

TBDG Design Note

Document Title:	Install and Commission
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Purpose of Paper*	FOR INFORMATION	FOR COMMENT	FOR DECISION
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Summary of Document Purpose	To provide clarification and guidance on the installation and commissioning of Smart Metering Systems		
Submitted By	Mike Bennett, DECC	Meeting Date	27/08/2014
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*Delete as appropriate

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1. Introduction

1.1 Summary of action required from TBDG

1. TBDG is invited to note this paper and that no changes are required to existing baseline documents (SMETS, CHTS, DCC User Gateway Catalogue) or the drafting of SEC4.

1.2 Identification of the issue

2. This Design Note describes the steps that Suppliers and Registered Supplier Agents¹ will need to take to firstly install and then commission Smart Metering Systems where there is WAN coverage² and includes :
 - Pre-installation activities and notifications
 - Installing Communication Hub and Smart Metering Devices
 - Handover of Smart Metering Devices
 - Establishing the HAN
 - Commission Smart Metering Devices
 - Joining type 1 and type 2 devices
 - Post Commissioning activities
 - Credential management
 - Configuration

2. Background and Context

3. Smart meters are designed to be operated in conjunction with a WAN service which will transfer information between equipment in the home and DCC, for onward communication with DCC Users (suppliers, network operators and other users).
4. Processes for installing and commissioning devices are central to their ability to be operated within DCC. These processes also establish Smart Metering Inventory relationships between devices and MPxNs (meter points).
5. This Design Note provides detail on processes that all Suppliers and Meter Operators may follow when installing and commissioning devices. This document identifies below where section H5 of the SEC requires that this is conducted in a particular sequence. This Design Note also recognises that there is scope for organisations to develop processes that suit their business requirements and does not seek to unnecessarily constrain innovation.
6. Processes that are not relevant to DCC (e.g. making an installation appointment with a customer) are not covered in this Design Note.
7. The relevant section of the SEC for Install and Commission is Section H.

¹ Registered Supplier Agents may install Smart Metering devices however only Suppliers may commission Smart Metering Systems (a Smart Metering System is defined as either (a) an Electricity Smart Meter together with the Communications Hub with which the meter is Associated; or (b) a Gas Smart Meter together with the Communications Hub with which the meter is Associated and an Associated GPF (together in the case of either (a) or (b) with the other Type 1 Devices Associated with the meter).

² No WAN scenarios are covered in the No WAN Design Note

8. There are a set of actions that must take place to enable Smart Meters to communicate with the DCC over the WAN, these include:
- Notifying DCC of the Smart Metering Devices to be installed so that DCC can add them to its Smart Metering Inventory
 - Installing and commissioning a Communications Hub (CH) – this means that the CH has end to end communications with the DCC, i.e. is on the WAN
 - Installing Smart Metering Devices and “whitelisting” (i.e. adding to the Device Log) them on the CH
 - Sending a Commissioning Service Request (SR) to synchronise time and provide the MPXN for display on the meter
 - Updating inventory to record that a Smart Metering Device is now “commissioned”
 - Configuring the Smart Metering Device to the requirements of the specific installation
9. Once a Smart Metering System is installed and commissioned the responsible supplier then has 7 days to:
- Instruct the device to regenerate its own private security key, and then manage the Certificate Signing Request such that the new certificate corresponding to the private key is stored within the SMKI Public Certificate Store and is also sent to the device
 - Replace the certificates in the Network Operator “slots” with the relevant Network Operator Certificates

3. Pre-installation activities

10. This section describes the activities that must be completed before a Smart Meter is installed.
11. Suppliers must ensure that Smart Meters have all their trust anchor cells populated as follows, prior to installation (as defined in GBCS):

<u>Remote Party Role Code</u>	<u>Certificate</u>
Root	the Root OCA Certificate
Recovery	the DCC Recovery Certificate
accessControlBroker	a DCC Access Control Broker Certificate
transitionalCoS	the DCC Transitional CoS Certificate
Supplier	One of the following: (a) one of the relevant Supplier Party's Organisation Certificates;

	<p>(b) a DCC Access Control Broker Certificate;</p> <p>(c) (where the consent of that other Supplier Party has been given) another Supplier Party's Organisation Certificate.</p>
networkOperator	<p>One of the following:</p> <p>(a) one of the relevant Network Operator's Organisation Certificates;</p> <p>(b) one of the relevant Supplier Party's Organisation Certificates;</p> <p>(c) (where the consent of that other Supplier Party has been given) another Supplier Party's Organisation Certificate;</p> <p>(d) a DCC Access Control Broker Certificate.</p> <p>(NB Network Operator Certificates are required for Electricity Smart Meter and Gas Proxy Function only)</p>

12. The table below (from GBCS) illustrates which devices require which security credentials:

				Type of Device (✓ = is required; empty = is not required)					
				ESME	GSME	CH (CHF)	CH (GPF ³)	HCALCS	PPMID
deviceType value(s)				1	0	2	3	4	5
TrustAnchorCellIdentifier									
No	remotePartyRole	keyUsage	cellUsage						
1	root	keyCertSign	management	✓	✓	✓	✓	✓	✓
2	recovery	digitalSignature	management	✓	✓	✓	✓	✓	✓
3	supplier	digitalSignature	management	✓	✓		✓	✓	
4	supplier	keyAgreement	management	✓	✓		✓		

³ Supplier and Network Operator credentials on the Communications Hub (Gas Proxy) relate to the supply of gas only. These Trust Anchor Cells on a Communications Hub are still required and valid where there is no GSME connected to the SMHAN, but the stores should be populated with Access Control Broker certificates (so ensuring the Gas Proxy functionality, apart from Update Security Credentials, is inoperable)

5	supplier	keyAgreement	prePaymentTopUp	✓	✓				
6	networkOperator	digitalSignature	management	✓			✓		
7	networkOperator	keyAgreement	management	✓			✓		
8	accessControlBroker	digitalSignature	management			✓			✓
9	accessControlBroker	keyAgreement	management	✓	✓	✓	✓	✓	✓
10	transitionalCoS	digitalSignature	management	✓	✓		✓	✓	
11	wanProvider	digitalSignature	management			✓			

13. Communications Hubs are provisioned by the DCC and Suppliers and meter operators will need to forecast and order Communications Hubs following DCC Self Service Interface processes.
14. Smart Meters and other devices (except type 2 devices e.g. CADs) intended for installation must be notified to the DCC - this may be done using Service Request 12.2 Device Pre-notification. Devices must be listed on the Certified Products List to be accepted by DCC. Accepted devices are listed on the Smart Metering Inventory with a status of Pending.
15. Suppliers and Meter Operators may wish, as part of their roll-out planning activities, to check the WAN coverage at particular postcodes. This may be done using Service Request 12.1 Wan Matrix, or via the Self Service Interface.
16. Suppliers and Meter Operators may wish to check the Smart Metering Inventory (via Service Request 8.2) to see if any devices have already been installed at a site – e.g. has a Communications Hub already been installed.
17. Suppliers and Meter Operators may wish to pre-pair devices (i.e. Smart Meter and Communications Hub) or pre-configure devices (possibly with a default configuration and tariff at manufacture).

4. Installation and Establishing the HAN

17. Where a Communications Hub has not been installed at a site, the installing Supplier or Meter Operator must first install one and establish WAN connection (where possible).
18. Once the Communications Hub is installed the installer powers it up. The Communications Hub is designed to automatically detect the WAN. When it does so, it initiates communications with the DCC, and request to join the WAN. The DCC, after validating the Communications Hub Device ID:
 - Records the Communications Hub Device ID and WAN address mapping in Inventory
 - Confirms WAN joining to the Communications Hub
 - Establishes valid UTC Time to the Communications Hub
 - Records the Communications Hub Device ID mapping to the Gas Proxy Function Device ID mapping in Inventory

- Updates the status of both the Communications Hub and the Gas Proxy Function to Commissioned

Full details of Communications Hub installation processes can be found in the Communications Hub Support Materials.

19. Current Communications Hub designs will visibly indicate that there is WAN connection. Should the Communications Hub fail to connect to the WAN, the Installer should follow instructions in the Communications Hub Support Materials. Dependent on Communications Hub variant this may require installation of an additional aerial. Should the inability to connect to the WAN persist the installer will need to decide whether to abort the installation or follow the Install and Leave process (see No WAN design note). In all cases of WAN failure the Supplier should report an incident to the DCC in order for it to be resolved.
20. The Installer should record the Communications Hub ID and Gas Proxy Function ID (if installing Gas Smart Metering Equipment).
21. Once the Communications Hub has connected to the WAN, the installer may request that Devices are added to the Communications Hub Function Device Log. This step must be completed before Devices can exist on the HAN. Once Devices are installed and powered on, the installer notifies the Supplier of the Communications Hub Device ID and the Device ID of the device to be added to the HAN. The Supplier generates Service Request 8.11 Update HAN Device Log per device to be added and includes details of the Communications Hub Device ID, the Device ID, device specific installation code, and the MPxN at which the device is being installed. The DCC, on receipt of such a Service Request, in addition to its standard checks, will confirm that the requesting Supplier is the registered Supplier for the MPxN given. Satisfied it will then instruct the Communications Hub to:
 - a. Add the device to the CHF device log
 - b. Allow joining (set the CH to “pairing mode”)
 - c. Accept a join request from the defined device using the install code (TC Link Key) provided
 - d. Send a response confirming successful completion of the join

It is worth noting that the Communications Hub is set to “pairing mode” for a minimum of 3600 seconds (1 hour) and so where the device being added to the HAN is a CAD, the consumer should be informed of this time limit.

22. The DCC will:
 - a. Update the Smart Metering Inventory status of the newly joined Smart Metering Device to “installed not commissioned”
 - b. Record the relationship of the Smart Metering Device ID to the MPxN provided in the service request
 - c. Record the relationship of Device ID to Communications Hub ID
 - d. Notify the Supplier of the outcome of the request

23. This process is repeated for each device that is to be added to the HAN.

5. Commissioning Smart Meters

25. Smart Meters are designed to send a Commissioning Alert when they establish end to end communications via the Communications Hub. This alert is to inform the Supplier (where their credentials are present in the Suppliers Trust Anchor Cell on the device) that the device is now ready to be commissioned. Where credentials other than the Suppliers are present in the Suppliers Trust Anchor Cell, the meter will not produce an alert – this is because GBCS requires that the meter take no action when it such action is reliant on the correct organisation credential being in a Trust Anchor Cell and this is not true.
26. Where a credential other than the Supplier is populated in the Supplier’s Trust Anchor Cell (e.g. DCC) the Supplier will have to request that that party “hands over” the Smart Meter. Where it is the DCC, the Supplier should use Service Request 6.21 Request Handover Of DCC Controlled Device. Where it is another party (e.g. within a group of companies) the Supplier must ask (outside DCC processes) the party whose credentials are on the device to update security credentials to the Supplier’s – this update can be achieved using Service Request 6.15 Update Security Credentials.
27. When the meter is ready to be commissioned (as a result of either 25 or 26 above) the Supplier sends service request 8.1 Commission Device to the DCC. This service request:
 - a. Instructs the meter to synchronise its clock with the Communications Hub clock
 - b. Sets the MPxN value for display on the meter
 - c. Sets the Smart Metering Inventory Status of the device to Commissioned - the meter is now in operation and available to DCC Service Users
28. When a meter has been commissioned the DCC will notify the relevant Network Operator of the MPxN and Device ID of that meter.

6. Gas Specific Activities

29. The Communications Hub contains a Gas Proxy Function. This stores data from the Gas Meter (as the Gas Meter relies on a battery for power it is a “sleepy device” that “wakes” and sends/receives information every 30 minutes, thus the Gas Proxy Function provides access to data when the Gas Meter is “asleep”). Because the relevant Supplier and Network Operator for a Gas Proxy Function are not known at the point of install, it is provisioned with DCC certificates in the Supplier and Network Operator trust anchor cells.
30. Prior to operating the Gas Proxy Function, the relevant Supplier must request that DCC “hands over” the Gas Proxy Function, as in 27 above.
31. The Supplier also needs to “join” the Gas Proxy Device to the Gas Meter. Joins are described in section 7 below. In the case of the Gas Meter, the Gas Proxy Function Device ID needs to be written to the Gas Meter Device Log.

7. Joining Devices

32. In order to communicate commands and data certain devices need joining. This means that they know of and are permitted to communicate with each other. Such relationships include:
- Gas Proxy Function to Gas Meter
 - Type 1 device (PPMID/HCALCS/ALCS) to Electricity meter and Gas meter (PPMID only) and vice versa
 - Type 1 device (PPMID) to GPF
 - Type 2 device (IHD/CAD) to Electricity meter / GPF
33. Any devices to be joined together must first be listed on the Communications Hub Function device log, i.e. devices must be members of the HAN. It is not necessarily to specifically add the gas proxy function to the Communications Hub Function device log, as the Gas Proxy Function is intrinsically known to the Communications Hub Function.
34. A join is achieved using service request 8.7 Join Device. This service request writes the device ID of the device in question to the device log of the meter defined in the service request (both device IDs are required for this service request). Where the device is a type 1 device the service request writes the meter's device ID to the device log of the type 1 device. NB joining a type 1 device to a meter is a critical command as type 1 devices can send / receive supply affecting commands.
35. Cryptographic protections pertaining to device Joins vary according to device to be joined as listed below (as defined in GBCS):
- Type 2 device (CAD) is non-critical and does not require Suppliers digital signature
 - A PPMID requires a command to be sent to the ESME/GSME, which is critical and thus requires digital signature by the Supplier and a command to be sent to the PPMID, which is critical and requires digital signature by the Access Control Broker (DCC) as the PPMID holds security credentials of the Access Control Broker
 - Where a PPMID is to be joined to a GPF, the command is non-critical and does not require Suppliers digital signature
 - Where a GPF is to be joined to a GSME, the command is non-critical and does not require Suppliers digital signature
 - An HCALC requires a command to be sent to the ESME which is critical and requires signature by the Supplier and a command to be sent to the HCALC which is critical and requires signature by the Supplier (as the HCALC holds security credentials of the Supplier)

8. Post Installation Requirements

36. Within 7 days of the Smart Meter being commissioned, the Supplier is required to ensure that the Smart Meter updates its private key material. This facilitates simpler manufacturing processes where private key material is inserted onto or generated by a meter that do not

require more stringent controls. The Supplier sends service request 6.17 Issue Security Credentials which instructs the meter to regenerate its private key and send a Certificate Signing Request (CSR). The Supplier, on receipt of the CSR, validates the CSR and forwards to the Registration Authority to request a public certificate for that meter's private key, as defined by SMKI

37. Once the Registration Authority has validated the CSR, it will send:
 - a. Public certificate to the DCC (for entry in the Public Key Repository)
 - b. Public Certificate Binding to the Supplier

38. The Supplier is then required to send the Public Certificate Binding to the meter it relates to, using service request 6.15 Update Security Credentials. On receipt of the successful response from the device the Supplier should update device certificate pointers for that device.

39. The Supplier is also obliged to, within 7 days of the Smart Meter being commissioned:
 - a. To ensure that the relevant Network Operator's organisation certificates are present on the device
 - b. Update at least one organisation security credential on the device (this has the effect of validating security credentials on the device)

40. As the relevant Network Operator may not be known at the point the meter is provisioned with certificates (as in Section 3 above) and will not be known when the Gas Proxy Function is provisioned with certificates, Suppliers can discharge both obligations in para 39 above by updating the Network Operator's security credentials.

41. Again the route to achieve this depends on the credentials currently populating the Network Operator's trust anchor cells. Where it is the Supplier's Certificate, service request 6.15 is used to update the credentials to those of the relevant Network Operator. Where it is DCC credentials, service request 6.21 Request Handover of DCC Controlled Device is used. This process results in a notification being sent to the Network Operator whose credentials are now present on the device, that the device is ready use.

9. Configuration

42. Suppliers will need to configure smart meters to fulfil the terms of their contract with their customer – i.e. setting tariff, price, and payment mode. Tariff is set using service request 1.1 Update Import Tariff; price may be set using service request 1.2 Update Price; and payment mode (prepay/credit) may be set using service request 1.6 Update Payment Mode.

43. Where prepayment mode is selected Suppliers will need to set other prepayment parameters using service request 2.1 Update Prepay Configuration. Suppliers and Network Operators will also need to configure devices to meet their requirements. Suppliers and Network Operators may configure devices using such service requests as required. Of interest for initial configuration may be:

- 6.4 Update Device Configuration (Load Limiting) [Supplier]
- 6.5 Update Device Configuration (Voltage) [DNO]
- 6.6 Update Device Configuration (Gas Conversion) [Supplier]
- 6.7 Update Device Configuration (Gas Flow) [Supplier]
- 6.8 Update Device Configuration (Billing Calendar) [Supplier]
- 6.12 Update Device Configuration (Instantaneous Power Threshold) [Supplier]
- 6.14 Update Device Configuration (Auxiliary Load Control) [Supplier]
- 6.19 Set Device Configuration (Local Time Change Calendar) [Supplier]
- 3.5 Reset Privacy PIN [Supplier]

44. Suppliers may wish to send a “welcome” message to the customer to the meter or IHD using service request 3.1 Display Message
45. DCC Service Users may also wish to establish schedules for meter reading with the DCC . This process means that DCC holds a defined schedule of read dates for that meter on behalf of a specific service user and will execute specific read requests at the frequency defined until instructed otherwise. Schedules may be established using service request 5.1 Create Schedule.

10. HHT Operations

46. Suppliers and Meter Operators may use a Hand Held Terminal to carry commands to Smart Meters for installation (and other) purposes.
47. To do this, service requests should be submitted to DCC for transformation, anomaly detection and the application of the DCC MAC, but marked as for return to the requester over the User Gateway (this is defined service request functionality) after which they may be loaded onto a Hand Held Terminal for local delivery. It should be noted that the security model requires that all cryptographic protections required for WAN delivered commands are required for locally delivered commands, via the Hand Held Terminal.
48. In order to deliver commands locally, the Hand Held Terminal will have to establish communication with the HAN via the Communications Hub. Current proposals (to be incorporated into GBCS) allow for at least two methods to achieve this:
49. Method 1: Installer Selects Communications Hub

Step	Action
1	The Comms Hub opens inter-PAN communication for 1 hour after power cycling.
2	The HHT is powered on
3	The HHT performs an active scan
4	The HHT will list the EPIDs from all neighbouring ZigBee Coordinators (using the EPID and PAN coordinator flag field in the beacon) on a display
5	The installer (who knows the Consumer’s HAN EPID as its printed on the CH, as per CHTS) picks the device broadcasting a beacon with the correct EPID, which should be the Comms Hub
6	The HHT initiates inter-PAN CBKE with the Comms Hub
7	The Comms Hub responds to inter-PAN CBKE
8	If inter-PAN CBKE completes successfully: <ol style="list-style-type: none"> 1. The HHT sends its installation code and EUI-64 to the Comms Hub

	<p>secured using the symmetric key obtained using the CBKE process</p> <ol style="list-style-type: none"> 2. The Comms Hub adds the HHT to its whitelist for local devices 3. The HHT joins the network as normal
9	Otherwise, it rejects the HHT

50. Method 2: HHT Uses Optical Scan

Step	Action
1	The Comms Hub opens inter-PAN communication for 1 hour after power cycling.
2	The HHT is powered on
3	The HHT optically scans identity information from the Comms Hub barcode (EUK requirement) , including the EUI-64 (which will be in the beacon)
4	The HHT performs an active scan
5	The HHT will pick the neighbouring ZigBee Coordinator broadcasting a beacon with the EPID matching the scanned information, which should be the Comms Hub
6	The HHT initiates inter-PAN CBKE with the Comms Hub
7	The Comms Hub responds to inter-PAN CBKE
8	<p>If inter-PAN CBKE completes successfully:</p> <ol style="list-style-type: none"> 1. The HHT sends its installation code and EUI-64 to the Comms Hub secured using the symmetric key obtained using the CBKE process 2. The Comms Hub adds the HHT to its whitelist for local devices 3. The HHT joins the network as normal
9	Otherwise, it rejects the HHT