIX K.

9, 10: TSO & Energy Supplier / Large Power Producer

The relationship between the TSO, suppliers, and large power producers is defined by the Balancing and Settlement Code. The BSC defines the TSO's responsibility for maintaining the physical balance between supply and demand, and the regulations an energy supplier or large power producer must follow in order to participate in the balancing mechanism. A more detailed functional summary of the BSC can be found in APPENDIX K.

11: Large Power Producer & Ancillary Services Market

The large power producer provides electricity or operational parameters to the TSO under contracts won through a tendering process. Ancillary services can include black start capabilities, frequency control and standing reserves. The contracts outline conditions and standards the power producer must adhere to and maintain in order to provide the necessary ancillary services. The payment for ancillary services usually constitutes a component for availability and a component for actual delivery of energy. The power producer is also expected to keep the required equipment to a set standard and is obliged to inform the TSO of any changes to the plant. More detailed functional summaries of contracts regarding ancillary services can be found in APPENDIX A, APPENDIX B and APPENDIX C.

12: Ancillary Services Market & TSO

The TSO procures ancillary service provision through regular tender rounds and enters into contractual agreements with the successful tenderers. The contracts outline the terms and conditions for the ancillary services market in order to provide the TSO with any needed electricity or operational parameters. More detailed functional summaries of contracts regarding ancillary services can be found in APPENDIX A, APPENDIX B and APPENDIX C.

8.2. Case Study One

In Case Study One, the DER is aggregated enabling it to access the market through the CVPP. The DER is now exchanging electricity or operational parameters with the CVPP via Fenix boxes. The supplier provides the CVPP with market data as any imbalance costs are transferred through the supplier to the CVPP.

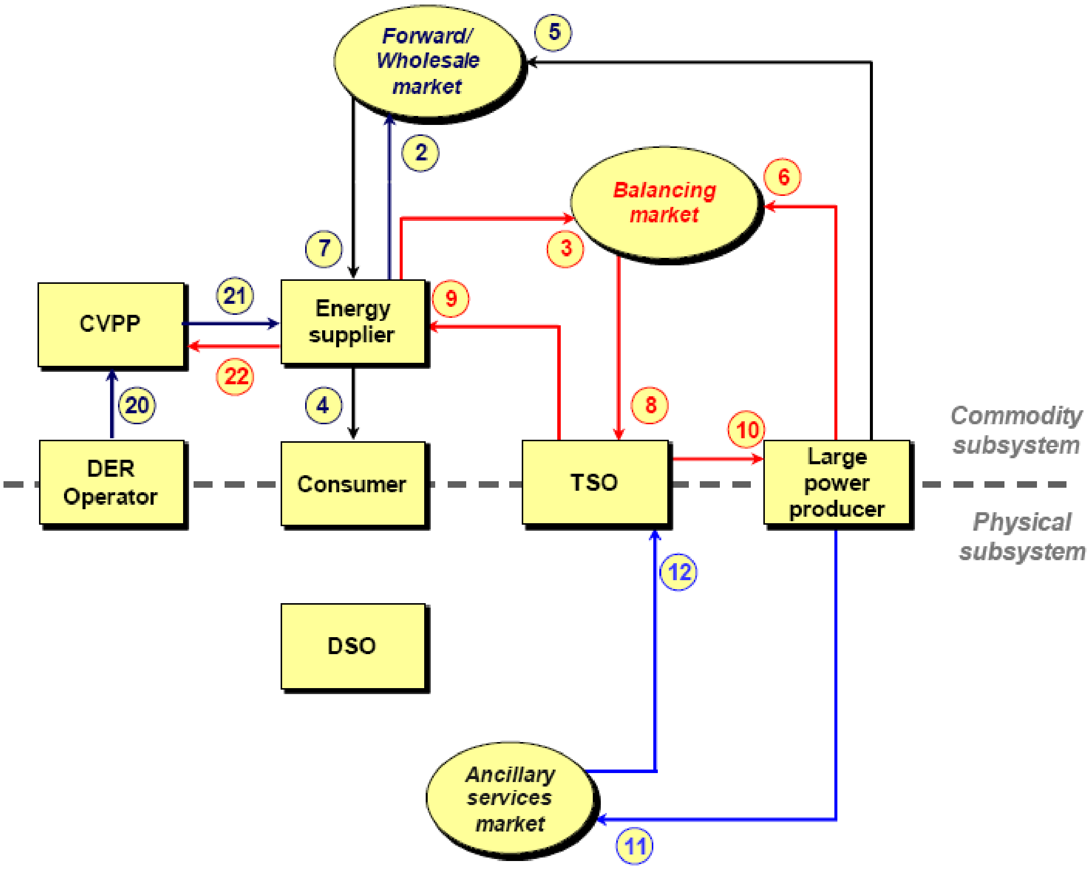

Figure 8.2: Case study 1: Wholesale market access[1]

20: DER and CVPP

The DER will be providing electricity generation to the CVPP for a payment. The CVPP can influence the physical behaviour of the DER either directly or by use of price signals. A similar contract to the 'top-up and spill' contract or PPAs that currently exist between DER and suppliers would be used. As with current contracts, the agreement defines and describes the details of metering, calculation of charges and payments between the two parties. In addition, the contract would contain features to accommodate the new communication and control functionality. It would also define a mechanism to account for any difference between expected and actual volumes of electricity delivered by the DER. A more detailed functional summary of the PPA and the Top-Up and Spill Agreement is found in Appendix D and Appendix I respectively.

21, 22: CVPP and Energy Supplier

The CVPP and the energy supplier participate in an exchange of electricity either directly through a bilateral contract or by buying and selling on a power exchange. The type of contract used will depend on the size of the CVPP. If the CVPP is small the contract between the CVPP and Energy Supplier would usually be a Power Purchase Agreement (PPA). Under such an agreement, the Energy Supplier is required to deliver price signals (either ex-ante or in real time), so that the CVPP can react accordingly, with the Supplier's payment to the CVPP being determined accordingly. However, if the CVPP is large, the BSC is used as the CVPP has the resources available to allow it to participate in the balancing market itself. A more detailed functional summary of the BSC and PPA can be found in APPENDIX K and APPENDIX D respectively.

8.3. Case Study Two

[1] Figure reproduced from original in Deliverable 3.1 'Northern and Southern Scenarios'

Case Study Two illustrates the situation where the DER is able to participate in the Balancing Mechanism. DER is required to submit any operational parameters to the CVPP at gate closure. The CVPP aggregates DER data to create a Final Physical Notification (FPN) so that bids/offers can be submitted to the balancing market. Once the CVPP receives information on bids/offers acceptances, the CVPP uses the information to create operating schedules for each CVPP.

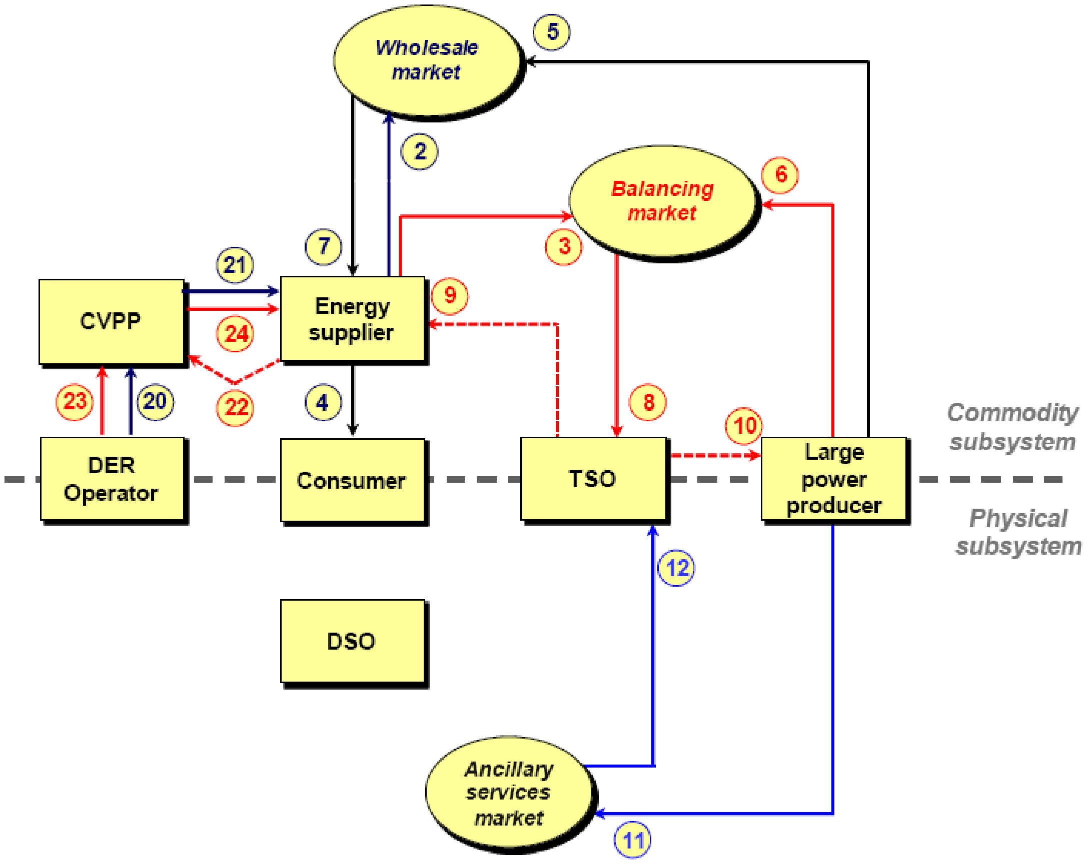

Figure 8.3: Case study 2: Balancing mechanism participation[1]

There is a new relationship between the Energy Supplier and Balancing Market- this relationship is described as partially new and has been described is the Reference Case. Furthermore, the relationships between the CVPP and Energy Supplier, and between the CVPP and DER Operator have been strengthened to take into account the fact that the DER is able to participate in the balancing market.

8.4. Case Study Three

Case Study Three introduces intra-day portfolio balancing so that DER can be used to balance the supplier's portfolio after gate closure. Case Study Three assumes that there are no network constraints.

[1] Figure reproduced from original in Deliverable 3.1 'Northern and Southern Scenarios'

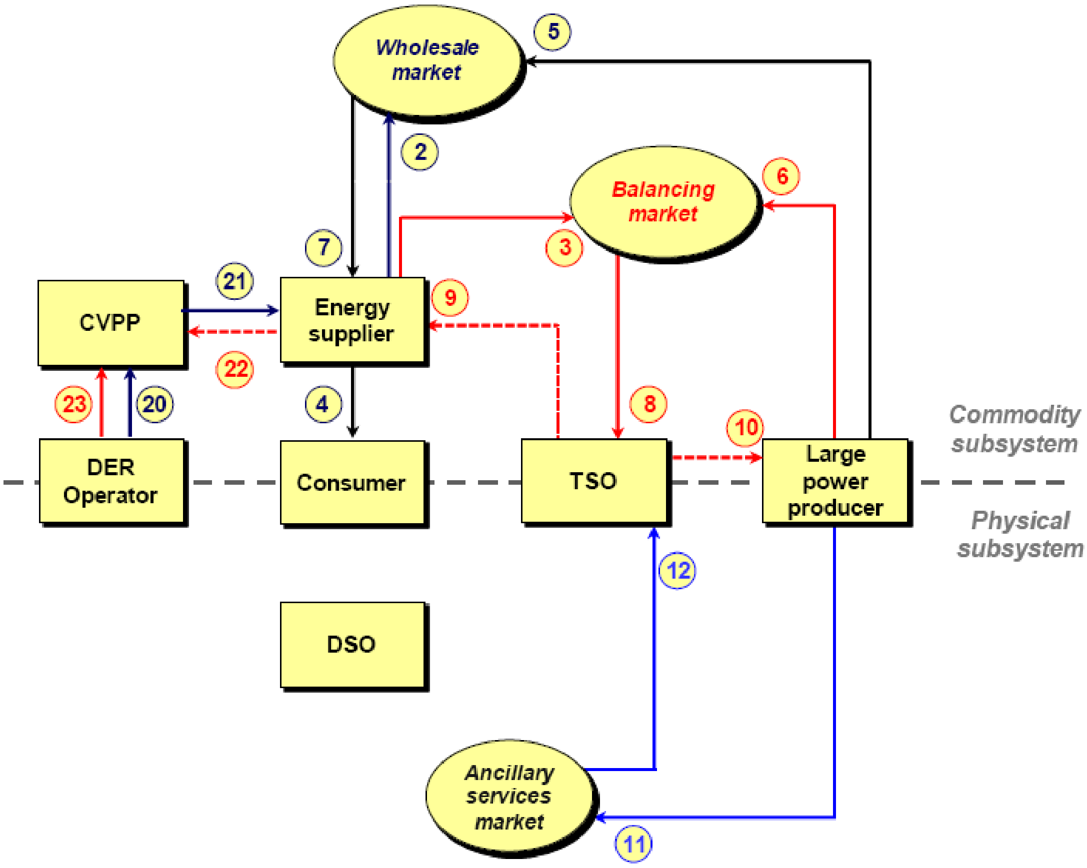

Figure 8.4: Case study 4: Intra-day portfolio balancing[1]

Compared with Case Study Two, Case Study Three does not contain any additional relationships.

8.5. Case Study Four

In Case Study Four the CVPP and TSO are in a direct long-term bilateral contract for ancillary services. Through aggregating the DER, the CVPP is able to provide ancillary services that the TSO may demand. The TSO is also responsible for the monitoring of the data on an ad-hoc basis, thus the CVPP and DER must be able to ensure that they always have the required capacity available.

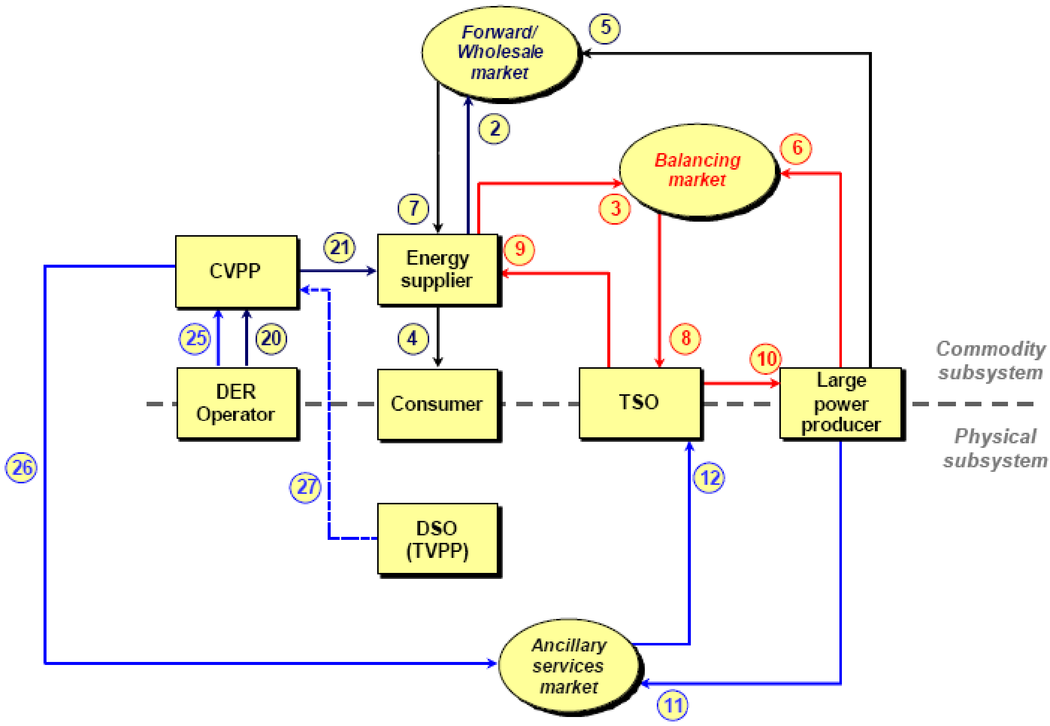

Figure 8.5: Case study 4: Scheduled ancillary services[1]

26: CVPP and Ancillary Services Market

The CVPP's contractual relationship with the procurer of ancillary services (the TSO) would be defined by the existing contracts for ancillary services provision by Large Power Producers. These are described in the Reference Case.

27: TVPP and CVPP

This contract would need to underpin a range of real-time interactions between the CVPP and TVPP. The contract therefore includes charges for use of the system, calculated by the TVPP based on an agreed methodology. It also requires the CVPP to inform the TVPP of its desired schedule a specific amount of time before real-time, and for the TVPP to reciprocate with a permitted dispatch list to the CVPP based on network constraints. The contract also defines how the additional cost of generation due to forced substitution of plant demanded by the TVPP is to be calculated, and the mechanism by which the TVPP meets this additional cost. TVPP to calculate Use of System charges using a pre-defined methodology. The contract also defines how and when the CVPP is to calculate and issue statements to the TVPP based on metering data and prices, and the time at which this falls due. Cost-reflective penalties are also defined for non-delivery of agreed services by the DER. Finally, the contract also outlines a procedure to allow for the seamless transfer of supply of a DER to another TVPP (if applicable).

[1] Figure reproduced from original in Deliverable 3.1 'Northern and Southern Scenarios'

9. Example Fenix Contracts for Specific Types of DER

As discussed in Chapter 3, the specific contracts signed by DER will differ according to the technology in question and the services the unit can offer. This section presents illustratative contracts for three specific types of DER operating as part of a CVPP portfolio under a Fenix arrangement. The section will discuss the features of new contract and will discuss the existing contracts will be need to be changes in order for them to be viable under the Fenix concept. Contracts for the following example technologies will be discussed:

- Controllable Domestic Demand
- Micro-CHP Generator
- Small-scale storage

Current contracting arrangements for each technology reflect the services that they currently provide and/or receive. The status quo contracting arrangements that this section describes are based on actual contracts that in is currently in use, all of which are summarised in Appendices A-H. Furthermore, changes to existing contractual features of each contract and any additions that are made to the contracts in order to allow participation in a CVPP will follow the same description of the status quo.

9.1. Controllable Domestic Demand

Currently Domestic Demand and the Supplier exchange through a Domestic Agreement. A detailed functional summary of this Agreement can be found in APPENDIX H. Table 9.1 outlines the main features of a typical agreement for Domestic Demand. The Table also shows the corresponding contract under Fenix for Controllable Domestic Demand. The modifications are based on those issues discussed in section 3 for the relationship between the CVPP and DER.

	Fenix (Customer-CVPP)	Status Quo (Customer-Supplier)
Price and products	CVPP supplies electricity to the demand/ customer at the agreed price, which is determined according to the section on 'Pricing'. The Customer offers demand dispatch/ reduction services at agreed prices, as determined in the section on pricing.	The Supplier must notify the Customer of charges for electricity supplied and notify them promptly when charges change. Metering and charging systems are based on the amount of volume demand and do not take into account electricity price variations according to the time of day.
Metering	The Customer or CVPP must appoint an agent to install and maintain appropriate metering facilities at the equipment. The meter must be maintained to agreed standards by the agent. The meter must be able to display real-time data and must be compatible with the communications device (as discussed in the 'Communication' section). A management procedure of the metered data is outlined.	The Customer must have the appropriate Metering Equipment installed. The equipment must take regular readings. Any installation of new metering can be charged to the customer. Metering is non-half-hourly.

	Fenix (Customer-CVPP)	Status Quo (Customer-Supplier)
Connection and Use of System Charging	The Customer must pay a connection fee that must be calculated using a standard regulator-approved methodology. The CVPP must charge for Use of the System according to an agreed standard methodology. Benefits of Customer location and characteristics are reflected in the charges.	Customer enters a connection and use of system agreement with DNO. Costs of connection are shared by all users of the network.
Communication	The Customer and CVPP must communicate using a mutually agreed electronic communications system which must be appropriate to any real-time or dynamic interactions between the CVPP and Customer.	The Customer and CVPP must communicate using a mutually agreed communications system.
Pricing	The Customer must indicate to the CVPP its availability, for demand shedding or dispatch, and price by an agreed time. The Customer must inform the CVPP if it will be unable to provide this service for a period of time due to technical problems or other unplanned circumstances. Communication of availability and pricing is done EITHER By a bid/offer system which can be one of the following: (i) A static bid at a price that varies according to the time of day (ii) An estimated availability at a day-ahead and a more certain estimate one or two hours ahead of real-time (iii) A more complex availability pattern with availability limited to a specific number of hours per day. OR An alternative arrangement where the system that allows Customer to be directly controlled by the CVPP must be implemented that is mutually agreed by both parties. Both Parties must agree on a method to share any value created between them.	[No current provision or contractual agreement]

	Fenix (Customer-CVPP)	Status Quo (Customer-Supplier)
Load Shedding/ Dispatch	The CVPP must instruct the Customer when to dispatch and shed load. The Customer must carry out these instructions within an agreed time manually or through the use of an automatic response system.	[No current provision or contractual agreement]
Billing	The CVPP must calculate and issue statements to the Customer based on metered data and performance standards that have been agreed in this contract.	Supplier issues bills based on meter readings or estimates.
Payment	Payment must be made in an agreed manner at an agreed time.	Payment must be made in an agreed manner at an agreed time.
Penalties	The CVPP must calculate penalties that must be paid by the Customer for non-delivery and/or partial delivery.	[No current provision or contractual agreement]
Transferability	A procedure allowing the Customer to transfer to another CVPP is outlined.	Any transfers must be notified to the Supplier within an agreed time period.

Table 9.1: Contract for Controllable Demand

The new features have been introduced to the contracts to allow a more dynamic and interactive relationship. Through the use of smart metering, dispatch/load shedding and the bids/offers system, the controllable demand is able to participate actively in the market and therefore, can also provide ancillary services. For example, when the system is short and there is high demand, a controllable demand system can turn down its demand so that it avoids the high prices of electricity and subsequently helps to manage the electricity system. Thus, in order to enable controllable demand to participate actively in the market, the contractual framework has been modified accordingly. Additional revenue from the value created by these additional services is passed through to the controllable demand owner through the contractual arrangement.

In the Controllable Domestic Demand contract, many sections such as metering and charges have been modified to suit the changes that will be put in place under Fenix. A bids/offers system section and a dispatching/load shedding section have both been added to allow for new features Fenix will introduce.

9.2. Micro CHP

Currently, the contract between a small/micro-generator and a supplier tends to take the form of a top-up and spill contact, whose functional summary can be found in Appendix APPENDIX J. Table 9.2 shows the features of a top up and spill contract for micro-CHP under the status quo situation. The table also states how each section of the contract will be different under the Fenix concept. Whilst some sections such as penalties and a bids/offers system will be introduced, other sections such as duration and termination remain very similar to the status quo situation. The new features that are introduced under the Fenix concept are based on the issues discussed in Section 3 for the relationship between the CVPP and DER.

	Fenix (CHP-CVPP)	Status Quo (CHP-Supplier)
Price and products	CHP must sell electricity energy produced and associated attributes to CVPP at the agreed price, which is determined according to the section on 'Pricing'.	The Supplier must buy the CHP's metered output for the duration of the contract and must pay the spill price for export electricity. The spill price is defined as the price for export electricity based on the CHP generation tariff to be notified to the CHP on an annual basis or as otherwise agreed.
Metering	The CHP or CVPP must appoint an agent to install and maintain appropriate metering facilities at the equipment. The meter must be maintained to agreed standards by the agent. The meter must be able to engage in real-time data communication. The CHP or CVPP is responsible for managing meter data or appointing an agent to do so.	The CHP plant must have appropriately calibrated non-half-hourly metering equipment installed. The equipment must take regular readings. The CHP must provide the Supplier with information on input electricity with its meter readings on request.
Connection and Use of System Charging	The CHP must pay a connection fee that is calculated using a standard regulator-approved methodology. The CVPP charges for Use of the System according to an agreed standard methodology. Benefits of CHP location and characteristics are reflected in the charges.	The CHP must enter a standard connection agreement with DNO.
Communication	The CHP and CVPP must communicate using a mutually agreed electronic communications system which must be appropriate to any real-time or dynamic interactions between the CVPP and CHP unit.	The CHP and Supplier must communicate using a mutually agreed communications system.

	Fenix (CHP-CVPP)	Status Quo (CHP-Supplier)
Pricing	The CHP must indicate to the CVPP its availability and price by an agreed time. The CHP must inform the CVPP if it will be unavailable for a period of time due to technical problems or other unplanned circumstances. Communication of availability and pricing is done EITHER By a bid/offer system which can be one of the following: (i) A static bid at a price that varies according to the time of day (ii) An estimated availability at a day-ahead and a more certain estimate one or two hours ahead of real-time (iii) A more complex availability pattern with availability limited to a specific number of hours per day. OR An alternative arrangement where the system that allows CHP to be directly controlled by the CVPP must be implemented that is mutually agreed by both parties. Both Parties must agree on a method to share any value created between them.	[No current provision or contractual agreement]
Billing	The CVPP must calculate and issue statements to the CHP based on metered data and performance standards that have been agreed in this contract.	The Supplier and CHP must agree on a set procedure for any billing. Billing is either based on metered data or an estimate.
Payment	Payment must be made in an agreed manner at an agreed time.	Payment must be made in an agreed manner at an agreed time.
Obligations and Penalties	The CVPP calculates penalties that must be paid by the CHP for non-delivery and/or partial delivery. When the CVPP issues instructions to dispatch, the CHP must respond in an agreed time period either through human operation or through an automated system.	[No current provision or contractual agreement]

	Fenix (CHP-CVPP)	Status Quo (CHP-Supplier)
Agency	The CHP is required to nominate the CVPP as its agent for all generation and (possibly) any additional certificates or other benefits arising from government incentives for CHP.	The CHP is required to nominate the Supplier as its agent for all generation attributes associated.
Transferability	A procedure allowing the CHP to transfer generation to another CVPP is outlined.	Any transfers must be notified to the Supplier within an agreed time period.

Table 9.2: Contract for Micro CHP

The contract between other types of small generators and a CVPP would be very similar to that of the micro CHP. For example, the contract for generation from photovoltaic cells follows is very similar to that of a micro-CHP except that, unlike micro-CHP, photovoltaic cells are not able to turn up their energy generation on demand. Therefore, the contract will only allow a turn down generation function.

The new features have been introduced to the contracts to allow a more dynamic and interactive relationship. Through the use of smart metering, the bids/offers system, and dynamic connection and use of system charges for example, the micro-CHP is able to participate more actively in the market. For example, using real-time two-way communicating smart metering, the generation plant can provide ancillary services such as frequency-response, by generating more when the frequency drops and generating less when the frequency is high. Under the Fenix concept, the micro-generation is connected to the network so that it can actively participate in the real-time market, thus providing it with the capabilities to provide ancillary services.

9.3. Domestic Scale Storage

In the status quo situation contracts for storage are not common as storage technologies have not developed enough to be widely commercially used. Thus the contract for storage under Fenix concentrates on the future use of storage assuming that the technologies for delivering small-scale electricity storage will be developed and efficient enough to use in the future. The status quo situation has not been described as there is currently no provision or contractual agreement. As with the previous two contracts, the storage contract under the Fenix concept is based on the relationship between the CVPP and DER which is depicted in section 3.

Recent developments in storage have included projects from major energy suppliers such as EDF Energy and Scottish Power. EDF have recently been examining how SVC light technology capable of converting HVAC into HVDC for DC transmission can be coupled with high performance DC battery strings providing reactive power compensation and power storage. A trial for this type of storage is being implemented near two wind farms in Norfolk. Furthermore, Scottish power is examining the feasibility of different types of storage devices on the distribution network, and how these can be used to balance distributed generation outputs with load demands. Although the project has not yet beed completed, the initial findings show that if storage costs where to reduce in the future, the use of storage could result in a more economically efficient and sustainable infrastructure for balancing electricity.

	Fenix (Storage-CVPP)
Price and products	CVPP may demand electricity energy and associated attribute from the Storage Unit at the agreed price, which is discussed according to the section on 'Pricing'. CVPP may export electricity energy produced and associated attributes to the Storage Unit at the agreed price, which is discussed according to the section on 'Pricing'. The CVPP cannot demand electricity from the Storage Unit if the Storage Unit is empty. The CVPP cannot export energy to the Storage Unit if the Storage Unit if full.
Metering	The Storage Unit or CVPP must appoint an agent to install and maintain appropriate metering facilities at the equipment. The meter must be maintained to agreed standards by the agent. The meter must be able to engage in real-time data communication. The Storage Unit or CVPP is responsible for managing meter data or appointing an agent to do so.
Connection and Use of System Charging	The Storage Unit must pay a connection fee that must be calculated using a standard regulator-approved methodology. The CVPP must charge for Use of the System according to an agreed standard methodology. Benefits of the Storage Unit location and characteristics are reflected in the charges.
Communication	The Storage Unit and CVPP must communicate using a mutually agreed electronic communications system which must be appropriate to any real-time or dynamic interactions between the CVPP and Storage Unit. If storage capacity is full or if the capacity is empty, the Storage Unit must inform the CVPP within a set time limit.

	Fenix (Storage-CVPP)
Bid/Offer Submission	The Storage Unit must indicate to the CVPP its availability and price by an agreed time. The Storage Unit must inform the CVPP if it will be unavailable for a period of time due to technical problems or other unplanned circumstances. Communication of availability and pricing is done EITHER By a bid/offer system which can be one of the following: (i) A static bid at a price that varies according to the time of day (ii) An estimated availability at a day-ahead and a more certain estimate one or two hours ahead of real-time (iii) A more complex availability pattern with availability limited to a specific number of hours per day. OR an alternative arrangement where the system that allows the Storage Unit to be directly controlled by the CVPP must be implemented that is mutually agreed by both parties. Both Parties must agree on a method to share any value created between them.
Load Shedding/ Dispatch	The CVPP must instruct the Storage Unit when to dispatch and shed load or export. The Storage Unit must carry out these instructions within an agreed time manually or through the use of an automatic response system.
Billing	The CVPP must calculate and issue statements to the Storage Unit based on metered data and performance standards that have been agreed in this contract.
Payment	Payment must be made in an agreed manner at an agreed time.
Penalties	The CVPP must calculate penalties that must be paid by the Storage Unit for non-delivery and/or partial delivery.

Table 9.3: Contract for Storage

Under Fenix, storage is able at different times to communicate with the CVPP in the form of a generator or as an element of controllable demand. The storage contract allows stored electricity to participate in the CVPP portfolio as if it were a producer or controllable demand. Thus, through the mechanisms introduced, the stored electricity is able to provide ancillary services to the network. Under Fenix, the contract is modified to include the system of bids and offers, smart metering, demand response, and electronic communication.

Under this more dynamic structure, storage can participate more interactively in the real-time market. For example, when generation is low and demand is high, the storage can inject more supply into the system in order to restore balance. Therefore, any stored energy can be used at the most appropriate time to maximise the return and as well as contributing to the provision of ancillary services.

References

Transmission ancillary and balancing services

The National Grid site contains a significant volume of information in relation to National Grid's use of Balancing Services. The links for each individual service are as follows.

Reactive Power (http://www.nationalgrid.com/uk/Electricity/Balancing/tenderreports/reactivepower/)

Firm Frequency Response (http://www.nationalgrid.com/uk/Electricity/Balancing/tenderreports/ffr/)

BM Start-Up (http://www.nationalgrid.com/uk/Electricity/Balancing/tenderreports/bmstartup/)

Fast Reserve (http://www.nationalgrid.com/uk/Electricity/Balancing/tenderreports/fastreserve/)

Standing Reserve (http://www.nationalgrid.com/uk/Electricity/Balancing/tenderreports/SR/)

Supplemental Standing Reserve
(http://www.nationalgrid.com/uk/Electricity/Balancing/tenderreports/supplementalstandingreserve/)

Short Term Operating Reserve
(http://www.nationalgrid.com/uk/Electricity/Balancing/tenderreports/stor2/index.htm)

National Terms of Connection (NTC)

The National Terms of Connection are published by National Terms of Connection (Great Britain) and the Energy Networks Association (ENA).

http://www.connectionterms.co.uk/

http://www.energynetworks.org/spring/regulation/index.asp

Supply

EDF Energy publishes the terms and conditions which apply for a domestic customer on their website.

http://www.edfenergy.com/edf-energy/showPage.do?name=homeenergy.switchBrand.tandc.til

Distribution Code and DCUSA

Licensed electricity distribution businesses, or Distribution Network Operators (DNOs), are obliged under Condition 9 of their licences to maintain a Distribution Code detailing the technical parameters and considerations relating to connexion to, and use of, their electrical networks.

http://www.dcode.org.uk/

The Distribution Connection and Use of System Agreement (DCUSA) provides a single centralised document which relates to the connection to and use of the distribution networks.

http://www.ofgem.gov.uk/Licensing/ElecCodes/DCUSA/Predesig/Documents1/15650-DCUSA.pdf

Transmission Connection and Use of System Code (CUSC)

The Connection and Use of System Code (CUSC) constitutes the contractual framework for connection to, and use of, National Grid's high voltage transmission system. Information relating to all aspects of the Connection and Use of System Code (CUSC) can be accessed on these pages:

http://www.nationalgrid.com/uk/Electricity/Codes/systemcode/

Balancing and Settlement Code (BSC)

ELEXON is the Balancing and Settlement Code Company (BSCCo) established under the provisions of the Balancing and Settlement Code (BSC). The BSC contains the rules and governance arrangements for electricity balancing and settlement in Great Britain.

http://www.elexon.co.uk/bscrelateddocs/default.aspx

APPENDIX A - FUNCTIONAL SUMMARY OF SHORT TERM OPERATING RESERVE STANDARD CONTRACT (STOR)

A 1. Declarations of Availability

By an agreed time and day of the week, the Reserve Provider will provide to the TSO a notice in relation to each of the contracted sites:

a) Confirming reserve is available in each Committed Window for the following week, or that Reserve is unavailable for technical reasons;

b) Indicating, for each Flexible Window, whether or not reserve is available the following week; and

c) Indicating whether reserve will be available in all the Optional Windows for each day in the following week.

Failure to provide a Declaration will be construed as constituting unavailability of Reserve, and this excludes the possibility of revision by the provider nearer Gate Closure.

The TSO will, at the end of the week, inform providers which of the Flexible Windows it has accepted.

For Committed Windows, if there is a change to the plant's technical capacity to provide reserve (i.e. it becomes available or becomes unavailable), the operator of that generator must let the TSO know of this change. It can do so any time until Gate Closure.

For Flexible Windows, the operator of that generator may let the TSO know of any change to its availability at any time until Gate Closure.

For Optional Windows, the operator of that generator may let the TSO know of any change to its availability at any time until Day-Ahead (24.00 on previous day).

If for some reason a generator becomes unable to provide reserve during after the times stipulated above, the provider must still inform the TSO as soon as possible.

If they do become unavailable, providers must give a reasonably detailed account of why they became unavailable.

Providers who fail to tell the TSO if they are going to be unavailable as described or who fail to explain their unavailability accordingly will be charged as described in a schedule to the contract.

If the provider has entered into any agreement that may mean it has to increase Generation / reduce Demand at the request of a third party, then it must declare itself unavailable for reserve provision at those times.

If the provider foresees that a contracted site may become unavailable during some or all of a Standing Reserve Agreement, it may substitute the site for another, provided it is connected to the same Grid Supply Point.

Even if no problem is foreseen, the provider may still request to substitute the contracted site for another at a different GSP.

A 2. Utilisation

During contracted availability/optional windows, the TSO may serve the provider with an instruction to provide. This instruction must be acknowledged within five minutes by the provider.

The TSO may ask any provider to stop providing at any time after its Minimum Utilisation Period. Any such instruction to stop must be acknowledged within 5 minutes.

The provider must continue to provide reserve until the end of its Maximum Utilisation Period or the end of its contracted window if it does not receive an instruction to stop.

A 3. Payment

Payment comes from two sources: the Reserve Availability Payment and the Reserve Utilisation Payment. These are described in the Payment Schedule.

If the reserve provided was repeatedly less than 90% of the reserve contracted for in a season, then the reserve provider must pay to the TSO an amount described in the Payment Schedule.

At the end of the Standing Reserve Agreement period, the provider must pay the TSO an amount described in the Payment Schedule to account for any Committed Windows when it failed to provide reserve.

A 4. Effects of defaults and consequences

The result of defaulting on provision in agreed Windows is defined in the Payment Schedule. All types of default are similarly penalised: non-payment of Reserve Availability Payment and, if the default is not the result of Force Majeure, termination of the contract or a reduction of 5% in the availability price.

A 5. Grid Code and Distribution Code

Generator must comply with the Grid Code and Generation Code.

A 6. Maintenance of Contracted Sites

Service provider must ensure that the site is maintained appropriately.

A 7. Weekly and Annual Limits and Revision of Energy Utilisation Price

There can be Weekly and Annual limits on the number of times the generator may be called upon to provide reserve. Beyond this limit the provider may offer to provide reserve at a new price for the rest of the contracted period.

A 8. Provision of Other Services

Any agreement entered into by a provider that places it under obligation to anyone other than the TSO to increase Generation / reduce Demand makes it ineligible to provide Reserve.

A 9. Communications

An electronic communications system will be used for communication between Parties, and the Parties are to agree amongst themselves how to communicate if this system fails.

A 10. Monitoring and Metering

Reserve provision can be monitored by an electronic communications system. If this system is found to be available, the TSO may withhold reserve availability payments and/or reserve energy payments for the period of unavailability.

A 11. Termination and other Consequences of Events of Default.

The TSO may terminate this agreement if a Reserve Provider fails to provide Reserve or comply with the Standing Reserve Despatch Procedure in a way that is reckless or intentional.

The TSO can also terminate the agreement if there are a certain number of events of default during a Season or the duration of a Standing Reserve Agreement. Alternatively, it may in this situation choose to reduce the Availability Price by up to 30% during that period.

APPENDIX B - FUNCTIONAL SUMMARY OF THE FIRM FREQUENCY RESPONSE TENDER RULES AND STANDARD CONTRACT TERMS (FFR)

B 1. Tender rules

B 1.1. FFR pre-qualification assessment

No plant may successfully tender for Firm Frequency Response (FFR) provision unless:

- it can demonstrate that it can provide a response of 10MW;
- it has the appropriate technology to provide either frequency-sensitive (dynamic) response or automatic relay (non-dynamic) response; and
- it has metering capabilities that are acceptable to the TSO.

Plant must submit to a pre-qualification assessment (at their own expense) before becoming eligible for FFR provision.

B 2. FFR tenders

B 2.1. Information that must be included in the tender

FFR contracts are awarded following a tender process. All tender applications must include:

- details of the periods to which the tender relates;
- the prices offered;
- an indication of whether there is flexibility over the time for which the plant is available to deliver FFR;
- any restrictions that apply to utilisation of the plant; and
- details of any agents appointed to communicate and make/receive payments to/from the TSO on the generator's behalf;

For dynamic FFR the following must also be included:

- A maximum and a minimum sustainable at which the generator can operate;
- A part load point between these two where the plant will 'normally' operate;
- Data tables indicating the amount of energy deliverable in a given period;

For non-dynamic FFR a single level of potential output must be submitted.

The tender is to be submitted during or before the month before the calendar month to which it applies. There is a standard procedure for tender submission. Tenders are assessed by the TSO using the tender criteria. Applicants are informed by a certain day in each month whether they have been successful or not.

B 3. Firm frequency response - Window Nomination

TSO will notify Providers on or before 14th business day of each month of any settlement periods during which it requires FFR from them. These are the FFR Nominated Windows. Providers must acknowledge receipt of this information. Providers must notify the TSO by fax if they become aware that any FFR Contracted unit will be incapable of providing the response during the period it is contracted to do so.

If the provider has offered in its tender the possibility of using the Window Revision Facility, the TSO can revise the FFR Nominated Windows up until 10am on the day before the revised Window.

B 3.1. Provision of Firm Frequency Response

The provider (generator) must confirm which Part Load Point it intends to operate at before 11am on the previous day unless it only referred to one Part Load Point in its tender.

The provider (generator) must ensure that:

- the best estimate of the expected input or output of the unit at Gate Closure (1 hr before settlement period) matches the confirmed Part Load Point;
- that output remains between the minimum and maximum stable limits defined in its tender; and
- the generator is capable of accepting an instruction from the TSO to operate in Frequency-Sensitive mode.

It is the provider's (generator's) responsibility to ensure that it has sufficient rights to access the transmission network in order to provide the FFR it is obliged to provide.

B 3.2. Payment

There are five possible streams of revenue from FFR provision of this type. These are:

- Availability Payment: Availability Fee * aggregate number of hours comprised within FFR Contracted Frames in that calendar month;
- Window Initiation Payment: Window Initiation Fee * number of individual FFR Nominated Windows in that calendar month;
- Nomination Payment: Nomination Fee * aggregate number of hours comprised within FFR Nominated Windows.
- Window Revision Payment: Window Revision Fee * aggregate number of hours which are the subject of revision during that calendar month. (Only for Units that make Window Revision possible).
- Response Energy Payment: A payment for the energy produced while providing the FFR, calculated as defined in the Connection and Use of System Code.

B 3.3. Events of default and consequences

The consequences of default events include set percentage reductions to fees and termination of the contract.

B 3.4. Substitution of FFR contracted units

Providers can request an agreement by the TSO for the substitution of one FFR contracted unit by another if they foresee that the contracted unit will be unable to provide FFR at any part of any day. The request must be made at least two hours before Gate Closure for the first settlement period in the affected FFR nominated windows in that day, and the substitution must be by another BM Unit at the same Grid Entry (or Supply) Point.

B 3.5. Grid Code

Provision of FFR doesn't exempt the Provider from its obligations under the Grid Code.

B 3.6. Maintenance of FFR Contracted Units

Provider is obliged to maintain its FFR Contracted Units adequately.

B 3.7. Provision of other services

The Provider undertakes not to agree provide any service to anyone else that may interfere with its ability to provide FFR

B 3.8. Monitoring and testing

The TSO may monitor the response actually provided by FFR Contracted units and penalise any that are not providing the service they have been contracted to do. If the performance measure (power delivered as a fraction of power required, measured second by second) is below 70% in any period, the Nomination Fee for all Settlement Periods, the Window Initiation Fee, and the Availability fee for that particular period will all be reduced to zero.

APPENDIX C - FUNCTIONAL SUMMARY OF A REACTIVE MARKET ANCILLARY SERVICES AGREEMENT

This contract is for generators providing reactive power. This is a summary of the part of that contract that relates to commercial (rather than obligatory) reactive power.

C 1. Service provision, payment, redeclaration

The generator must set out in the contract:

- How much reactive power capability the generator has at rated output, at full output and at other output power levels (at the commercial boundary);
- How much reactive power capability each individual generation unit has at rated output, at full output and at other output power levels (at the generator's stator terminal);
- How much reactive power capability is available at the step-up transformer; and
- How much reactive power capability varies with temperature.

The generator must inform the TSO if the capacity of any unit to provide VArs is altered due to a change in its registered capacity.

The TSO may install additional metering equipment to monitor provision of reactive power. It may also require reactive tests at any time, in addition to regular scheduled reactive tests. This measures the deliverability of MVArs.

C 2. Utilisation

The TSO has the right at any time to issue a dispatch instruction to the Generator, instructing them to provide MVArs.

C 3. Payment

Payment is made to the generator monthly by the TSO.

C 4. Monitoring

The TSO may use its own equipment to monitor provision of reactive power by the generator.

C 5. Grid code

The generator is bound by relevant codes and agreements relating to connection and use of the grid.

C 6. Termination

The agreement may be terminated if the Generator under-delivers on reactive power for a number of days during a given period.

APPENDIX D - FUNCTIONAL SUMMARY OF DISTRIBUTED GENERATION POWER PURCHASE AGREEMENT (PPA)

D 1. Conditions precedent

Generator must:

- be accredited for all relevant renewable/DER benefit schemes;
- be accredited for relevant Guarantee of Origin scheme;
- have a Connection Agreement(s) in place for its generating unit(s);
- hold a generation licence or have evidence of being licence-exempt;
- provide a forecast of metered output to the Supplier;
- certify to the Supplier that it complies with all applicable industry codes and regulation; and
- provide the Supplier with credit support information (in the form of bank guarantee, parent company guarantee, other instrument).

D 2. Sale and purchase of the Products

The Generator agrees to sell the products discussed in the PPA to the Supplier. The Supplier agrees to purchase the products from the Generator under the agreed terms and conditions.

D 3. Payments

The product price for each billing period will be the aggregate amount of the payments described in the Payments Schedule.

The Supplier will provide the Generator with a billing statement within a number of days of the end of the billing period.

D 4. Transfer of renewable benefits

The Generator agrees to transfer to the Supplier all rights to certificates arising from renewable generation.

D 5. Metering equipment and data collection

The Generator is to appoint a meter operator to install and maintain all metering equipment and associated communications equipment.

The Supplier is to be registered in the central metering system for the Generator's output, and will appoint a data collector and data aggregator.

D 6. Power forecasting

The Generator shall inform the Supplier of any planned outage at least 60 days in advance, and of unplanned outages as soon as practicable.

The Generator will inform the Supplier if the actual output of the Generator seems likely to deviate from its prediction.

D 7. Payment Schedule

Payment for generation and embedded benefits can be at a fixed or time-of-day basis. Different elements of revenue from green certificates are bought at a fixed price.

APPENDIX E - FUNCTIONAL SUMMARY OF GRID TRADE MASTER AGREEMENT (GTMA)

E 1. Key Definitions

A "Transaction" is a written or oral agreement between the two parties (Buyer and Seller) to undertake one or more Grid Trades. The agreement will contain details of the Transaction Term, Settlement Period Volumes, Energy Contract Volume (ECV) Notification Agent and contract Price.

A Grid Trade means, for a Settlement Period, the making of an ECV Notification so that the Settlement Administration Agent deducts the ECV from the Account Energy Imbalance Volume of the seller's Energy Account and adds the same ECV to the buyer's Account Energy Imbalance Volume.

An ECV Notification means, for a Settlement Period, a notification made by the ECV Notification Agent to the ECV Aggregation Agent identifying the Buyer and the Seller and the volume of electricity involved.

The ECV Aggregation Agent is the person who needs to be notified so that the electricity volumes traded can be taken into account in determining the parties' Account Energy Imbalance Volumes.

E 2. Confirmation Procedure

The Parties are bound by the terms of each Transaction from the time it is made. The Seller will send to the Buyer a Confirmation recording the details of the Transaction within 2 banking days of that Transaction being entered into. If happy with the Confirmation, the Buyer will return the Confirmation to the Seller within 2 banking days of receiving it.

E 3. General Obligations, Representations and Warranties

E 3.1. Representations and Warranties

Both parties represent and warrant to the other that they are able to honour the contract.

E 3.2. Balancing and Settlement Code

Both parties are to ensure that they are Party to the B&SC at all times during each Transaction Term (which is defined as the period from the time the Transaction is agreed to the time the Transaction expires or is terminated).

E 4. ECV Nominations

For any Settlement period where a volume of electricity is traded, the Seller will make an Accurate ECV Nomination which it also sends to the Buyer who then confirms it to the ECV Notification Agent, or each Party will make corresponding ECV Nominations to the ECV Notification Agent, or the parties will communicate in some other way with each other and the ECV Notification Agent. This will happen in time for the ECV Notification Agent to make an ECV Notification not later than an hour before the ECV Notification Deadline.

E 5. Accurate ECV Nominations/Notifications contain:

Settlement Period Volume to be taken into account as an Energy Contract Volume (which is defined as, for a Settlement Period and an Energy Account, a volume of electricity that is accepted by the Settlement Administration Agent as a volume of electricity which is the subject of one or more bilateral trades between B&SC Parties);

The names of the Parties, identifying which is the Seller and which the Buyer;

The Energy Account for each Party for the Transaction; and

Any other information required by the Settlement Administration Agent in determining the respective Account Energy Imbalance Volumes of the relevant Energy Accounts of the Parties for that Settlement Period.

E 6. Notification Failure

If one Party, but not the other, fails to honour the agreement, the Non-Complying Party will owe the other the net amount of the Contract Amounts (defined as Contract Price * Traded Settlement Period Volume) calculated for all Transactions for that Settlement Period as if an accurate ECV Notification had been made and the Traded Settlement Period Volume (the amount of electricity actually traded) was equal to the Settlement Period Volume (the amount it was agreed beforehand that would be traded). Also, both Parties will owe each other any Deemed Imbalance Charges incurred/payable.

E 7. Billing and Payment

On or before the 5th Banking Day of a month, the Seller shall send a Monthly Statement showing for the preceding Month for that Transaction:

- The Traded Settlement Period Volume for each Settlement Period in that Month;
- The Contract Price for each Settlement Period in that Month;
- The Contract Amount for each Settlement Period in that Month;
- Any amount owing from one Party to the other; and
- The net amount payable from one Party to the other.

Payment should be made by the 10th Banking day of the month, or by 5th Banking Day after receipt of the bill, whichever is earlier.

APPENDIX F - FUNCTIONAL SUMMARY OF THE DISTRIBUTION CONNECTION AND USE OF SYSTEM AGREEMENT (DCUSA)

The agreement is between DNOs ("Companies") and suppliers and generators ("Users"). It is a large document (presently 250 pages) and this functional summary is necessarily brief. The agreement is intended to evolve through the Governance and Change Control Process.

F 1. Governance and Change Control Process

This section outlines the objectives of the Agreement, how it is to be maintained and modified, how its governing panel is to be constituted and how membership is to be managed.

F 2. Company/User Relationships

F 2.1. Conditions precedent

The User must hold a Supply Licence, a Generation Licence, or be exempt from the requirement to hold a Generation Licence. The Company must hold a Distribution License.

Both the User and the Company must be a party to the Connection and Use of System Code.

Both the User and the Company must be a party to the Balancing and Settlement Code.

There must be a Master Registration Agreement and a Data Transfer Service Agreement between the two parties.

User must have appropriate credit rating or provide financial cover.

F 2.2. Contracts

The User must ensure that all customers and generators sign the National Terms of Connection.

F 2.3. Use of system

The Company will transport electricity from to each Entry Point and from each Exit Point registered to the User under the Master Registration Agreement. This is subject to the User's Maximum Import Capacity and Maximum Export Capacity. There must also be:

- A connection agreement in place for the User;
- A meter operator, data collector and data aggregator;
- For non-half-hourly metered customers, an Unmetered Supplies Certificate and an Equivalent Meter.

F 2.4. Commencement and duration

Contract commences upon signing and continues in force until terminated.

F 2.5. Charges

User pays Use of System Charges to the Company. These include payment for:

- provision of use of the distribution system;
- metering services;
- data transfer services.

These charges are calculated in accordance with the Charging Statement.

F 2.6. Billing and Payment by Settlement Class

Arrangements for billing and payment.

F 2.7. Site Specific Billing and Payment

Arrangements for billing and payment for Metering Points that aren't billed be Settlement Class.

F 2.8. Energisation, De-Energisation and Re-Energisation

Practical arrangements for any De- or Re-Energisation procedures.

F 2.9. Compliance with the Distribution Code

Both parties will comply.

F 2.10. Metering Data and Metering Equipment

The User is responsible for the installation and maintenance of appropriate metering equipment. The User will also provide data from these meters to the Company.

F 2.11. Provision of information

The User will provide the Company with information about its Customers and the Metering Point relating to each. Also the Customer's Maximum Import Capacity if they've a Maximum Power Requirement more than 20kVA and the customer is a new occupier of the site. If the Customer is a generator, then their Maximum Export Capacity needs to be supplied.

F 2.12. Demand control

[Refers to Schedule 11]

The User undertakes not to change the Standard Settlement Configuration at any Metering Point in a way that would affect the Company's ability to fulfil its obligations to maintain an efficient, secure, safe, co-ordinated and economical distribution system.

The Company can designate some parts of the Distribution System to be Load Managed Areas. These are areas where the need for reinforcement or extension of the network has been identified by the company but where this need would be avoided by the reduction in the coincidence of Demand by the adoption of Customer Demand management to control the timing of load switching.

The Company shall send out: Provisional Security Restriction Notices when the SSC in place at a particular Metering Point have changed in such a way as to "marginally infringe the Capacity Headroom" [a margin of 15% below the maximum capacity of the Distribution System] of the LMA; Firm Security Restriction Notices when changes to the SSC have increased the coincidence of demand resulting in a material risk to the Security of Supply; and Emergency Security Restriction Notices where there is an immediate risk to Security of Supply.

F 2.13. Revenue protection

If the Company provides a revenue protection service it will do so in accordance with the provisions of the Revenue Protection Code of Practice. [This document details the DSO's responsibilities with respect to detecting and preventing theft of electricity, damage to electrical plant electric line and Metering Equipment, and interference with any Metering Equipment].

F 2.14. Guaranteed performance standards

To do with the Company's compliance with the Electricity (Standards of Performance) Regulations 2005 SI 2005/1019, and compensation if it does not comply.

F 2.15. Confidentiality restrictions on the company

The information exchanged between User and Company is confidential except to employees of the Company, any consultants or advisors they use to help run their business, any Authority allowed by law to request information from the Company.

F 2.16. Confidentiality restrictions on the user

Similarly, confidential information supplied to the User by the Company may not be made public without the Company's consent, except to bodies permitted to request legally that it be sent to them.

F 3. Company/Company Relationships

(This section is initially blank in version 1 of DCUSA and is to be developed by the DNOs.)

F 4. Schedules

SCHEDULE 1 COVER

SCHEDULE 2A MANDATORY TERMS FOR CONTRACTS

SCHEDULE 2B NATIONAL TERMS OF CONNECTION

SCHEDULE 3 INTEREST RECONCILIATION ACCOUNTS

SCHEDULE 4 BILLING AND PAYMENT DISPUTES

SCHEDULE 5 APPROVAL AND PERMISSION PROCEDURES

SCHEDULE 6 METERING ACCURACY

SCHEDULE 7 EVENT LOG

SCHEDULE 8 DEMAND CONTROL

SCHEDULE 9 ACCESSION AGREEMENT

SCHEDULE 10 DCUSA LTD

SCHEDULE 11 PARTY DETAILS

SCHEDULE 12 MATTERS FOR FUTURE DEVELOPMENT

APPENDIX G - FUNCTIONAL SUMMARY OF GB NATIONAL TERMS OF CONNECTION (NTC)

G 1. Duration

Connection agreement begins when supply contract takes effect and ends only when:

- customer permanently stops having electricity delivered through the connection;
- customer ceases to own or occupy the premises;
- circumstances arise where the DNO is legally allowed to cut off the supply, and the supplier informs the customer in writing that it intends to do so.

G 2. Network constraints

The network operator's obligations are subject to the size and nature of the customer's connection at the time of entering the contract. The customer must inform the DNO if it intends to make any significant changes to the connection or to the way it is used.

G 3. Delivery

The DNO does not guarantee continuous supply or that supply will be of a consistently high quality (due to the inevitable temporary disturbances caused by faults on the network).

G 4. Cutting off your supply

The DNO may cut off the customer's supply if it is allowed to do so by general law, or when it is required to do so by the customer's supply contract or the industry agreements.

G 5. If something goes wrong

If the DNO fails to fulfil its obligations under the contract or is negligent, the customer is entitled to recover compensation for any loss caused. The customer's ability to recover compensation is limited to losses that occur from things that are within the DNO's reasonable control.

G 6. Business customers

The damages for which the DNO is liable where the customer is a business customer is limited to £100,000 a year.

G 7. Changing this connection agreement

The terms of the connection agreement may be changed automatically to incorporate any changes that are approved by the regulator. Any changes of this kind will be announced publicly. The DNO or the customer may ask the other party for a change in the agreement if the connection changes or they feel the agreement is no longer suitable. If no agreement can be reached about the proposed change, the regulator will make the decision.

APPENDIX H - FUNCTIONAL SUMMARY OF A DOMESTIC SUPPLY AGREEMENT

H 1. Supply contract

Contract is between supplier and customer. Supplier will write to customer to inform them of start date of electricity supply. Customer must cancel contract with any other supplier before commencing supply from the new supplier. If a new meter is required, or the existing one needs modification, this can usually be done, at the customer's cost. Entering into this agreement also entails entering into a Standard Connection Agreement with the DNO.

H 2. Charges

Charges for electricity supplied will be made known from time to time by the supplier.

H 3. Payment

Supplier will send bills regularly based on a meter reading, or where there is no meter reading, an estimated reading. Payment in full is due from the time the bill is issued. Payment must be made in the manner agreed under this contract. Interest may be charged on late payments. The supplier may require the customer to install a pre-payment meter or pay a deposit.

H 4. Access to the property

The customer must allow the supplier, its agents, and the DNO access to the property to do work they are legitimately entitled to do to the meter and other distribution assets. Other than for meter readings, reasonable advance notice will be given of such visits.

H 5. Termination

The supplier will stop supplying when the customer has given written notice that it wants to end the contract and another supplier has started to supply the property or another supplier has started to do so. The customer must give at least 2 days' warning to the supplier if they are moving out of the property. If the supplier changes the agreement's terms and conditions, the customer may change supplier within 21 days without the new terms and conditions taking effect.

H 6. Liability

The supplier may not be held liable for breaches of the contract caused by things outside its control. The supplier's liability for negligence, except for death or injury, is limited to £100,000.

H 7. Changes to the supply contract

The supplier will give 10 days' notice of any changes to the supply contract. Only the supplier may transfer the contract to another supplier- the customer may not do so (however, the suppliers must act when instructed to by the customer).

H 8. Domestic representatives

The customer may cancel the agreement within 7 days if they entered into it following a visit to their home by a representative, or a telephone conversation, or over the internet.

H 9. General

If the customer requests further services (additional to the supply of electricity), the supplier may charge for these. The customer permits the supplier to use previous meter information collected by other suppliers.

APPENDIX I - FUNCTIONAL SUMMARY OF A TOP-UP AND SPILL AGREEMENT

I 1. Renewable generation contract

Contract is between the supplier and the renewable generator, for supply of renewable electricity to the generator and the supply of renewable electricity by the generator to the supplier.

I 2. Sale of generation

The generator grants to the supplier the right to all its metered output.

I 3. Conditions precedent

The generator must be a registered customer of the supplier's.

The generator has a renewable plant that is less than 50kW in capacity.

The renewable generation plant has installed the appropriate metering equipment.

The generator has a connection agreement with the DNO.

An initial meter reading has been supplied to the supplier in the contact.

The generator confirms to the supplier that it is free to sell the electricity generated.

The supplier has a supply licence.

I 4. Home generation

I 4.1. Generator's obligations

Generator must remain a registered customer of the supplier's.

Generator must continue to have a connection agreement.

Generator must make reasonable endeavours to maintain the plant and ensure its continued operation.

Generator must inform supplier within 10 days of generator ceases to output.

Generator must ensure there is an appropriately located meter recording generation.

Generator must provide, install, and maintain metering equipment to measure generation for output. Supplier must provide install, and maintain metering equipment for onsite electricity.

Generator shall provide a meter reading within 10 days of any request for one.

If the generator believes the metering equipment not to be measuring energy accurately, it must inform the supplier. If the supplier disagrees with this view, the equipment will be examined independently. If it is concluded that the metering equipment is not functioning correctly, the supplier shall pay for a replacement or recalibration. If it is found to be accurate, then the generator must pay the costs of the tests.

The generator will give access to metering equipment to the supplier or anyone authorised by the supplier, provided reasonable notice is given to them beforehand.

The generator must allow any authorised representative of the supplier's to inspect the plant and cut off generation if it is reasonably suspected that it is dangerous.

I 4.2. Supplier's obligations

The supplier agrees to buy the generator's metered output for the duration of the contract and will pay the spill price for export electricity.

Supplier warrants that it can fulfil its obligations under the contract.

I 5. Onsite electricity

I 5.1. Supply of electricity

Generator agrees to sell all its electricity to the supplier.

Generator agrees to buy and supplier agrees to supply onsite electricity.

I 5.2. Generator's obligations

Generator has ensured or will ensure that it is accredited as a renewable generator.

Generator will nominate the supplier as its agent for green certificate purposes.

Generator will comply with any legal requirements for continuing as an accredited renewable generator and collecting the associated benefits. It will pass these benefits, when accrued, on to the supplier.

Generator will provide the supplier with any information on electricity used by the generation plant in that month.

I 5.3. Supplier's obligations

Supplier will pass on any relevant metering data to the body responsible for monitoring renewable generation.

Supplier will act as an agent for the generator.

I 6. Duration

Agreement is effective from the first meter reading until terminated.

Both parties agree to make any changes to this contract that may be required from time to time by the Regulator.

I 7. Termination

Contract may be terminated by supplier when:

- Generator no longer owns the premises described in the contract;
- Electricity supply to the premises has been disconnected;
- Supplier suggests the renewable generator has been interfering with metering equipment or otherwise falsifying readings or other data relating to its consumption or generation.
- Generating plant has been removed;
- Generator has failed to attain renewable accreditation within a given period.

Supplier may terminate the contract at 28 days' notice or immediately if its licence is revoked.

Contract automatically ends if the generator ceases to be a customer of the supplier's.

A meter reading will be required and the supplier will issue a termination account.

APPENDIX J FUNCTIONAL SUMMARY OF SPILL AGREEMENT FOR MICRO-CHP OPERATORS

J 1. Generation Contract

The contract is between the Supplier and the CHP Generator, for the supply of electricity by the Generator to the Supplier.

J 2. Sale of Export

The CHP Generator grants the Supplier with sole and exclusive rights to the electricity exported by the CHP Generator.

J 3. Conditions Precedent

The CHP Generator must have a CHP Generation plant installed less than or equal to 500kWe capacity.

The CHP Generation plant must have the appropriate Metering Equipment installed.

The Generator has a connection agreement with the DNO.

An initial meter reading must be supplied to the Supplier in the contract.

The Generator confirms to the Supplier that it is free to sell the electricity generated.

The Supplier has a supply licence.

J 4. Obligations of the CHP Generator

Generator must remain a registered customer of the Supplier's.

Generator must continue to have a connection agreement.

Generator must make reasonable endeavours to maintain the plant and ensure its continued operation.

Generator must inform Supplier within 10 days if generator ceases to output.

Generator must provide, install and maintain metering equipment to measure generation for output. The inaccuracy of the registration of any demand indicator at normal loads should not exceed 5%, and metering equipment at normal load should not exceed 2.5% plus or 1.5% minus.

The Generator must provide the supplier with any information on Input Electricity with its Meter Readings on request from the supplier.

The Generator will give access to metering equipment to the supplier or anyone authorised by the Supplier, provided reasonable notice is given to them beforehand.

J 5. Obligations of the Supplier

The Supplier agrees to buy the Generator's metered output for the duration of the contract and will pay the spill price for export electricity. The spill price is defined as the price for Export Electricity based on the CHP Generation Tariff to be notified to the CHP Generator on an annual basis or as otherwise agreed.

Supplier warrants that it can fulfil its obligations under the contract.

When acting as Agent, the supplier should ensure that it provides the Authority with CHP generator Plant data on metered output as per the Authority Timetable.

J 6. Duration

Agreement is effective from the first meter reading until termination.

Both parties agree to make any changes to this contract that may be required from time to time by the Regulator.

J 7. Termination

Contract may be terminated by the Supplier when:

- Generator no longer owns the premises described in the contract;
- Electricity supply to the premises has been disconnected;
- Supplier suggests the CHP Generator has been interfering with metering equipment or otherwise falsifying readings or other data relating to its consumption or generation;
- Generation plant has been removed
- Generator has not received Accreditation within 8 weeks of the date of this Contract or such longer period as supplier may agree.

Supplier may terminate the contract at 28 days' notice or immediately if its licence is revoked.

Contract automatically ends if the generator ceases to be a customer of the Supplier's.

A meter reading will be required and the supplier will issue a termination account.

J 8. Liability

Neither Party is reasonable for changes beyond their control.

J 9. Variations to the CHP Generation Contract

Any changes must be notified to the corresponding party within an agreed time period.

J 10. General

Notices in relation to the contract will be sent to the customer's billing address.

Any notice or consent must be in legible writing and sent by first class pre-paid letter, by hand or by fax.

APPENDIX K - BALANCING AND SETTLEMENT CODE (BSC)

The Balancing and Settlement Code (BSC) sets the guidelines from electricity balancing and settlement in GB. The BSC also defines the role of ELEXON, the Balancing and Settlement Company, which carries out the operations of the BSC arrangements. Any work carried out by ELEXON is overseen by the BSC Panel.

K 1. Parties and Participation

Any person, other than a BSC agent can become a BSC party, provided they accede to the Framework Agreement, by successfully completing an application and providing the following party details:

- Contact details
- Licence information
- Details of other parties who are affiliates
- VAT registration details
- Participation capacities

Once parties are under BSC, they should:

- Apply to register metering systems or BM units
- Submit contract notifications

K 2. The Panel

The Panel, appointed by trading parties, provides an annual report summarising the implementation of the BSC and any changes in the BSC for the preceding year. The panel work to ensure the BSC supports other objectives set by the government.

K 3. ELEXON and its subsidies

ELEXON's main duty is to deliver the BSC effectively, efficiently, and economically. ELEXON's powers, functions and responsibilities include:

- Entering into and management of BSC Agent Contracts for the supply of services
- Advising the Panel on the management of ELEXON's functions and responsibilities
- Collecting and holding data information, and maintaining books and records

K 4. BSC Cost Recovery and Participation Charges

In order to recover costs incurred in connecting to the BSC, the charges include:

- Main Specified Charges- this includes a base monthly charge for being a party to the BSC, charges for having BM Units, charges associated with Energy Contract Volume Notifications (ECVNs) and Metered Volume Reallocation Notifications (MVRNs) involving the party and communication charges
- SVA Specified Charges- these are £1.25 per month for each half hourly metered system
- Specified NETA Funding Charges

Parties are due to make payments by the payment date regardless of whether or not the party wishes to dispute the payment.

K 5. BSC Agents

ELEXON is required to ensure a BSC Agent is appointed to each BSC service description. ELEXON contracts with the BSC Agent and has the duty to manage the contact, enforce it and renew/terminate upon expiry.

K 6. Modification Procedures

Any modifications must be notified to parties, Panel members, the Authority, BSC Agents and each Core Industry Document Owner. If an effective time is not specified in the modification, then it will take effect from 00:00 hours on the following day.

K 7. Contingencies

Payments regarding contingencies, such as failure of the ECVAA to receive contract notifications or Black Start Periods, are made following the receipt of Generator Compensation Instructions (a compensation amount that the generator delivers to ELEXON in accordance to the Fuel Security Code).

K 8. General

The obligations of any one party under the code are separate and individual, thus any one party is not responsible for the obligations or liabilities of any other party.

Any disputes under BSC can be referred to the Electricity Arbitration Association.

K 9. Transmission Arrangements for the Implementation of BETTA

In April 2005, the England and Wales BSC provisions to electricity trading were extended to Scotland. Parties in Scotland are required to allow the BSCCo and BSC Agents access to metering systems, communication lines and metered data. Transitional Code Subsidy Documents outline the implementation of BETTA and thus aid the Panel in making any related decisions.

K 10. Party Agents

Parties responsible for metering systems are required to assign the following agents:

- Meter Operating Agent (MOA) unless the Metering System relates to an Unmetered System
- A data collector and an aggregator for each SVA Metering System
- A meter administrator for SVA Metering System relating to an Equivalent Unmetered Supply

Prior to agents being appointed, they must be accredited and their Agency Systems Certified. A Performance Assurance Board (PAB) is in charge of Accrediting and Certifying persons to carry out Party Agent Functions.

K 11. Classification and Registration of Metering Systems and BM Units

A Party is responsible for an export if it is generating electricity and is responsible for an import if it supplies electricity to the premises.

If a supplier fails, a replacement supplier is appointed. The replacement supplier's duties start from 00:00 hours on the Appointment day.

K 12. Metering

Participants in the balancing mechanism must appoint an agent to install, test, and commission an appropriate meter.

Metering must be half-hourly for all centrally registered meters and all supplier volume allocation meters.

K 13. Credit Cover and Credit Default

Measures to provide companies with credit cover, when there is energy indebtedness, are in place as well as credit default measures.

K 14. Clearing, Invoicing and Payment

Payment by and to parties is entirely through the BSC Clearer, which acts as counterparty to all other parties.

Payments and charges are:

- Accepted bids and offers;
- Payment for top-up (SBP) and spill (SSP);
- Other charges relating to the administration of the scheme.

K 15. Communication under the Control

Forms of communication specified in the data catalogue must be sent in the format specified. Each Party should have the use of the system up to interface with the communications mediums.

K 16. Energy Contact Volumes and Metered Volumes Reallocations

Agents can submit Energy Contract Volume Notifications (ECVN) and Metered Volume Reallocation Notifications (MVRN) on behalf of Contract Trading Parties in order to notify contract volumes to settlement.

K 17. Balancing Mechanism Activities

K 17.1. Data Submission

The Lead Party for each BM Unit participating in the Balancing Mechanism must submit to the TSO several types of data relating to the BM Unit. These are outlined here:

- Dynamic Data Set
- Run-Up & Run-Down rates;
- Notice to Deviate from Zero;
- Notice to Deliver Offers and Bids;
- Minimum Zero and Non-Zero times;
- Maximum Delivery Volume and associated Maximum Delivery Period;
- Stable Export and Import limits;

K 17.2. Final Physical Notification Data

The BM Unit's expected generation during each settlement period must be submitted prior to that settlement period's Gate Closure.

K 17.3. Balancing Mechanism Bid-Offer Submission

A Bid-Offer pair is data which may be submitted in relation to a BM unit for a settlement period, where a Bid is the quantity in a Bid-Offer pair if it is considered as a decrease in export or an increase in import of the relevant BM unit at a given point in time. Likewise, an offer is the quantity in a Bid-Offer pair if it is considered as a increase in export or an decrease in import of the relevant BM unit at a given point in time. For each Settlement Period, one or more Bid-Offer pairs may be submitted, comprising of:

- A generation level at the beginning and end of the Settlement Period;
- Up to 10 Bid-Offer pairs: 5 with positive MW levels and 5 with negative MW levels;

Bids and Offers can be accepted by the TSO by issuing a communication to the Lead Party, who must normally then confirm that the instruction has been received.

K 18. Collection and Aggregation of Meter Data from CVA Metering Systems

The Central Data Collector Agent (CDCA) collects metered data using either remote interrogation or manual on-site interrogation. If the Metering System is registered with CMRS, then the CDCA is responsible for running and the maintenance of it. The CDCA is responsible for testing metering systems, reporting any errors to the Meter Operator Agents (MOAs).

K 19. Supplier Volume Allocation (SVA)

If suppliers wish to transfer their supplier IDs amongst each other, then they are to notify the Balance and Settlements Code Company. Each supplier is to nominate a Meter Operator Agent (MOA). MOAs are responsible for monitoring and maintaining SVA Metering System data to relevant data aggregators.

A Supplier Meter Registrant Agent should have arrangements to exchange data with suppliers, distribution system operators and the Supplier Volume Allocation Agent (SVAA). The supplier should ensure:

- The SVAA has total consumption details for each settlement period.
- The Half Hourly Data Collector (HHDC) collects metered data from the metering system
- Each of its Half Hourly Data Aggregators (HHDA) receive data from HHDC and use it in order to calculate BM Unit's Metered Consumption

Non-half hourly data collectors and aggregators are responsible for providing data to the SVAA, to allow it to carry out profiling calculations to determine half hourly consumption values. If there is a severe delay or failure, the SVAA will derive any missing data from the previous run for that settlement day.

K 20. Settlement and Trading Charges

The Settlement Administration Agent validates any information it receives in accordance with BSC Procedure 01 which describes the activities of the Trading Arrangements detailed in the code.

The Panel establishes and maintains the Market Index Definition Statement, which contains information on the Market Index Data Providers, who are responsible for market index data for each settlement period.

A delivering trading unit has a trading unit that is a net exported over the settlement period. Likewise, an off-taking trading unit has a trading unit that is a net importer. Transmission losses are calculated using the transmission loss factor and multiplier, and the cost is split between delivering and off-taking trading units. The transmission loss factor is used to allocate transmission losses in respect to location for each BM Unit in a settlement period so that the transmission loss multiplier can be calculated. The transmission loss multiplier is then applied to a BM Unit's Metered Volume so that it adjusts for any transmission losses.

The data received from the transmission company is converted to a suitable format so that it can be used by the settlement software. Once converted, the Acceptance Data is used to determine the Continuous Acceptance Duration for each acceptance. Values of point Final Physical Notification (FPN) determines the final physical notification function which shows the level at which the BM unit should be operating at any instance in time.

When carrying out the Settlement Run, the SAA uses data from CDCA and SVAA ensuring it uses any adjustments or revisions that are made to the data.

K 21. Provisions Relating to Settlements

Any data provided by Parties to the Panel must be accurate and complete. Settlement of trading charges occurs in six phases; one at the start, four further ones, and one following the settlement payment known as the Timetabled Reconciliation Settlement Run.

Parties and agents are required to retain at least 40 months of information for the Trading Disputes process and the data should be kept in a live environment for the first 28 months.

K 22. Reporting

The Authority and ELEXON can request any data from the Balancing Mechanisms Reporting Service (BMRS) without charge. The BMRS provides near real time and historic data about the Balancing Mechanism. If any errors are made, or information is not placed in the BMRS, then the rights and obligations of the Parties in relation to the settlements are not affected.

K 23. Trading Queries and Trading Disputes

Any trading queries are first attempted to be resolved using the trading resolution process and if they cannot be resolved then they are turned into trading disputes. If it is unclear whether something can be classified as a trading dispute, then it left to the panel to decide. Trading disputes are resolved by the Trading Disputes Committee.

Further Sections: Definitions, Summary of Acronyms and Defined Terms