ene.field project

project meeting 20-21/02/2013 Berlin

workshop data monitoring

Status: D 27/02/2013

(D-Draft, FD-Final Draft, F-Final)

Dissemination level: PP

(PU – Public, PP – Restricted to other programme participants, RE – Restricted to a group specified by the consortium, CO – Confidential)

Contents

1. **Minutes**
2. **List of participants**
3. **Presentation**

Minutes on WP2 monitoring workshop

20.02.13, Berlin, ene.field project meeting

For list of participants see attachment

(1) **Technical Procedure** *(handling agreement)*

Way of approval was introduced as to automatically accept the technical procedure by not objecting to a major version circulation within three weeks.

Comment: we need actual agreement on critical changes of the document like the clean room process list.

Technical procedure will be put into internal section of homepage for consortium to access.

(2) **Preamble**

Institutes and utilities need vision on the document and want to be included in the circulation list.

(3) **Questionnaire**

DTU and EST have to create questionnaires as well. WP2 has created a technical questionnaire asking for data on the household, heating installation and so on. Goal is to put together all questionnaires into one package and give this to the end-user / installer one time via the manufacturer. DTU and EST have the surveys ready within two month from this meeting.

Clarify which manufacturer is responsible for the translation of the questionnaire(s) in which language has to be agreed. A fair distribution is favoured. A back-translation of the replies is not needed, because the questions have to be answered with quantitative information (numbers, drop-down and multiple choice).

(4) **Monitoring**

(4.1) measured Data Points

see presentation

(4.2) Detailed Monitoring

We need to have 20% of detailed monitoring because DoW says so.

Remark that households in certain countries are more interesting than others. Maybe manufacturers can use this fact when distributing the detail monitored systems.

At least one manufacturer needs to measure the electricity consumption of peak load boiler which is not included in the measurement scheme yet.

(4.3) Overall Monitoring

A summary and description of the current state of work was given.

(5) **Issues Encountered**

A list of issues encountered categories has been adapted to a final version which was presented. The final amount and type of categories are fixed herewith with the exception of the categories “stack”, “reformer” and “inverter”. A short statement will be circulated to fix this last open task. The format of the collected data in form of “unit ID”, “issue category”, “time of entrance” and “time of confirmation” was accepted and is herewith fixed, too.

(6) **Laboratory Tests**

General layout is clear and will be described in technical procedure. A suggestion for the splitting of costs will be proposed in the next technical procedure. DBI and GWI will

(7) **Clean Room Process**

The concept of the Clean Room Process was shown. The concept will be defined in more detail in the next version of the technical procedure and needs acceptance within the paper.

(8) **General**

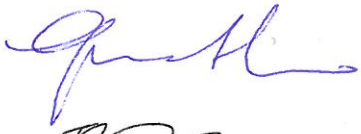
Another meeting or at least netmeeting was proposed after the monitoring workshop to discuss further details of monitoring and to finalize the technical procedure on data handling.

ene.field

Ene.field Project Consortium Meeting

Workshop on data monitoring- Berlin

Name	Organization	Signature
CISA RUF	ELEMENT ENERGY	
IAN WALKER	ELEMENT ENERGY	
TILL BACHMANN	EIFER	
Aksel Pedersen	DONG Energy	
Fiona Riddoch	COGEN EUROPE	
Will Keown	British Gas	
ADRIAN RICHARDSON	BRITISH GAS	
STEFANO MODENA	SOFCPOWER	
MADS MELCHIORS	DANTHERM POWER	
PER BALSLEV	DANTHERM POWER	
Michael Braun	Baxi Innotech	
Philipp Klose	Baxi Innotech	
Mike Harms	Baxi Innotech	
CHRIS EVANS	CERES POWER	
JONATHAN WATKINS	CERES POWER	
Marc Schellen	Vaillant	
MARTIN EICHELBRÖNNER	ELCORE	
ANDRÉ ACKERMANN	RBZ GmbH	
Katrin Groner	RBZ GmbH	

Per Hjalmarsson	DTU	
Eva Rønn Nielsen	DTU	
Fleni Seriatou	HyER	
María Gómez-Roino	COGEN	
TOMAS LARRIBA MARTINEZ	POLITO	
ALESSANDRO GRAZZARO	ENVIPARK	
TOM BYRNE	EST	
Frank Erler	DBI	
Detlev Dehn	HEXIS	
Rolf Clemens	(Hexis	
Wolfgang Friede	Bosch Thermotechnik	W. Friede
Stéphane HODY	GDF SUEZ	
Clément DUPE	GDF SUEZ	

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European-wide field trials for residential fuel cell micro-CHP

Workshop data monitoring

DBI GTI Gastechnologisches Institut

gwi Gas- und Wärme-Institut Essen e.V.

New Energy World JU
fuel cells & hydrogen for sustainability

(1) **Technical Procedure** *(handling agreement)*

(2) **Preamble**

(3) **Questionnaire**

(4) **Monitoring**

- **(4.1) measured Data Points**
- **(4.2) Detailed Monitoring**
- **(4.3) Overall Monitoring**

(5) **Issues Encountered**

(6) **Laboratory Tests**

(7) **Clean Room Process**

(1) Technical Procedure

- First draft circulated
- Language not yet adjusted nor checked for spelling
- Technical procedure as continuous / dynamic document from first major version
  - List of changes will be included in each version for fast approval
  - Typical adds will be changes in sensor list and clean room process list
- Way of approval for each version update:
  - Update circulated via email and placed in member area of enefield homepage
  - Three weeks time for objection via email otherwise approved automatically
  - Email contact will be made public in final version
- Goal: first major version at 25-03-13

- For today:
  - List of attendance with signature
  - Minutes for today will include way of approval from first major version on

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(2) Preamble - 1/2

This document is the working and data handling basement for

1. DBI - Gastechnologisches Institut gGmbH Freiberg (short: DBI)
2. Gas- und Wärme-Institut Essen e.V. (short: GWI)
3. ELEMENT ENERGY

1. BAXI INNOTECH GmbH (short: Baxi)
2. Bosch Thermotechnik GmbH (short: Bosch)
3. Ceres Power (short: Ceres)
4. Dantherm Power A/S (short: Dantherm)
5. Elcore GmbH (short: Elcore)
6. Hexis GmbH (short: Hexis)
7. RBZ - Riesaer Brennstoffzellentechnik GmbH (short: RBZ)
8. SOFCpower
9. Vaillant Deutschland GmbH & Co. KG (short: Vaillant)

(2) Preamble - 2/2

- This technical procedure does not include any other participants of other work packages

- Technical procedures with other, non above named partners have to be agreed additionally if needed.

➔ **DBI/GWI only responsible for data passed on from them, not responsible for use of data by other institutes!**

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(7) **Clean Room Process**

(3) Questionnaire

- **Circulation of first draft on 29th of January**
  - **Amount of replies: 3 / 9**
    (2 explicit acceptance, 1 constructive critical statement)

- regarding the huge amount if input we are herewith focussing on the main, general statements
  1. **local language is required**
     - English questionnaire with an included language sheet which can be adopted by each manufacturer separately
  2. **paper questionnaire is required**
     - the next version of the questionnaire will be in a standardised format that can be filled out digital (in Excel) or non-digital (printed version)
       ➔ manufacturers are responsible to digitalise the paper versions!
  3. **max. 3 pages / max. 15 min time to fill in**
     - a maximum of 3 pages is not realisable, because of some multiple choice paper questions (tick one or more boxes)
     - the timeframe is an ambitious goal, but this seems possible

(3) Questionnaire (2)

- Additional need for questionnaires from WP3/WP5
- Questionniares from analysis: → Eva

- Goal: combine all questionnaires and surveys into one package that needs to be filled out at installation

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(6) **Laboratory Tests**

(7) **Clean Room Process**

(4) Monitoring

- Need for monitoring in project -> DoW (WP2, WP3, WP5 do analysis work)
- **But:** Reduced budget does not allow extended monitoring equipment on every installation (funded is only about 800 EUR/unit)
- **WORKAROUND: four columns of monitoring to create solid data base for analysis work**

Monitoring ene.field

Detailed monitoring

- 10-20% of units
- FC, boiler, household
- Data from extra installed meters
- DBI receives all meter readings and brings it through clean room
- 15 minute time steps

Overall monitoring

- All units
- Try to gather same data as detailed monitoring through other sources
- Manufacturer forwards data to GWI (once a month)
- Longer timesteps

Lab Test

- One unit per manufacturer
- About 2 weeks in lab DBI / GWI
- Performance measured in lab conditions
- Unit can be installed at trial afterwards

Installer questionnaire

- One time information about household and installation
- Extended for detailed monitoring

--- solid database for analysis in WP2,3,5 ---

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(5) **Issues Encountered**

(6) **Laboratory Tests**

(7) **Clean Room Process**

(4.1) Monitoring | measured Data Points

meter number	type	measured variable	code	physical quantity	measure-ment unit
1	gas	consumption peak load boiler	ZHG_Gas	V	m³
2	gas	consumption fc	BZE_Gas	V	m³
3	electricity	power consumption fc	BZE_Wbezg	W	kWh
		power export fc	BZE_Wabg	W	kWh
4	electricity	power consumption house	HA_Nbezg	W	kWh
		power export house	HA_Neinsp	W	kWh
5	heat	heat output fc	BZE_WM	Q	kWh
		outgoing temperature	BZE_TV	T	°C
		return temperature	BZE_TR	T	°C
		flow rate	BZE_V	V	m³/h
6	heat	heat output peak load boiler	ZHG_WM	Q	kWh
		outgoing temperature	ZHG_TV	T	°C
		return temperature	ZHG_TR	T	°C
		flow rate	ZHG_V	V	m³/h
7	heat	heat output hot water	WW_WM	Q	kWh
		hot water temperature	WW_TA	T	°C
		cold water temperature	WW_TE	T	°C
		flow rate	WW_V	V	m³/h
8	heat	heat output space heat	HK_WM	Q	kWh
		outgoing temperature	HK_TV	T	°C
		return temperature	HK_TR	T	°C
		flow rate	HK_V	V	m³/h
9	temperature	temperature outside	TA	T	°C
		relative air humidity	Fi_A	j	%
10	temperature	inside living area	TI	T	°C

Data needed for a complete energy balance of mCHP and domestic buildings

Additional collums needed?

(1) **Technical Procedure** *(formerly known as data handling agreement)*

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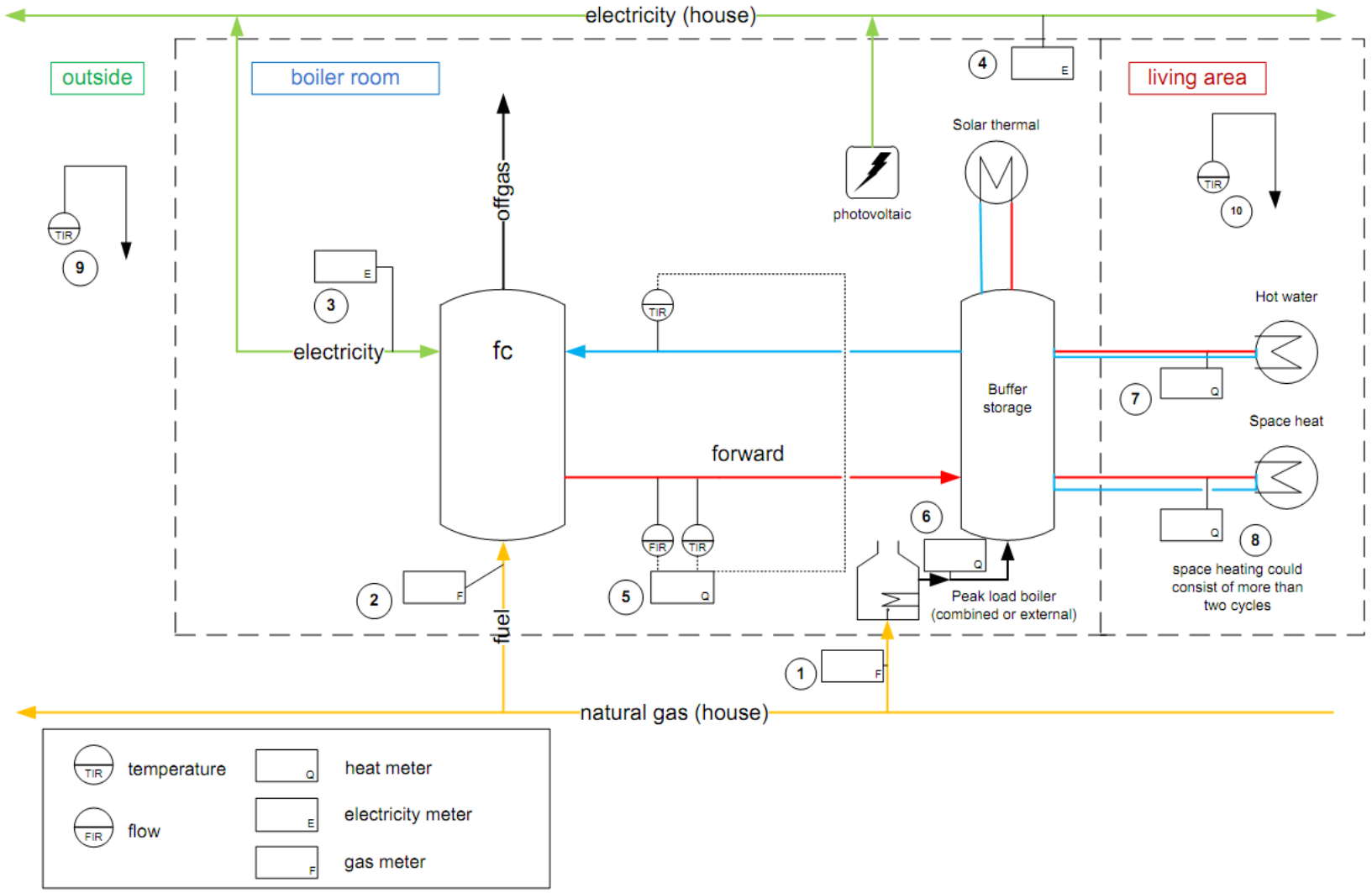
(4.2) Monitoring | Detailed Monitoring (1)



Detailed monitoring – general flow diagram

(4.2) Monitoring | Detailed Monitoring (2)

no.	type	company	details
	controller		
0	ACOS 700	IDS GmbH	ACOS 700 M-Bus 230/Callux; wireless M-Bus; Micro-SD
	gas		
1,2	AERIUS	Diehl Gas Metering	0,04 - 6 m³/h; self calibrating; M-Bus; wireless M-Bus
1,2	BK-G 2,5T with Absolute Encoder AE	Graube GmbH (Elster)	0,025 - 4 m³/h; temperature compensated (operable range: -10 - +40 °C); M-Bus
	electricity		
3,4	ED300L	EMH	3 x 230V/400V; 5 (60) A; both ways; 0,1 kWh; wireless M-Bus
3,4	ED300L	EMH	3 x 230V/400V; 5 (100) A; both ways; 0,1 kWh; wireless M-Bus
	heat		
5	Sharky 775	Hydrometer GmbH	0,6 m³/h; DN: 20 mm; PN: 16 BAR; length 130 mm; certification EN 1434 /without declaration of conformity; 0,1 kWh steps; M-Bus
5,6, 8	Sharky 775	Hydrometer GmbH	1,50 m³/h; DN: 20 mm; PN: 16 BAR; length 130 mm; certification EN 1434 /without declaration of conformity; 0,1 kWh steps; M-Bus
7	Sharky 775	Hydrometer GmbH	2,50 m³/h; DN: 20 mm; PN: 16 BAR; length 130 mm; certification EN 1434 /without declaration of conformity; 0,1 kWh steps; M-Bus
	temperature		
9	CMa20	International Control Metering - Technologies GmbH (Elvaco)	outdoor (IP65); M-Bus, with humidity
9, 10	MBS-120	pikkerton GmbH	outdoor; wireless M-Bus
10	MBS-122	pikkerton GmbH	indoor; wireless M-Bus, with humidity

Detailed monitoring – equipment list

(4.2) Monitoring | Detailed Monitoring (3)

- ACOS700 aka Callux-box (IDS GmbH, Ettlingen)
- Two ports (Manufacturer ←→ fc, other ←→ M-Bus meters)
- Manufacturer can access M-Bus readings via S-Bus (PLC)
- „other“ cannot access fc – PLC
- 15 minute readings and forwarding to server (pull)
- Archive safes M-Bus readings up to one week
- IEC 61850 Standard

- **Necessary update of drivers and Setup language**
  - Current language for setup page is German, English would be preferable (16.000 EUR once)
  - driver update for wireless M-Bus temperature-sensors from Pikkerton (3.500 EUR once)
  - Payment via DBI-GUT and sub invoice to manufacturers (according to number of units? or divided by 9 manufacturers) ->Fiona?
  - ALTERNATIVE: Sub invoice from IDS to manufacturers

Detailed monitoring – data box

(4.2) Monitoring | Detailed Monitoring (4)

- Setup of callux box, Communication flow, Monitoring the connections and security will be described in detail in the technical procedure
- Installation phase:
  - Installation setup scheme for detailed monitoring must be communicated to DBI (unit ID, meters used, serial number of meters, location of meters, contact)
  - communication test between callux box and BTC Control Center at DBI after completion of each field installation
  - DBI will also test, if all sensors data available and plausible
  - DBI needs the date and time of communication test approximately one week before (for service personnel to be available)

Detailed monitoring – Communication process

(4.2) Monitoring | Detailed Monitoring (5)

- Breakdown of communication process
  - no communication to a callux box
    - DBI will promptly (one day weekdays) communicate with the contact person of the fuel cell manufacturer
    - The manufacturer will send a trained local technician to the location to solve the problem
  - Sensor data not available
    - automatic plausibility check of Control Center will report fault
    - DBI will contact the manufacturer likewise

Detailed monitoring – Communication process

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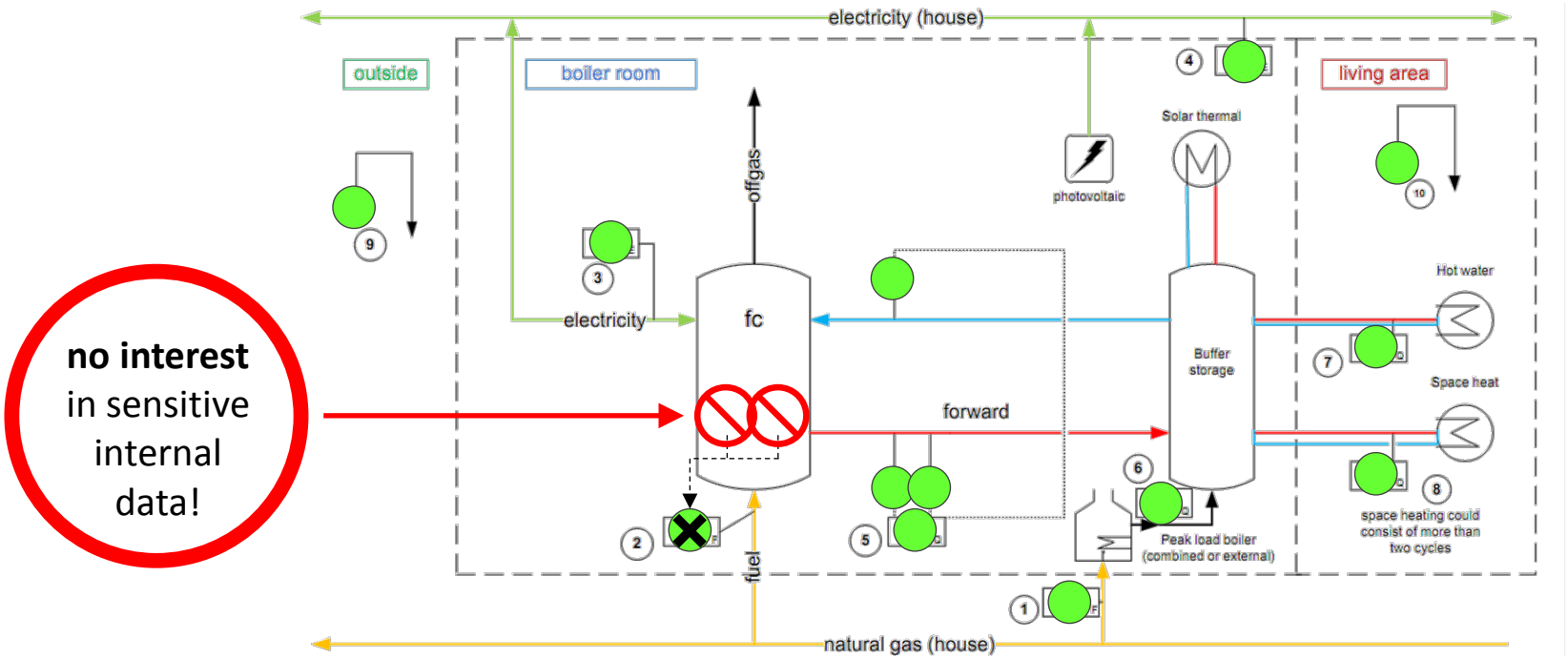
(6) **Laboratory Tests**

(7) **Clean Room Process**

- for the overall monitoring only data is needed which is measured in the detailed monitoring as well ➔ **This data can be measured and / or calculated**



● = detailed monitoring *(with independent equipment 20%)*
= manufacturers' sensors
✖ = manufacturers' calculated values
} available data

intersection
● & ✖ = **needed data**

(4.3) Monitoring | Overall Monitoring - 2/2

- collection of **data, measured or calculated by the manufacturers for 100% of their units** in ene.field

meter number	type	measured variable	code	physical quantity	measure-ment unit	measured	cofidentially calculated	approximately calculated
1	gas	consumption peak load boiler	ZHG_Gas	V	m^3			
2	gas	consumption fc	BZE_Gas	V	m^3			
3	electricity	power consumption fc	BZE_Wbezg	W	kWh			
		power export fc	BZE_Wabg	W	kWh			
4	electricity	power consumption house	HA_Nbezg	W	kWh			
		power export house	HA_Neinsp	W	kWh			
5	heat	heat output fc	BZE_WM	Q	kWh			
		outgoing temperature	BZE_TV	T	°C			
		return temperature	BZE_TR	T	°C			
		flow rate	BZE_V	V	m^3/h			
6	heat	heat output peak load boiler	ZHG_WM	Q	kWh			
		outgoing temperature	ZHG_TV	T	°C			
		return temperature	ZHG_TR	T	°C			
		flow rate	ZHG_V	V	m^3/h			
7	heat	heat output hot water	WW_WM	Q	kWh			
		hot water temperature	WW_TA	T	°C			
		could water temperature	WW_TE	T	°C			
		flow rate	WW_V	V	m^3/h			
8	heat	heat output space heat	HK_WM	Q	kWh			
		outgoing temperature	HK_TV	T	°C			
		return temperature	HK_TR	T	°C			
		flow rate	HK_V	V	m^3/h			
9	temperature	temperature outside	TA	T	°C			
		relative air humidity	Fi_A	φ	%			
10	temperature	inside living area	TI	T	°C			

input manufacturer (measured) | *input manufacturer* (cofidentially calculated) | *input manufacturer* (approximately calculated)

measured
collected field data with very high accuracy

confidentially calculated
data depending on experience with good accuracy

approximately calculated
data depending on experience with middle to bad accuracy

plausibility check

- plans on analysis
  - **comparison of the 20% detailed data with the 100% overall data**
  - database of pan-European energy demand profiles

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(5) **Issues Encountered**

(6) **Laboratory Tests**

(7) **Clean Room Process**

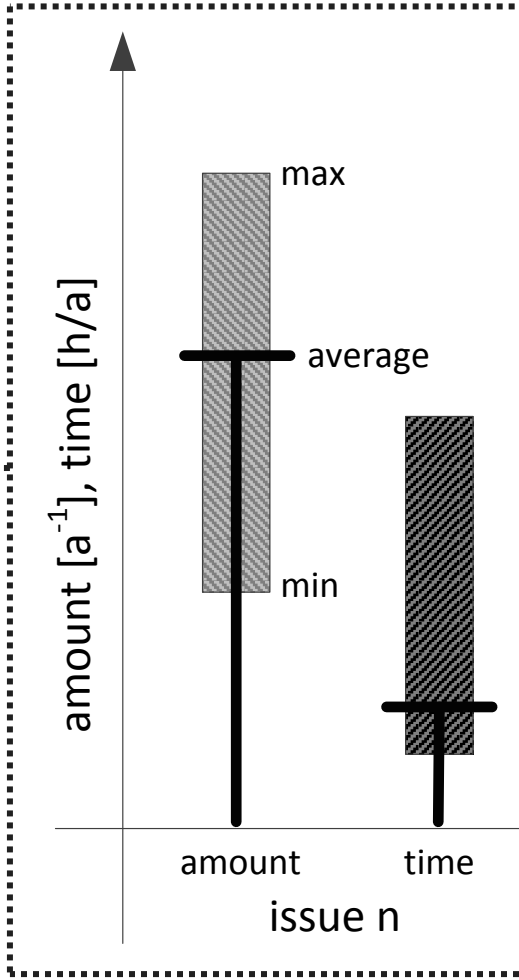
(5) Issues Encountered - 1/3

- essential information needed
  - **unit ID**
  - **category of fault**
  - **time of entrance**
  - **time of confirmation**

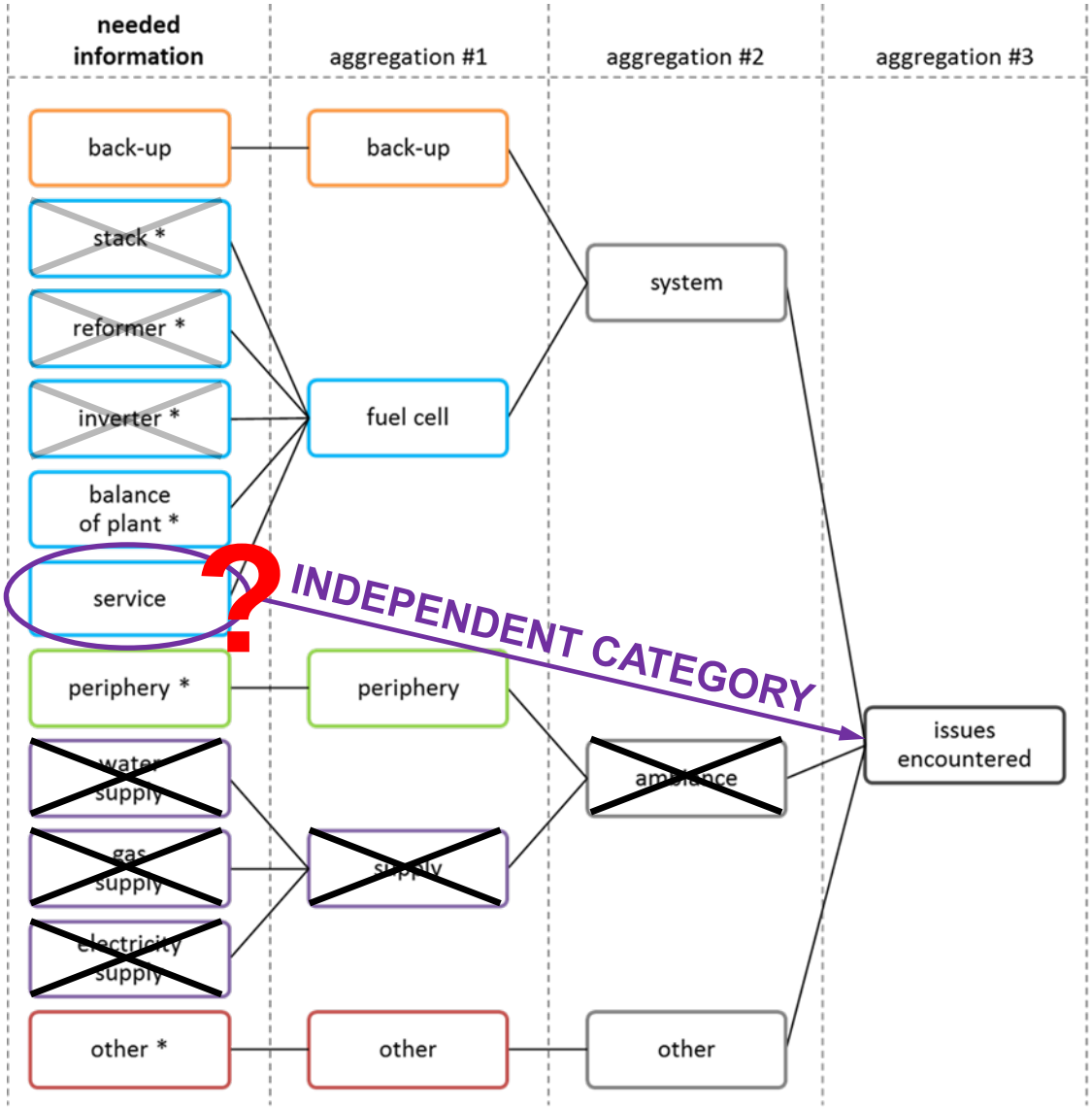
- inspired by the issue categories of the Callux project

- plans on analysis
  - compare different issues, aggregated groups etc.
  - comparison of certain characteristics (e.g. region)
  - *information on the service "quality" (fast or slow) will be collected ➔ trend at the end of the project*

- **circulation of first draft on 29th of January**
  - **amount of replies: 5 / 9**
    (5 constructive critical statements)



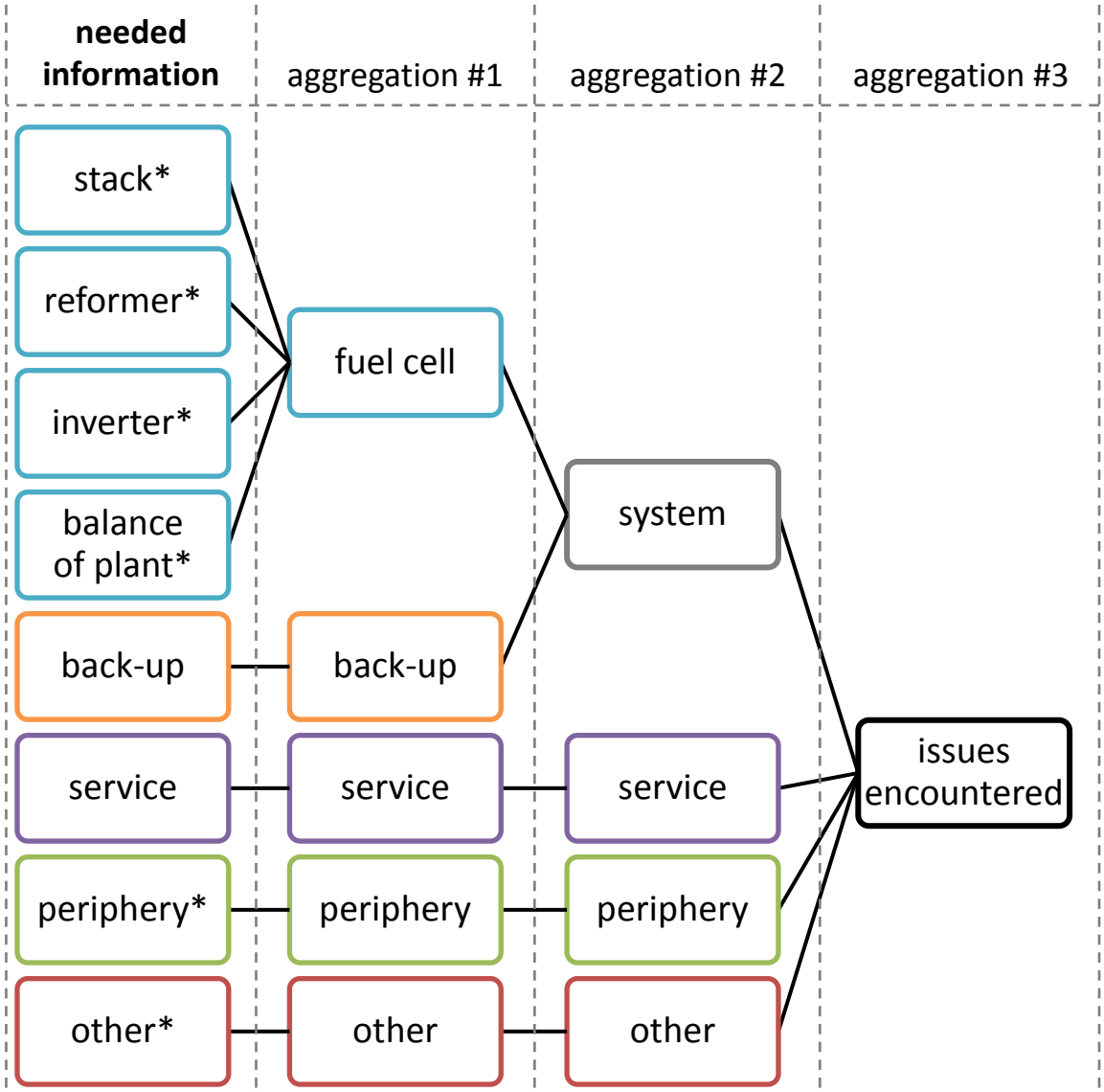
(5) Issues Encountered - 2/3



- **1 received statement:**
  "Due to the tight interactions between stack, reformer and inverter we like to combine these issues to a SRI category"
  ➔ Combination of Stack, Reformer and Inverter to SRI
  DENIED

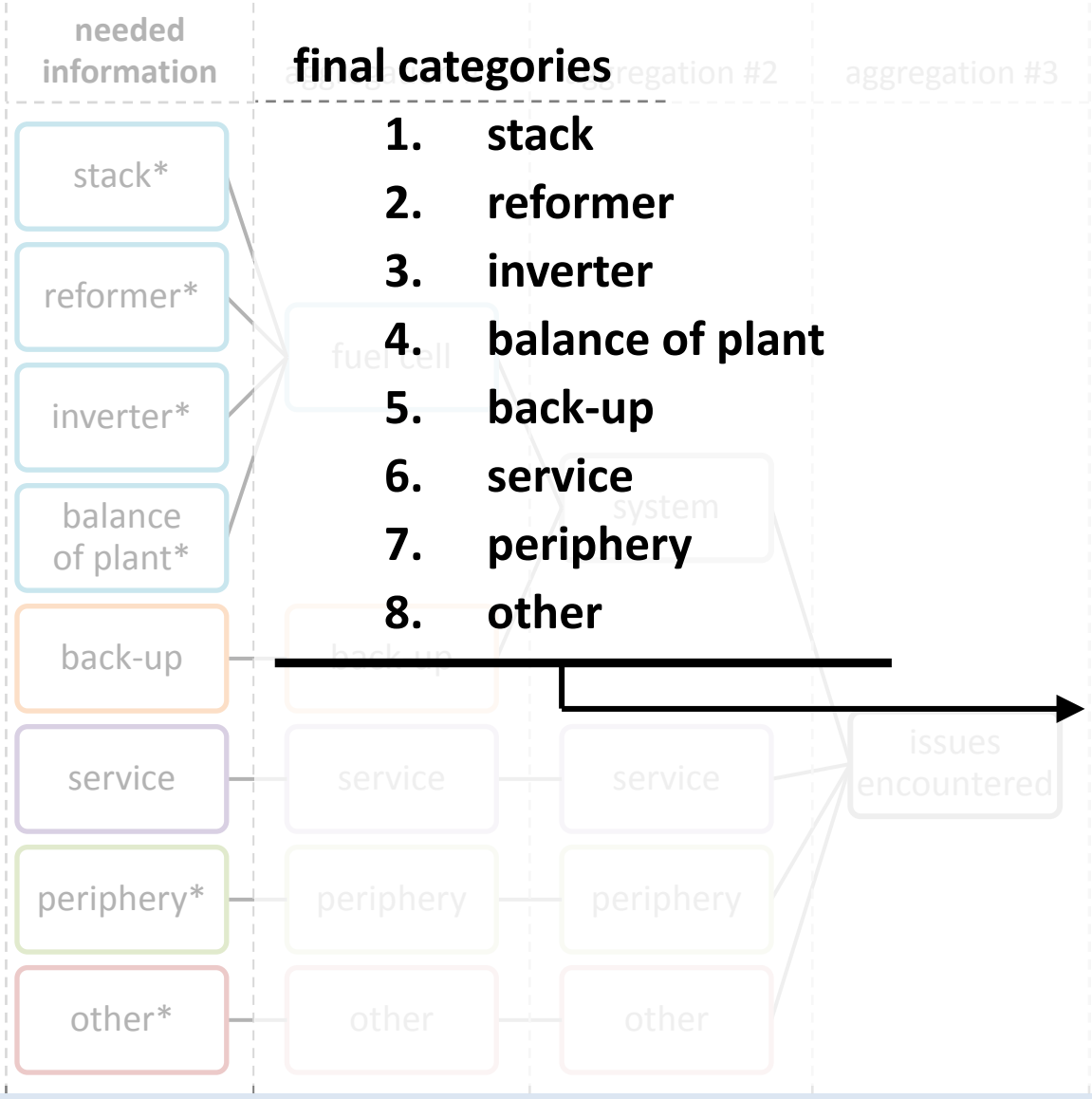
- **4 received statements:**
  unsolvable problems to receive information from outside the building
  ➔ Delete the sub categories and sum all related issues up to periphery
  ACCEPTED

(5) Issues Encountered - 3/3



- **decreasement** of the needed information categories **from 11 to 8 categories** as a result of the statments given on the first draft
- the **issue categories are herewith fixed** to the 8 categories, mentioned in the column “needed information”

(5) Issues Encountered - 3/3



- **decreasement** of the needed information categories **from 11 to 8 categories** as a result of the statments given on the first draft
- the **issue categories are herewith fixed** to the 8 categories, mentioned in the column “needed information”
- these fixed categories will be included into the next update of the **technical procedure**

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(5) **Issues Encountered**

(6) **Laboratory Tests**

(7) **Clean Room Process**

(6) Laboratory Tests (1)

- At the beginning of each individual trial one unit of respective supplier shall be lab tested at independent DVGW test lab at either DBI or GWI (distribution of units will be suggested before major document version in march, we will try to make a meaningful distribution)
- **Goal:** back-up of field data, measurement of exclusive lab values and scenarios, definition of field measurement errors
- Test duration approx. two weeks (four weeks in total)
- Contents of test procedure:
  - Energy balance around unit
  - Test of several load levels
  - Cold /warm start performance
  - Start /stop performance
  - Reaction on shutdowns (external errors)
- Detailed test program will be defined through GWI and DBI before the beginning of the first test and included in the technical procedure

- **Costs for lab-testing**
  - DBI /GWI
    - Test laboratory
    - Test personnel
    - Analysis
    - gas and electricity used during test procedures
  - Individual suppliers
    - Shipment of units to and from institute
    - Installation personnel (if necessary) inclusive travel costs
    - Unit itself for test time (insurance?, risk?)
  - What happens if units break down during test?

- Special agreement before each test to agree on hire conditions?

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(7) **Clean Room Process**

(7) Clean Room Process - 1/3

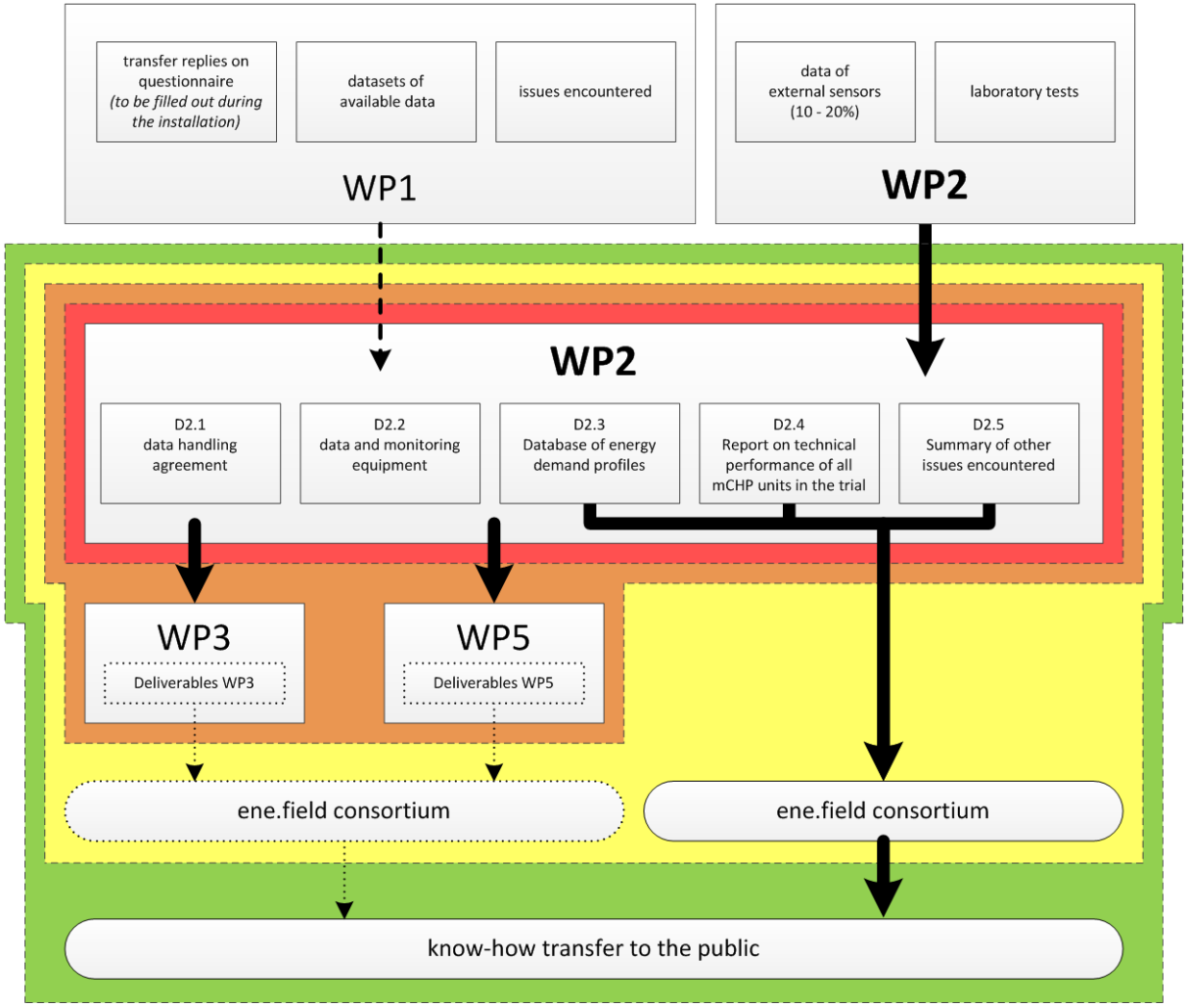
- The basic idea of the clean room process (short: CRP) is to anonymise the collected sensitive data and to define which amount and kind data may be passed to whom
- There is no transparent traceable possibility to anonymise the data, because this transparency would relate to the original data.

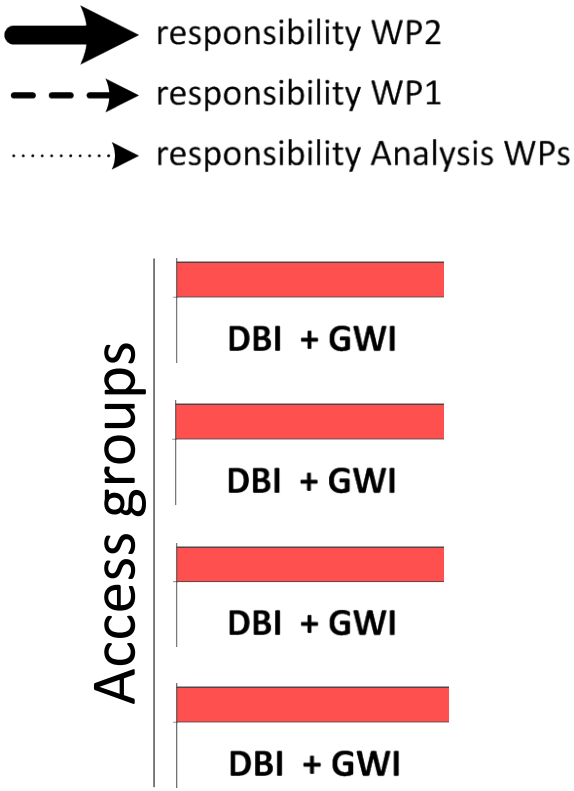
➔ **approach of CRP-List with different access groups**

- Access group **"DBI + GWI"** contains DBI and GWI and has access to all information.
- Access group **"Analysis WPs"** contains the participants of WP3 and WP5 with access on semi-sensitive data, because they are not able to work with abstractly data.
- Access group **"Consortium"** contains the participants of the ene.field project.
- Access group **"Dissemination"** is defined as the public with the lowest amount of in-formation e.g. in form of scientific knowledge dissemination.

(7) Clean Room Process - 2/3

- Access groups and responsibilities in the clean room process





(7) Clean Room Process - 3/3

- the concept is as a accumulative list of all information gathered or developed in WP2 including the agreed fixings on delivery allowance

	Data-Levels			
kind of information	DBI + GWI	Analysis-WPs	Consortium	Publication
information #1	x	x	x	x
information #2	x	x	x	x
result = f(#1, #2)	x	x	x	x
...	x	x	x	
...	x	x		
...	x	x		
...	x			
...	x			
information #n	x			
...	x			

- continuously acting element of the data handling agreement
- new information will only be passed on to other data levels after acceptation of the manufacturers

- **Unit ID**
  - For identification of unit between manufacturer, utility, local stuff, DBI, GWI
  - Manufacturer will generate unit ID (for example: Vai23, Bos10, RBZ15)
  - Pass unit ID to local stuff (for setup of callux-box) and to DBI/GWI
  - DBI/GWI will generate random number when communicating data out of clean room process
  - Decoding will be erased after end of project

Following discussion on document structure and collection of feed-backs / remarks