

Power Quality Contracts

1 Descriptions of Function

All prior work (intellectual property of the company or individual) or proprietary (non-publicly available) work should be so noted.

1.1 Function Name

Power Quality Contracts

1.2 Function ID

IECSA identification number of the function

M-1.1,M-1.2,D-11,C-9,C-9.1,C-9.2,C-9.4,C-9.5

1.3 Brief Description

Describe briefly the scope, objectives, and rationale of the Function.

The purpose of the power quality contracts enterprise activity is to enable a mechanism whereby energy service providers could lock in long term contracts with large industrial customers by providing service guarantees based on the quality of electric power supplied over a period of time. In return for signing a long term contract, the customer receives favorable long term rates as well as power quality performance guarantees from the energy service provider. This assures the industrial customer that the energy service provider will be responsive to their problems over the duration of the contract.

1.4 Narrative

A complete narrative of the Function from a Domain Expert's point of view, describing what occurs when, why, how, and under what conditions. This will be a separate document, but will act as the basis for identifying the Steps in Section 2.

Industrial customers are facing increasing energy costs and increasing competition. Energy service providers are facing increasing competitive threats from other ESPs in a deregulated environment. In order for industrial customers to lock in long term favorable rates

and in order for ESPs to prevent customers from going elsewhere to obtain electric power, the concept of the power quality contract has emerged. In return for signing a long term contract whereby the industrial customer agrees to not seek power from other providers, the EnergyServiceProvider must guarantee a certain level of power quality and reliability. If the level of power quality and reliability is worse than an agreed upon level, the EnergyServiceProvider would owe penalty payments to the industrial customer. Therefore, the incentive exists for the EnergyServiceProvider to keep upgrading and improving the performance of the system.

In order to do this, the EnergyServiceProvider must install electric power monitoring instrumentation at the service entrance of each customer. In general these contracts would apply to large transmission customers where outages are rare, so the primary concern is the number and severity of voltage sags caused by faults on the system. These instruments generally must be able to capture RMS variations, call back to a central server when an event occurs, and be able to capture enough data such as current to be able to ascertain whether the event was caused by something on the EnergyServiceProvider system or inside the customer facility. This requires communication from the central server location to the monitoring instrument either by telephone, Internet, satellite or other.

In general, a database is maintained at the central server so that event analysis can be conducted as well as the calculation of a score or index for a particular customer or site. A base level is required and is generally done before the contract term is started. The baseline or target is continually updated usually on a yearly basis and is in effect a rolling average. A score is given for each event and then totaled on a yearly basis. If the score is above the target number, then payments are made to the customer based on previously agreed upon formula.

1.5 Actor (Stakeholder) Roles

Describe all the people (their job), systems, databases, organizations, and devices involved in or affected by the Function (e.g. operators, system administrators, technicians, end users, service personnel, executives, SCADA system, real-time database, RTO, RTU, IED, power system). Typically, these actors are logically grouped by organization or functional boundaries or just for collaboration purpose of this use case. We need to identify these groupings and their relevant roles and understand the constituency. The same actor could play different roles in different Functions, but only one role in one Function. If the same actor (e.g. the same person) does play multiple roles in one Function, list these different actor-roles as separate rows.

| <i>Grouping (Community)'</i> | | <i>Group Description</i> |
|---|---|---|
| Energy Service Provider (EnergyServiceProvider) | | Provides the electric power |
| <i>Actor Name</i> | <i>Actor Type (person, device, system etc.)</i> | <i>Actor Description</i> |
| Central Server | System | Downloads instruments located at service entrance of industrial customers under contract, accepts incoming calls from instruments, creates database of sag scores and calculates penalty payments |
| Contract administrator | Person | Person responsible for writing and administering the power quality contract |
| EnergyServiceProvider | | |

| <i>Grouping (Community)'</i> | | <i>Group Description</i> |
|-------------------------------|---|---|
| Hardware and Software Vendors | | Provide instruments and software to enforce contracts |
| <i>Actor Name</i> | <i>Actor Type (person, device, system etc.)</i> | <i>Actor Description</i> |
| PowerQuality Instrument | Device | Captures and records power quality events and sends to central server |
| Database and SoftwareProvider | Software | Provides download, archiving and reporting software |

| <i>Grouping (Community)'</i> | | <i>Group Description</i> |
|-------------------------------|---|---|
| Hardware and Software Vendors | | Provide instruments and software to enforce contracts |
| <i>Actor Name</i> | <i>Actor Type (person, device, system etc.)</i> | <i>Actor Description</i> |
| Communication | Device and System | Mechanism for power quality instrument to contact or be contacted by the central server |

| <i>Grouping (Community)'</i> | | <i>Group Description</i> |
|------------------------------|---|--|
| Customers | | Consumes electric power |
| <i>Actor Name</i> | <i>Actor Type (person, device, system etc.)</i> | <i>Actor Description</i> |
| FacilityManager | Person | Responsible for supplying reliable electric power in customer facility |
| Customer | | |

Replicate this table for each logic group.

1.6 Information exchanged

Describe any information exchanged in this template.

| <i>Information Object Name</i> | <i>Information Object Description</i> |
|--------------------------------|---|
| Raw Power quality event data | Events and performance monitoring results captured by power quality instruments |

| <i>Information Object Name</i> | <i>Information Object Description</i> |
|----------------------------------|--|
| Aggregated performance summaries | Post processed raw data summarized and compared to baseline data for the purpose of calculating penalty payments |

1.7 Activities/Services

Describe or list the activities and services involved in this Function (in the context of this Function). An activity or service can be provided by a computer system, a set of applications, or manual procedures. These activities/services should be described at an appropriate level, with the understanding that sub-activities and services should be described if they are important for operational issues, automation needs, and implementation reasons. Other sub-activities/services could be left for later analysis.

| <i>Activity/Service Name</i> | <i>Activities/Services Provided</i> |
|------------------------------|--|
| Event capture | Instruments in the field must capture events when they occur |
| Data download | Periodically, the central server must download the data from the instruments in the field |
| Account reconciliation | Periodically, the database employed must generate summary reports and calculate penalty payments |
| Baselining | Periodically, the minimum level at which penalties are applied needs to be calculated |

1.8 Contracts/Regulations

Identify any overall (human-initiated) contracts, regulations, policies, financial considerations, engineering constraints, pollution constraints, and other environmental quality issues that affect the design and requirements of the Function.

| <i>Contract/Regulation</i> | <i>Impact of Contract/Regulation on Function</i> |
|----------------------------|--|
| PQ Contract | Terms dictate amount and frequency of penalties and also how the baseline is calculated, refined and set |

| <i>Policy</i> | <i>From Actor</i> | <i>May</i> | <i>Shall Not</i> | <i>Shall</i> | <i>Description (verb)</i> | <i>To Actor</i> |
|------------------|-----------------------|------------|------------------|--------------|--|---------------------------|
| Customer Service | EnergyServiceProvider | | | X | Provide guaranteed levels of power quality and adequate customer service | Customer |
| Customer Lock In | Customer | | X | | Seed power from other sources while under contract | EnergyServicePr ovider |

| <i>Constraint</i> | <i>Type</i> | <i>Description</i> | <i>Applies to</i> |
|-------------------|-------------|--|-------------------|
| Instrument | Data | PQ contract is contingent on the accuracy and reliability of data captured by monitoring instruments | Overall program |

2 Step by Step Analysis of Function

Describe steps that implement the function. If there is more than one set of steps that are relevant, make a copy of the following section grouping (Preconditions and Assumptions, Steps normal sequence, and Steps alternate or exceptional sequence, Post conditions)

2.1 Steps to implement function

Name of this sequence.

2.1.1 Preconditions and Assumptions

Describe conditions that must exist prior to the initiation of the Function, such as prior state of the actors and activities

Identify any assumptions, such as what systems already exist, what contractual relations exist, and what configurations of systems are probably in place

Identify any initial states of information exchanged in the steps in the next section. For example, if a purchase order is exchanged in an activity, its precondition to the activity might be 'filled in but unapproved'.

| <i>Actor/System/Information/Contract</i> | <i>Preconditions or Assumptions</i> |
|--|---|
| EnergyServiceProvider | Must have adequate monitoring instruments pre-installed over a period of time in order to set up a baseline for calculation of penalty payments |

2.1.2 Steps – Normal Sequence

Describe the normal sequence of events, focusing on steps that identify new types of information or new information exchanges or new interface issues to address. Should the sequence require detailed steps that are also used by other functions, consider creating a new “sub” function, then referring to that “subroutine” in this function. Remember that the focus should be less on the algorithms of the applications and more on the interactions and information flows between “entities”, e.g. people, systems, applications, data bases, etc. There should be a direct link between the narrative and these steps.

The numbering of the sequence steps conveys the order and concurrency and iteration of the steps occur. Using a Dewey Decimal scheme, each level of nested procedure call is separated by a dot ‘.’. Within a level, the sequence number comprises an optional letter and an integer number. The letter specifies a concurrent sequence within the next higher level; all letter sequences are concurrent with other letter sequences. The number specifies the sequencing of messages in a given letter sequence. The absence of a letter is treated as a default 'main sequence' in parallel with the lettered sequences.

Sequence 1:

*1.1 - Do step 1
1.2A.1 - In parallel to activity 2 B do step 1
1.2A.2 - In parallel to activity 2 B do step 2
1.2B.1 - In parallel to activity 2 A do step 1
1.2B.2 - In parallel to activity 2 A do step 2
1.3 - Do step 3
1.3.1 - nested step 3.1
1.3.2 - nested step 3.2*

Sequence 2:

*2.1 - Do step 1
2.2 - Do step 2*

| # | Event | Primary Actor | Name of Process/Activity | Description of Process/Activity | Information Producer | Information Receiver | Name of Info Exchanged | Additional Notes | IECSA Environments |
|-----|--|---|---|--|--|---|---|--|---|
| # | <i>Triggering event? Identify the name of the event.¹</i> | <i>What other actors are primarily responsible for the Process/Activity? Actors are defined in section 1.5.</i> | <i>Label that would appear in a process diagram. Use action verbs when naming activity.</i> | <i>Describe the actions that take place in active and present tense. The step should be a descriptive noun/verb phrase that portrays an outline summary of the step. "If ...Then...Else" scenarios can be captured as multiple Actions or as separate steps.</i> | <i>What other actors are primarily responsible for Producing the information? Actors are defined in section 1.5.</i> | <i>What other actors are primarily responsible for Receiving the information? Actors are defined in section 1.5. (Note – May leave blank if same as Primary Actor)</i> | <i>Name of the information object. Information objects are defined in section 1.6</i> | <i>Elaborate architectural issues using attached spreadsheet. Use this column to elaborate details that aren't captured in the spreadsheet.</i> | <i>Reference the applicable IECSA Environment containing this data exchange. Only one environment per step.</i> |
| 1.1 | Event Capture and Transmittal | Instrument | Event Capture and Transmittal | If an event is triggered, the instrument calls back to the central server and the server downloads the data | PowerQuality Instrument | Central Server | Voltage and current waveforms and data | Basic telecommunication constraints such as modem and dial up telephone connection, but could also include internet TCP/IP connectivity or even cellular | Customer / ESP |

¹ Note – A triggering event is not necessary if the completion of the prior step – leads to the transition of the following step.

| # | Event | Primary Actor | Name of Process/Activity | Description of Process/Activity | Information Producer | Information Receiver | Name of Info Exchanged | Additional Notes | IECSA Environments |
|-----|----------------------|----------------------------------|--------------------------|--|----------------------|----------------------|---|---|--------------------|
| 1.2 | Sag Score Calculated | Central server database software | Sag Score Calculated | Based on events recorded, data is characterized and loaded into a database, then a sag score is calculated based on previously agreed algorithm | Central Server | Customer | Data report that includes a sag score | Data management in terms of culling important information | Customer / ESP |
| 1.3 | Penalty calculation | Central server database software | | Based on the previously agreed upon baseline or rolling average, the previous sag score is compared to the baseline and a penalty is then calculated | Central Server | Customer | Report that summarizes penalty payments | None | Customer / ESP |

2.1.3 Steps – Alternative / Exception Sequences

Describe any alternative or exception sequences that may be required that deviate from the normal course of activities. Note instructions are found in previous table.

| # | Event | Primary Actor | Name of Process/Activity | Description of Process/Activity | Information Producer | Information Receiver | Name of Info Exchanged | Additional Notes | IECSA Environments |
|---|-------|---------------|--------------------------|---------------------------------|----------------------|----------------------|------------------------|------------------|--------------------|
| | | | | | | | | | |
| | | | | | | | | | |

2.1.4 Post-conditions and Significant Results

Describe conditions that must exist at the conclusion of the Function. Identify significant items similar to that in the preconditions section.

Describe any significant results from the Function

| <i>Actor/Activity</i> | <i>Post-conditions Description and Results</i> |
|-----------------------|---|
| EnergyServiceProvider | Must be able to create sag score and penalty calculation from data collected as well as updating the baseline on a period basis |

2.2 Architectural Issues in Interactions

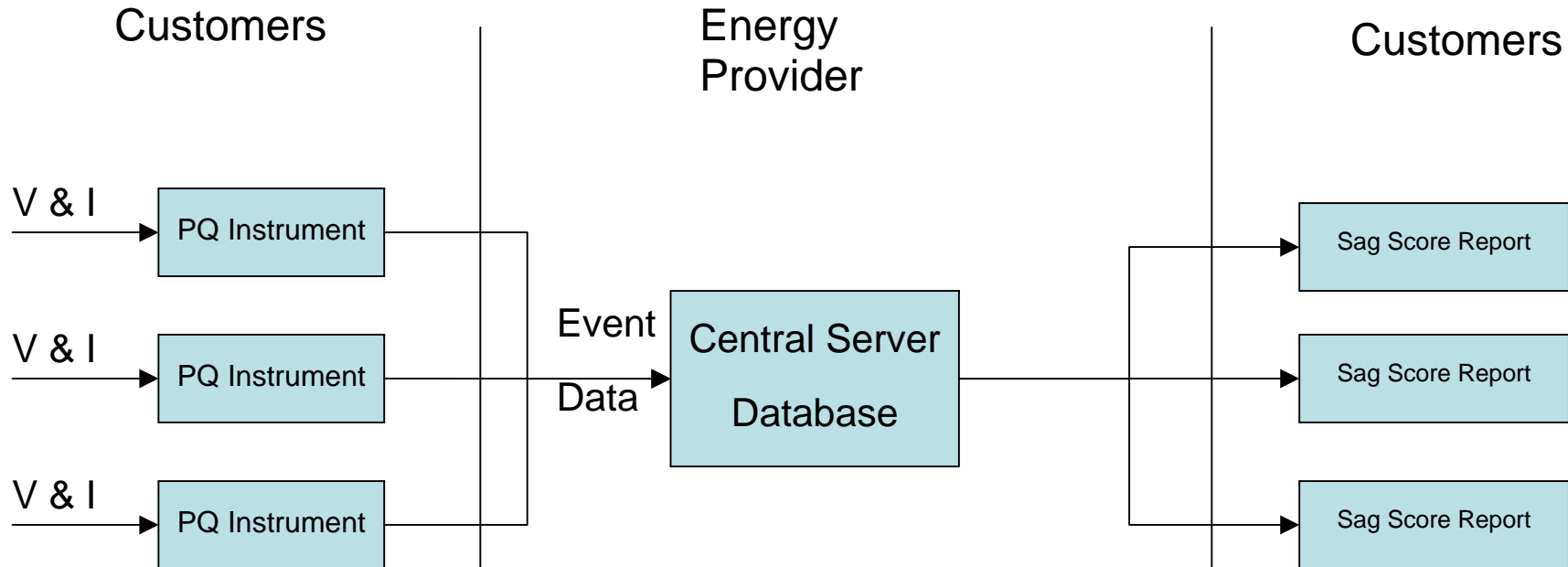
Elaborate on all architectural issues in each of the steps outlined in each of the sequences above. Reference the Step by number..



Microsoft Excel
Worksheet

2.3 Diagram

For clarification, draw (by hand, by Power Point, by UML diagram) the interactions, identifying the Steps where possible.



3 Auxiliary Issues

3.1 References and contacts

Documents and individuals or organizations used as background to the function described; other functions referenced by this function, or acting as “sub” functions; or other documentation that clarifies the requirements or activities described. All prior work (intellectual property of the company or individual) or proprietary (non-publicly available) work must be so noted.

| ID | Title or contact | Reference or contact information |
|-----|---------------------|----------------------------------|
| [1] | Andy Detloff Papers | Detroit Edison |
| [2] | | |

3.2 Action Item List

As the function is developed, identify issues that still need clarification, resolution, or other notice taken of them. This can act as an Action Item list.

| ID | Description | Status |
|-----|-------------|--------|
| [1] | | |
| [2] | | |

3.3 Revision History

For reference and tracking purposes, indicate who worked on describing this function, and what aspect they undertook.

| No | Date | Author | Description |
|----|------|--------|-------------|
| 0. | | | |
| | | | |

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