



Dispatch Data Exchange Manual

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1 Introduction

1.1 Background

1.1.1 Section 26 (1) of LI 1934 mandates GRIDCo as the Utility to establish transparent Scheduling and Dispatch processes in carrying out its responsibility as the operator of the National Interconnected Transmission System (NITS).

1.1.2 This manual therefore outlines specific rules and guidelines for the Data Exchange requirement for Dispatch operations of the Wholesale Electricity Market (WEM) to ensure system reliability and economic Merit Order dispatch processes in accordance with prudent utility practice and to minimize NITS technical losses.

1.1.3 Dispatch is the operating control of NITS to:

- a) assign specific generating units/plants and other sources of supply to effect the most reliable and economical supply to meet power demand at all times;
- b) control operations and maintenance of high voltage lines, substations and equipment, including administration of safety procedures;
- c) efficiently operate the NITS and minimize losses;
- d) schedule and manage energy supply transactions and
- e) when necessary, curtail electricity demand to balance supply from available generation.

1.2 Definitions

The definitions of capitalised items are as presented in the National Electricity Grid Code. Additionally, in this Manual, unless the context otherwise requires,

“Bilateral Agreements” means a contract entered into between a bulk customer or a distribution company and a Wholesale Supplier for the purchase of power;

“Data Exchange” means the process of exchange of require data between the System Operator and the Market Coordinator to achieve efficient dispatch

“Dependable Capacity” means the maximum megawatt output of a generating plant that it can reliably produce when required, assuming all units are in service;

“Dispatch Day” means a period from midnight to the following midnight

“Dispatch Period” means a sixty-minute time interval beginning on the hour

“Installed Capacity” means the megawatt production capacity of a generating plant based on its rated (nameplate) capacity;

“Market Coordinator” means the representative of the Market Participant responsible for market and dispatch communications with the System Operator

“Market Oversight Panel” means a body to be established by the Energy Commission according to LI 1937 16(1) to supervise the administration and operation of the Wholesale Electricity Market.

“Market Participant” means a cooperate authorised by an electricity license, to trade in the wholesale electricity market

“National Electricity Grid Code” means the technical and operational rules of practice and standards of performance rules developed and approved by the Energy Commission;

“System Operator” means the Electricity Transmission Utility responsible for the operation of Wholesale Market and operations of the NITS;

“Wholesale Electricity Market” means an electricity market established by market rules approved by the Commission for bulk trading of electricity, ancillary services or any other related electricity supply product or service

2 Overview of the NITS

The National Interconnected Transmission System (NITS) of Ghana comprises over 4,000 kilometers of high voltage electric transmission lines operating at 330 kV, 161 kV and 69 kV that interconnect more than 45 load centers. Ghana’s power network is also interconnected with the power grids of neighboring countries of La Cote d'Ivoire (CIE), Togo and Benin (CEB).

3 Major Transmission lines

The primary backbone of Ghana’s NITS is a network of 161 kV lines and 161/34.5 kV or 161/11.5 kV substations. A 161kV closed loop or grid serves the major load centres located largely in the southern part of the country. A 161kV radial line serves the relatively lightly loaded northern part of Ghana from Techiman through Tamale to Bolgatanga. Another 161 kV radial line from Techiman to Sawla serves the northwestern part of the country, with an extension to Wa, in the Upper West Region through a 161 kV insulated transmission line currently operated at 34.5 kV. A new 330 kV line from Aboadze substation near Takoradi to Volta substation in Tema was energized in 2010. Table 1 provides summary of the transmission network.

Table 1: Summary of Transmission Lines and Substations (As at April 2012)

ITEM	DESCRIPTION
330kV Lines	219.5km
161kV Lines	3,888.1km
225kV Lines	73.4km
69kV Lines	132.8km
No. of Transformers	79
Total Transformer Capacity	2,915MVA
No. of Transformer/Switching Substations	51

4 Existing Generating Plants

Ghana currently relies on two main types of generation facilities – hydroelectric and thermal plants. The Akosombo and Kpong Hydroelectric Plants are located in the south-eastern part of the country. The thermal facilities operate on natural gas, light crude oil (LCO) and diesel fuel oil (DFO) and are located at the Western and Greater Accra Regions along the coast of Ghana. Table 2 below shows the main generation facilities in Ghana.

Table 2: Nominal Capacity and Available Generation Levels of Existing Plants (as at April, 2012)

Plant	Installed Capacity (MW)	Dependable Capacity (MW)
Akosombo Hydroelectric Plant	1020	900
Kpong Hydroelectric Plant	160	140
Takoradi Thermal Power Plant-T1 (TAPCO)	330	300
Takoradi Thermal Power Plant-T2 (TICO)	220	200
Tema Thermal Power Plant-T1 (TT1PP)	126	100
Mines Reserve Plant (MRP)	80	35
Tema Thermal Power Plant-T2 (TT2PP)	50	40
Sunon Asogli Power Plant (SAPP)	200	170
Total	2,186	1885

5 Responsibility of the System and Market Operator (SO)

By the Grid Code's definition, the System Operator is the only entity that can provide system control and scheduling service. The NITS System Operator's (SO) responsibilities typically include, but not limited to the following:

- a) Transparently and Independently operating the NITS,
- b) Planning for expansion of the NITS to adequately :
 - meet forecasted growth of customers' demand,
 - evacuate power from potential generation additions, and
 - meet prudent reliability standards.
- c) Control and/or coordination of the facilities connected to the NITS;
- d) Regularly collecting load data, collating it and preparing the demand forecast on the NITS;

- e) Determining the generating capacity needed to meet the demand requirements of the NITS, including energy consumption, losses, internal usage, etc;
- f) Controlling output of various connected generation units/plants to ensure reliable and economic operation of the NITS;
- g) Collecting and updating information on all available Bilateral Energy and Capacity supply Contracts including relevant Load Demand, source of supply, contracted commercial elements /cost/charges and other relevant data;
- h) Installing, maintaining and reading the main energy export and import meters at the delivery and withdrawal points;
- i) preparing and issuing generation schedule according to procedures described in this Manual and the relevant Market Rules;
- j) issuing of Dispatch Instructions for the scheduled generating units/plants according to procedures outlined in this Manual, relevant Market Rules and the Operations Sub-Code in the Grid Code; and
- k) Fully documenting the operation of the Generation Scheduling process.

6 The System Control Center (SCC)

6.1.1 The System Control Center (SCC) is the central nerve system of the power system. It senses the pulse of the power system, adjusts its condition, coordinates its movement, and provides defense against exogenous events.

6.1.2 For the NITS, the SCC is the office from which the SO executes its responsibilities. From the SCC the SO is able to measure critical parameters of the NITS and is able to tell the condition of the NITS from the Supervisory Control and Data Acquisition (SCADA).

7 Responsibility of the Market Coordinator:

7.1 Each Wholesale Supplier, Bulk Customer, Distribution Utility or any other Market Participant that is connected to the NITS must designate and register a Market Coordinator with SO.

7.2 The Market Coordinator is designated by the Market Participant for communications with the SO with respect to the Market Participant's facility.

7.3 Every appointed Market Coordinator shall be responsible for submission and receiving of data between the Market Participant and the SO.

7.4 Specific Responsibilities of Wholesale Supplier's Market Coordinators:

- a) Regular and timely submission to the SO, of any Supply Schedule as per existing Bilateral Agreements entered into by Wholesale Supplier and Load facility (that describes the quantities of energy and capacity, source of supply for Load facility) as well as any variation thereto;

- b) ensuring that all above schedules comply with the Grid Code and Dispatch Manual,
- c) submission of Availability Declaration data (for generators), (for Loads) and any other relevant data as may be requested by the SO,

7.5 Specific Responsibilities of Bulk Customer's or Distribution Utility's Market Coordinators

- a) Regular and timely submission to the SO, Demand as per existing Bilateral Agreements entered into by Load facility and Wholesale Suppliers as well as any variation thereto;
- b) Submission of Demand Forecast and any other relevant data as may be requested by the SO,

8 Scheduling and Dispatch Procedures

8.1 Scheduling:

- 8.1.1 Scheduling of electric power generation is the assignment of generation to meet anticipated demand. This involves determination of generating unit start-up and shut-down times, ramp-up and ramp-down rates and production levels of all generation units/plants for all Dispatch Periods, considering unit technical characteristics and system restrictions.
- 8.1.2 The SO has the duty to ensure that enough generation is scheduled to meet reliability requirements of the NITS as spelt out in the Grid Code¹ and therefore must coordinate generation schedules accordingly.
- 8.1.3 Scheduling is performed on a daily basis by power system engineers with the assistance of software tools. Information is co-ordinated between SO and Market Coordinators and results in an indicative schedule of anticipated output per generator unit/plant. The indicative schedule details the discrete MW set point for each Dispatch Period.

8.2 Dispatch:

- 8.2.1 Dispatch is the process of instructing a generation unit /plant as to the level of physical operation required in a given Dispatch Period.
- 8.2.2 Dispatch is the refinement of the scheduling process and relates to the real-time control of all generation and transmission resources that are being used and/or are available to meet demand requirements of the NITS.
- 8.2.3 The dispatch process recognises the operational priorities of safety, security and economy. Dispatch aims to match demand with generation on continuous basis and where technically feasible, ensure ²adequate levels of operating reserve.
- 8.2.4 The dispatch process also manages real-time fluctuations in system demand and the output of generators and system disturbances such as generation trips or transmission contingencies.
- 8.2.5 The SO uses the demand forecast and availability declaration submitted by the generators and Load and their relevant production cost and system losses data for any given day as the basis for optimising the dispatch.

¹Available Generation currently in the NITS is not enough to meet this reliability standard ¹

² No adequate levels of Operating Reserve currently available

8.3 The SO Coordination Role

- 8.3.1 The SO projects demand based on historical data, information provided by Market Coordinators and other relevant information, considers the generating plants that are available to provide supply to the NITS, the constraints within the NITS and then schedules generation in merit-order to meet the projected demand, in accordance with the NITS performance, reliability standards and safety standards.

9 Data Exchange Procedures

9.1 Dispatch Data Exchange

- 9.1.1 Each day, the Market Coordinators of each Market Participant will submit and receive dispatch data in relation to the facility as required in forms A and B shown in Appendix 1 for the subsequent Dispatch Day.
- 9.1.2 By 10:00hrs of each day, the Market Coordinators for Bulk Customers and Distribution Utilities shall submit the Demand Forecast and Source(s) of Supply peculiar to his facility as per the Daily Demand Data Sheet in Appendix 1 for the subsequent Dispatch Day.
- 9.1.3 By 10:00hrs of each day, the Market Coordinators for Wholesale Suppliers shall submit Availability Data and Recipient(s) of Supply peculiar to his facility as per the Daily Availability Declaration Sheet in Appendix 1 for the subsequent Dispatch Day.
- 9.1.4 A daily dispatch data is one that applies to only one Dispatch Day.
- 9.1.5 The dispatch data, hereinafter referred to as Offers, shall comprise availability declarations for each Dispatch Period (in MW and MVar) for Wholesale Suppliers
- 9.1.6 The Offers for Bulk Customers shall comprise peak power demand and average power demand for each feeder (in MW and MVar) and the periods of occurrence.
- 9.1.7 The offer shall remain in place until it is superseded.
- 9.1.8 If an Offer is not submitted, the Market Participant shall be deemed to have submitted for such a Dispatch Day an offer in the same value and terms as indicated in the most recent offer made. However, all offers shall not be valid beyond a period of one week.
- 9.1.9 Should a Market Participant fail to submit data as required by this Manual, the Market Participant shall be deemed not to require power supply and power may not be delivered to the Market Participant. The issue will be referred to the Market Oversight Panel and or the Energy Commission.
- 9.1.10 Following receipt of Offers, the System Operator shall develop and issue to Market Coordinators the Dispatch Schedule for the subsequent Dispatch day by 14:00hrs of each day.

9.1.11 The Market Coordinators shall review the Dispatch Schedule and submit changes (where applicable) to the Schedule to the System Operator by 15:00hrs of each day.

9.1.12 The System Operator will incorporate the changes and submit a final Dispatch Schedule by 16:00hrs of each day to Market Coordinators.

9.1.13 Any further variations in the offers, acceptable only on account of a major breakdown or major load relief, must be made at least 180mins before the Dispatch Period.

9.2 Communication for Data Exchange

9.2.1 The following contact details will also be forwarded to the SO:

- a) Name and Title of Market Coordinator
- b) Telephone numbers of Market Coordinators
- c) Telephone number of other communication systems in relation to the facility
- d) The facsimile number for the facility
- e) The electronic mail address for the facility.

9.2.2 The Market Participant must maintain the telephone, facsimile, electronic and any other communication system in good condition and must investigate faults and repair or procure replacement promptly.

9.2.3 The contact office for the System Operator for exchange of information pertaining to the operation of the NITS shall be:

The System Control Centre
GRIDCo Head Office
Tema

Telephone: 030 7010 499

Fax:

Email:marketoperations@gridcogh.com

9.2.4 The SO and Market Participant must record each operational/Market communication (transaction) by means of a log book, a voice recorder or any form that may provide permanent records of transactions.

9.2.5 Records must identify parties, time and content of communication. Voice recording if available may be used. Both parties must give an indication when voice recording is being used.

9.2.6 The SO and Market Participant must both maintain records of transactions over five (5) years after the event.

9.3 Market Operations Timeline

9.3.1 The SO and Market Coordinators of each Generator/Wholesaler and Load shall perform the actions as applicable to his facility at the time line shown in Table 3 below:

Table 3: Time Lines for Data Exchange Activities

Time Line	Data Exchange & Actions Requirement	
Day Ahead	10:00 AM	<ul style="list-style-type: none"> ▪ Loads provide hourly load forecast for subsequent Dispatch Day ▪ Wholesale Suppliers provide availability declarations for each generating unit for the subsequent Dispatch Day
	2:00 PM	<ul style="list-style-type: none"> ▪ SO provides preliminary dispatch schedule for subsequent Dispatch Day
	3:00 PM	<ul style="list-style-type: none"> ▪ Loads provide updated schedule data ▪ Generators provide updated availability data
	4:00 PM	<ul style="list-style-type: none"> ▪ SO provides Dispatch Schedule to applicable Loads and generators. It also provides total hourly system load
	5:00 PM	<ul style="list-style-type: none"> ▪ Loads and generators acknowledge SO Dispatch Schedule

10 Operation Monitoring

10.1 Measurands

The system operator monitors the following continuously:

- MW
- MVAR
- MVA
- Bus kV and Feeder kV

- System Frequency
- Current, (Amps) etc.
- Power factor

10.2 Reporting Centres

10.2.1 The parameters at all major load centers are monitored to ensure system reliability and security:

10.3 Reporting on Actual versus Forecast Values

10.3.1 The SO shall issue a daily report that compares the forecast and actual demand and any other parameters seen on the system on the previous day explaining any variations appropriately.

10.3.2 The report shall be made available to Market Participants at 12.00 p.m.

11 Event Information and Reporting

11.1 Importance of Event Reporting

11.1.1 For secure and reliable operation of the NITS, the SO depends on timely and accurate reporting and exchange of information. This is particularly important during grid disturbances or a crisis situation. All events on the NITS are logged with synchronised timing across the system indicating the equipment involved if any, the personnel, and source of information.

11.2 General Reporting

11.2.1 Any operational activity planned to be carried out by the SO, which may have an impact on the NITS, or on any of the grid elements, shall be reported by SO to the Market Coordinators in advance.

11.2.2 The Market Coordinators must timely report any event in their facility that will impact on the NITS to the SO.

11.2.3 Oral reporting of events to SO shall be followed with a detailed report in writing within 24 hours with the following details of the event:

- i. Time & date of event
- ii. Location
- iii. Plant and/or equipment directly involved
- iv. Description and cause of event
- v. Antecedent conditions

- vi. Demand and/or generation (in MW) interruption and duration of interruption
- vii. All relevant system data including copies of records of all recording instruments (including disturbance recorders event logger, etc.)
- viii. Sequence of tripping with time
- ix. Details of relay flags
- x. Remedial measures.

11.2.4 The SO shall give a Daily Incident Report to all Market Coordinators detailing all incidents of the previous day.

11.2.5 If the system restoration after a grid disturbance is likely to be delayed beyond thirty (30) minutes and is likely to affect the public in a particular area or across the country, the public in that area or across the country will be duly informed.

11.3 Outage Reporting

11.3.1 The Market Coordinator is responsible for reporting both planned and unplanned outage to the SO. Outages must be reported according to 11.2.3 for:

- a) Any planned or unplanned outage to equipment that either forms part of or is connected to the NITS
- b) Any planned outage that will cause a change of 5% or more to the facility's normal consumption/supply pattern.
- c) Any process change or unplanned outage that causes a change of 5% or more to the facility's normal consumption pattern for a period of 8 hours or longer.

11.3.2 Market Coordinators are expected to supply/consume according to their Offer during a planned outage. Therefore, dispatch data should reflect the expected supply/consumption during planned outages. This has two main aspects:

- The outage plan should indicate if the outage includes testing or varied supply/consumption.
- If a Market Coordinators normally offer part of a facility's capacity as a minimum supply/consumption level, the Market Coordinator must remember to ensure that the total Offer reflects the facility's actual supply/consumption. The Market Coordinators must ensure that the Offer reflect any outage that reduces the facility's ability to supply/consume to below the normal minimum injection/withdrawal level. In the event of a total outage, the Market Coordinator must cancel all Offer in the system.

11.3.3 Market Coordinators are expected to update their bid and offer data and to notify the System Operator if they need to make changes to an outage plan.

APPENDIX I:

**Demand and Availability
Data Sheets**



DAILY DEMAND DATA SHEET FOR DISPATCH DAY -----/-----/2012

1. Main Addresses

Submit this form by email to marketoperations@gridcogh.com

Organisation Name	_____
Mailing Address	_____
Location	_____
City	_____
Telephone	_____

2. Market Coordinator

Name _____	Designation _____
Cell phone _____	Other Phone _____
Email _____	Fax Number _____

3. Details of Demand

Date: -----/-----/2012

Source(s) of Power Supply and Amount of Power (MW)

- I. _____
- II. _____
- III. _____

<i>Hour</i>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
<i>Demand (MW)</i>																									

Comments:

Signatory: _____

Date: _____

Name: _____

Designation: _____



DAILY AVAILABILITY DECLARATION SHEET FOR DISPATCH DAY ----/----/2012

1. Main Addresses

Submit this form by email to marketoperations@gridcogh.com

Organisation Name _____	Mailing Address _____	Location _____
City _____		
Dispatch Coordinator		
Name _____	Cell phone _____	Other Phone _____
Email _____	Fax Number _____	

2. Recipient of Power and MW

Date: ----/----/2012

- I. Eg. Anglogold Ashanti – 40MW..
- II.
- III.

3. Details of Unit Availability

Unit No.:

Hour	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Total
MW																									
MVAr																									

Unit No.:

Hour	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Total
MW																									
MVAr																									

Unit No.:

Hour	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Total
MW																									
MVAr																									

Comments

Signatory: _____

Date: _____

Name: _____

Designation: _____

