



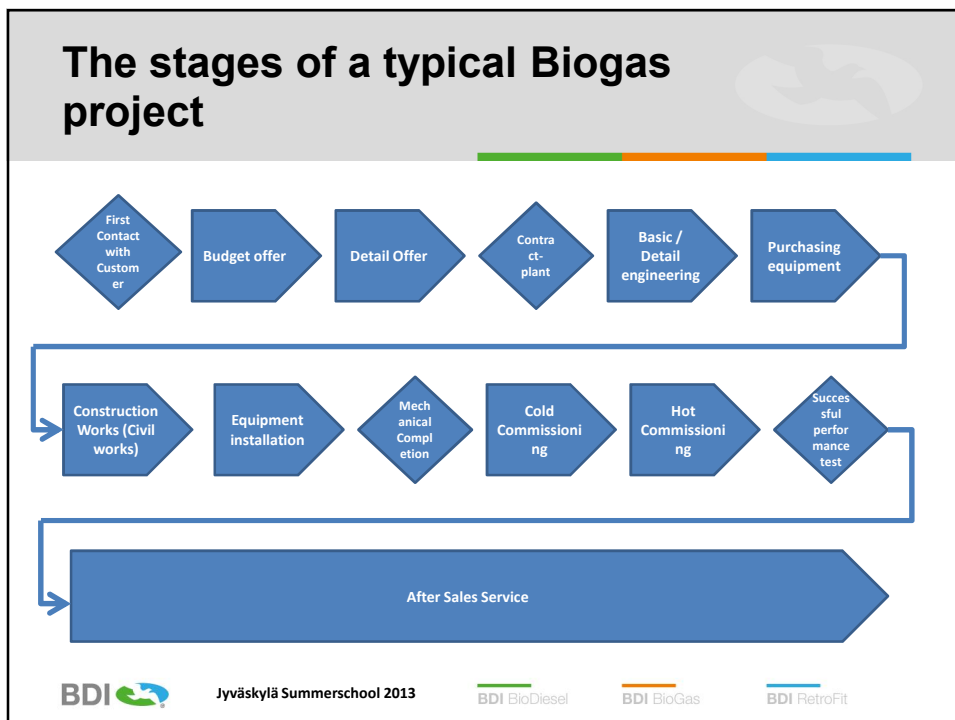


Biogas – An Industrial perspective

BDI    



First contact with customer

- Potential customer announces interest
 - Inquiry via telephone or e-Mail
 - Contact on trade fare
- First contact to sales department
 - Fill in special biogas project questionnaire to gather required information for plant design
 - Feedstock types and quantities
 - Feedstock properties
 - Available construction area
 - Desired type of energy conversion (CHP, Biomethane upgrading, ...)
 - Digestate utilization
 - ...



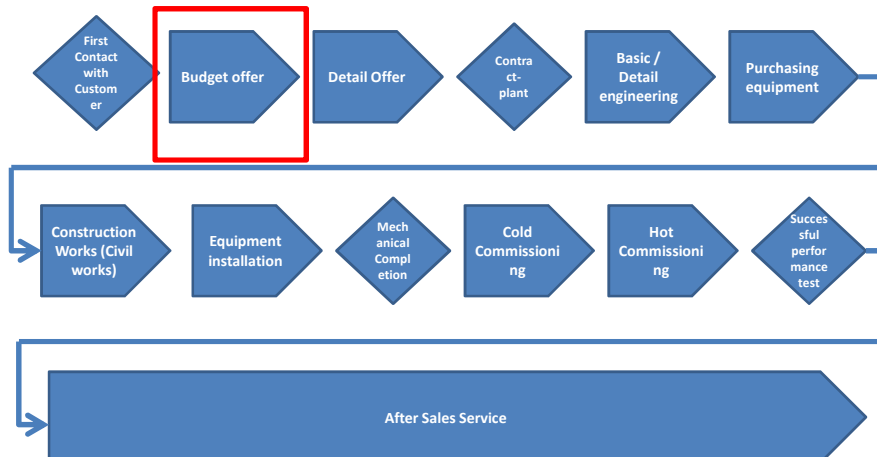
Jyväskylä Summerschool 2013

BDI BioDiesel

BDI BioGas

BDI RetroFit

Budget offer



Jyväskylä Summerschool 2013

BDI BioDiesel

BDI BioGas

BDI RetroFit

Budget offer

Budget offer is based on:

- Data from tender or questionnaire and first meeting with customer

The budget offer consists of

- A preliminary process concept
- A preliminary mass and energy balance
- An example layout
- A standard project schedule
- A cost estimation

=>Basis for a further discussion and vendor pre selection

If required an authority engineering contract is set up for gathering the permits



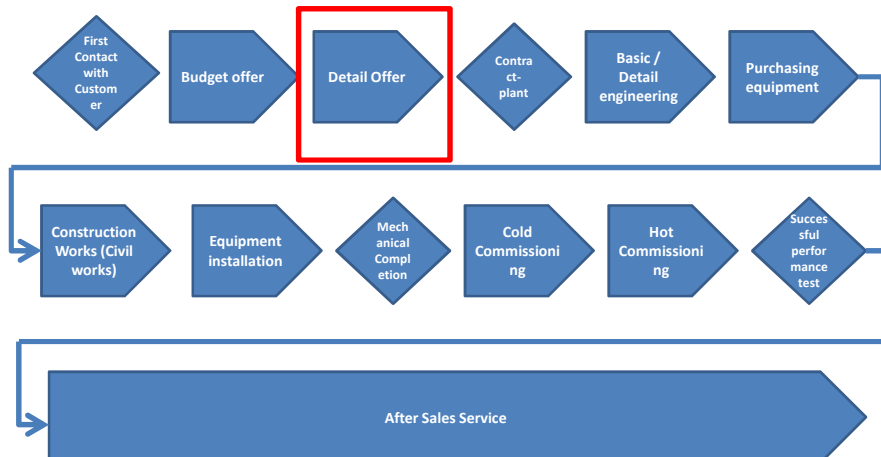
Jyväskylä Summerschool 2013

BDI BioDiesel

BDI BioGas

BDI RetroFit

Detail offer (fixed price offer)



Jyväskylä Summerschool 2013

BDI BioDiesel

BDI BioGas

BDI RetroFit

Detail offer (fixed price offer)

The detail offer is based on:

- Detailed information from the customer and the permitting documents

The detail offer consists of

- A final process concept
- A final mass and energy balance
- An final layout
- A specific project schedule
- Defined main equipment
- Scope of supply definition
- Basic economic calculation
- A fixed price

- Desired result of detail offer is a signed contract for building the plant



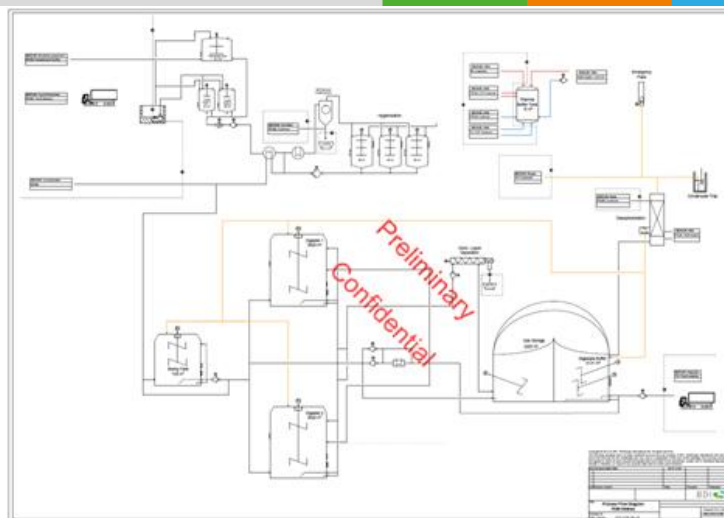
Jyväskylä Summerschool 2013

BDI BioDiesel

BDI BioGas

BDI RetroFit

Process flow diagram

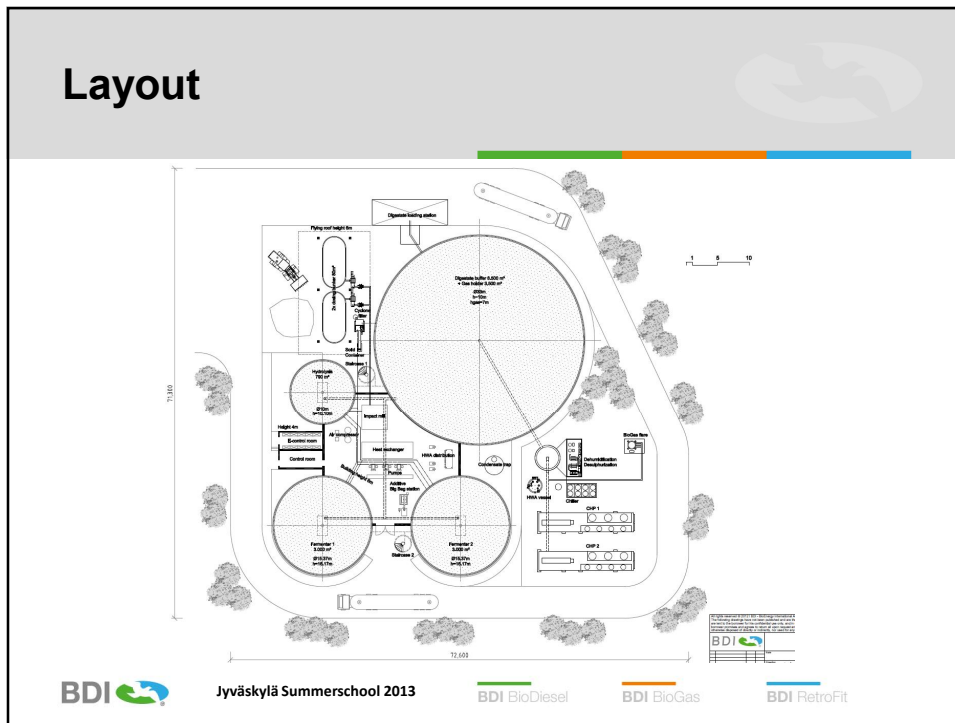


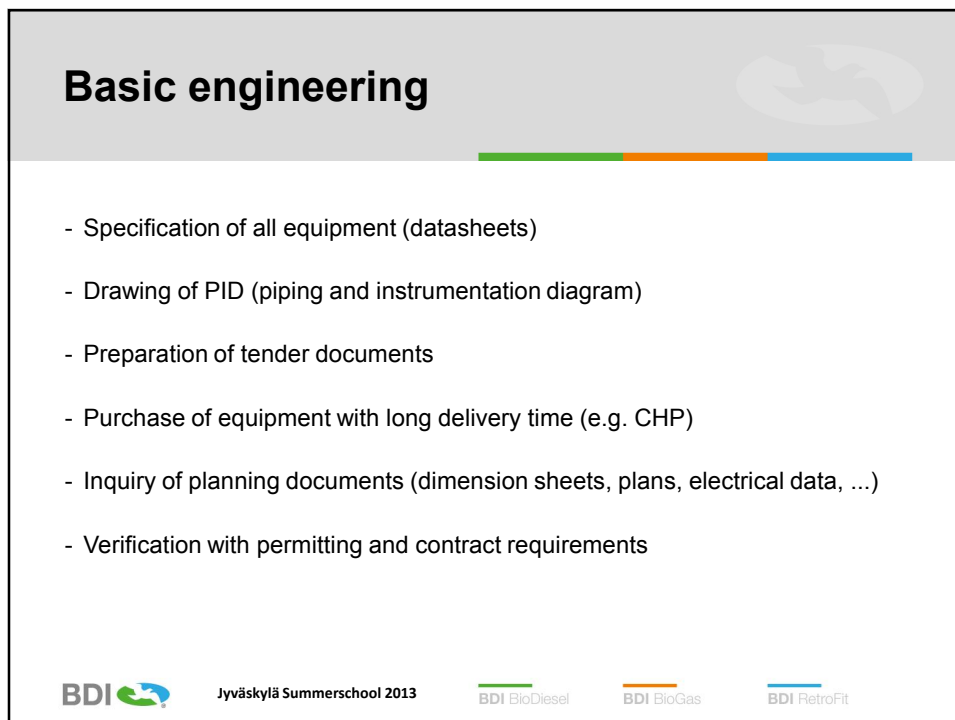
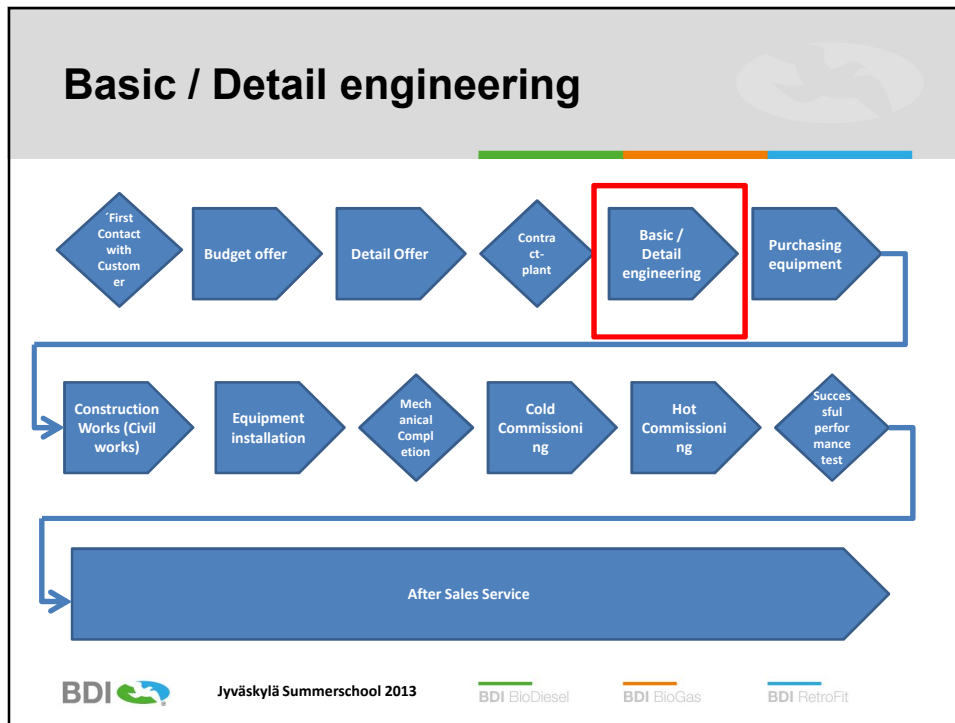
Jyväskylä Summerschool 2013

BDI BioDiesel

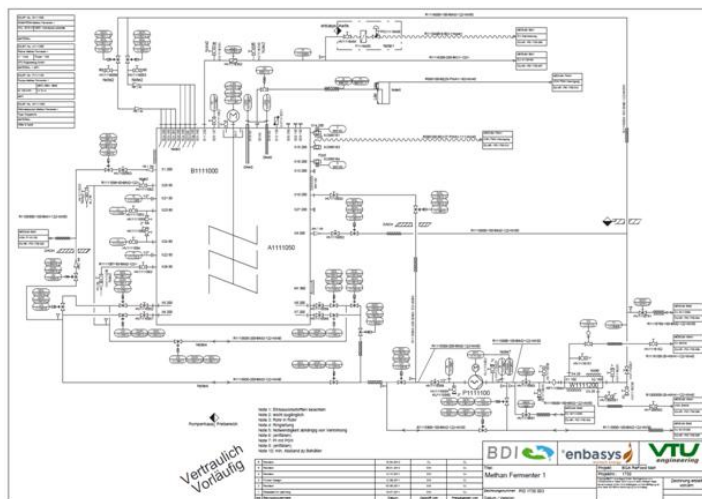
BDI BioGas

BDI RetroFit





PID – Piping and instrumentation diagram



BDI Jyväskylä Summerschool 2013 BDI BioDiesel BDI BioGas BDI RetroFit

Data sheet

VTU engineering		Vessel Data Sheet		BDI engineering																																																							
Project No. 1020	Project Biochem plant redesign	Date 04.10.2009																																																									
Proj No. PFC 0202 001	Supplier Gussaksky Zhuravskiy Heavy Industry Co., Ltd (GZH)	Order No.																																																									
Item No. 011000	Item Name: Epoxidation tank 1																																																										
Material	S355 J2L, 100% VENT, 304Ti, 304Ti, 304Ti																																																										
Operating Data: Medium Properties	<table border="1"> <tr> <td>Working temperature</td> <td>Pa</td> <td>min</td> <td>0</td> <td>°C</td> <td>Design temperature</td> <td>Pa</td> <td>min</td> <td>0</td> <td>°C</td> <td>Blanketing gas</td> <td>Pa</td> <td>min</td> <td>0</td> <td>°C</td> </tr> <tr> <td>Working pressure</td> <td>Pa</td> <td>min</td> <td>0</td> <td>°C</td> <td>Design pressure & stress</td> <td>Pa</td> <td>min</td> <td>0</td> <td>°C</td> <td>Blanketing gas</td> <td>Pa</td> <td>min</td> <td>0</td> <td>°C</td> </tr> <tr> <td>Medium density</td> <td>kg/m³</td> <td>min</td> <td>0</td> <td>°C</td> <td>Medium viscosity</td> <td>kg/m³</td> <td>min</td> <td>0</td> <td>°C</td> <td>Blanketing gas</td> <td>Pa</td> <td>min</td> <td>0</td> <td>°C</td> </tr> </table>					Working temperature	Pa	min	0	°C	Design temperature	Pa	min	0	°C	Blanketing gas	Pa	min	0	°C	Working pressure	Pa	min	0	°C	Design pressure & stress	Pa	min	0	°C	Blanketing gas	Pa	min	0	°C	Medium density	kg/m ³	min	0	°C	Medium viscosity	kg/m ³	min	0	°C	Blanketing gas	Pa	min	0	°C									
Working temperature	Pa	min	0	°C	Design temperature	Pa	min	0	°C	Blanketing gas	Pa	min	0	°C																																													
Working pressure	Pa	min	0	°C	Design pressure & stress	Pa	min	0	°C	Blanketing gas	Pa	min	0	°C																																													
Medium density	kg/m ³	min	0	°C	Medium viscosity	kg/m ³	min	0	°C	Blanketing gas	Pa	min	0	°C																																													
Design Data	<table border="1"> <tr> <td>Design code</td> <td>Pa</td> <td>min</td> <td>0</td> <td>°C</td> <td>Design pressure & stress</td> <td>Pa</td> <td>min</td> <td>0</td> <td>°C</td> <td>Blanketing gas</td> <td>Pa</td> <td>min</td> <td>0</td> <td>°C</td> </tr> <tr> <td>Design temperature</td> <td>Pa</td> <td>min</td> <td>0</td> <td>°C</td> <td>Design pressure & stress</td> <td>Pa</td> <td>min</td> <td>0</td> <td>°C</td> <td>Blanketing gas</td> <td>Pa</td> <td>min</td> <td>0</td> <td>°C</td> </tr> </table>					Design code	Pa	min	0	°C	Design pressure & stress	Pa	min	0	°C	Blanketing gas	Pa	min	0	°C	Design temperature	Pa	min	0	°C	Design pressure & stress	Pa	min	0	°C	Blanketing gas	Pa	min	0	°C																								
Design code	Pa	min	0	°C	Design pressure & stress	Pa	min	0	°C	Blanketing gas	Pa	min	0	°C																																													
Design temperature	Pa	min	0	°C	Design pressure & stress	Pa	min	0	°C	Blanketing gas	Pa	min	0	°C																																													
Substitutions	<table border="1"> <tr> <td>Substitution</td> <td>Pa</td> <td>min</td> <td>0</td> <td>°C</td> <td>Substitution</td> <td>Pa</td> <td>min</td> <td>0</td> <td>°C</td> <td>Substitution</td> <td>Pa</td> <td>min</td> <td>0</td> <td>°C</td> </tr> </table>					Substitution	Pa	min	0	°C	Substitution	Pa	min	0	°C	Substitution	Pa	min	0	°C																																							
Substitution	Pa	min	0	°C	Substitution	Pa	min	0	°C	Substitution	Pa	min	0	°C																																													
Material	<table border="1"> <tr> <td>Material</td> <td>Pa</td> <td>min</td> <td>0</td> <td>°C</td> <td>Material</td> <td>Pa</td> <td>min</td> <td>0</td> <td>°C</td> <td>Material</td> <td>Pa</td> <td>min</td> <td>0</td> <td>°C</td> </tr> </table>					Material	Pa	min	0	°C	Material	Pa	min	0	°C	Material	Pa	min	0	°C																																							
Material	Pa	min	0	°C	Material	Pa	min	0	°C	Material	Pa	min	0	°C																																													
Annotations	<table border="1"> <tr> <td>Annotations</td> <td>Pa</td> <td>min</td> <td>0</td> <td>°C</td> <td>Annotations</td> <td>Pa</td> <td>min</td> <td>0</td> <td>°C</td> <td>Annotations</td> <td>Pa</td> <td>min</td> <td>0</td> <td>°C</td> </tr> </table>					Annotations	Pa	min	0	°C	Annotations	Pa	min	0	°C	Annotations	Pa	min	0	°C																																							
Annotations	Pa	min	0	°C	Annotations	Pa	min	0	°C	Annotations	Pa	min	0	°C																																													
Revision	<table border="1"> <tr> <td>Rev.</td> <td>Description</td> <td>Pa</td> <td>min</td> <td>0</td> <td>°C</td> <td>Rev.</td> <td>Description</td> <td>Pa</td> <td>min</td> <td>0</td> <td>°C</td> <td>Rev.</td> <td>Description</td> <td>Pa</td> <td>min</td> <td>0</td> <td>°C</td> </tr> <tr> <td>1</td> <td>Initial design</td> <td>Pa</td> <td>min</td> <td>0</td> <td>°C</td> <td>1</td> <td>Initial design</td> <td>Pa</td> <td>min</td> <td>0</td> <td>°C</td> <td>1</td> <td>Initial design</td> <td>Pa</td> <td>min</td> <td>0</td> <td>°C</td> </tr> <tr> <td>2</td> <td>Final design</td> <td>Pa</td> <td>min</td> <td>0</td> <td>°C</td> <td>2</td> <td>Final design</td> <td>Pa</td> <td>min</td> <td>0</td> <td>°C</td> <td>2</td> <td>Final design</td> <td>Pa</td> <td>min</td> <td>0</td> <td>°C</td> </tr> </table>					Rev.	Description	Pa	min	0	°C	Rev.	Description	Pa	min	0	°C	Rev.	Description	Pa	min	0	°C	1	Initial design	Pa	min	0	°C	1	Initial design	Pa	min	0	°C	1	Initial design	Pa	min	0	°C	2	Final design	Pa	min	0	°C	2	Final design	Pa	min	0	°C	2	Final design	Pa	min	0	°C
Rev.	Description	Pa	min	0	°C	Rev.	Description	Pa	min	0	°C	Rev.	Description	Pa	min	0	°C																																										
1	Initial design	Pa	min	0	°C	1	Initial design	Pa	min	0	°C	1	Initial design	Pa	min	0	°C																																										
2	Final design	Pa	min	0	°C	2	Final design	Pa	min	0	°C	2	Final design	Pa	min	0	°C																																										

confidential preliminary

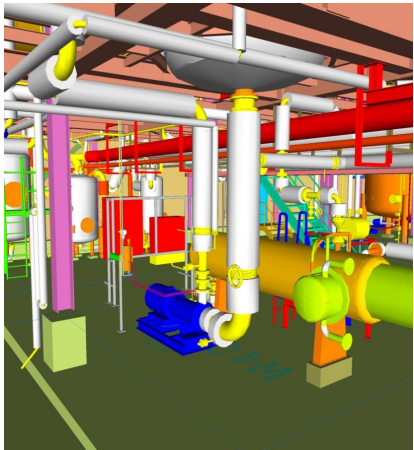
BDI Jyväskylä Summerschool 2013 BDI BioDiesel BDI BioGas BDI RetroFit

Detail engineering

- Detailed electrical planning
 - Wiring diagrams
 - Instruments
- Detailed piping planning
 - 3D planning
 - Isometric drawings
 - Part lists
- development of a description for the process control system
 - PLC description

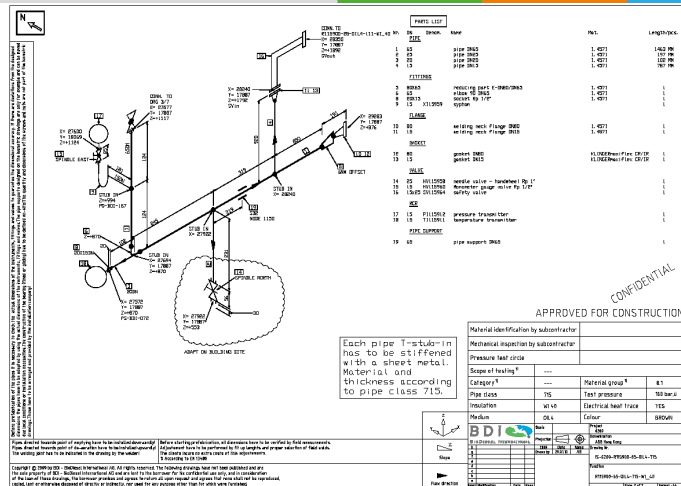
Piping - Planing

Item	QTY	Pipe Number	Dimensions	Material	Notes	Quantity	Unit
Material 1	1	10	101600-08-COL-12181_01_01	SA1020	DN 125x10	1	m
Material 2	1	11	101600-08-COL-12181_02_01	SA1020	DN 125x10	1	m
Material 3	1	12	101600-08-COL-12181_03_01	SA1020	DN 125x10	1	m
Material 4	1	13	101600-08-COL-12181_04_01	SA1020	DN 125x10	1	m
Material 5	1	14	101600-08-COL-12181_05_01	SA1020	DN 125x10	1	m
Material 6	1	15	101600-08-COL-12181_06_01	SA1020	DN 125x10	1	m
Material 7	1	16	101600-08-COL-12181_07_01	SA1020	DN 125x10	1	m
Material 8	1	17	101600-08-COL-12181_08_01	SA1020	DN 125x10	1	m
Material 9	1	18	101600-08-COL-12181_09_01	SA1020	DN 125x10	1	m
Material 10	1	19	101600-08-COL-12181_10_01	SA1020	DN 125x10	1	m
Material 11	1	20	101600-08-COL-12181_11_01	SA1020	DN 125x10	1	m
Material 12	1	21	101600-08-COL-12181_12_01	SA1020	DN 125x10	1	m
Material 13	1	22	101600-08-COL-12181_13_01	SA1020	DN 125x10	1	m
Material 14	1	23	101600-08-COL-12181_14_01	SA1020	DN 125x10	1	m
Material 15	1	24	101600-08-COL-12181_15_01	SA1020	DN 125x10	1	m
Material 16	1	25	101600-08-COL-12181_16_01	SA1020	DN 125x10	1	m
Material 17	1	26	101600-08-COL-12181_17_01	SA1020	DN 125x10	1	m
Material 18	1	27	101600-08-COL-12181_18_01	SA1020	DN 125x10	1	m
Material 19	1	28	101600-08-COL-12181_19_01	SA1020	DN 125x10	1	m
Material 20	1	29	101600-08-COL-12181_20_01	SA1020	DN 125x10	1	m
Material 21	1	30	101600-08-COL-12181_21_01	SA1020	DN 125x10	1	m
Material 22	1	31	101600-08-COL-12181_22_01	SA1020	DN 125x10	1	m
Material 23	1	32	101600-08-COL-12181_23_01	SA1020	DN 125x10	1	m
Material 24	1	33	101600-08-COL-12181_24_01	SA1020	DN 125x10	1	m
Material 25	1	34	101600-08-COL-12181_25_01	SA1020	DN 125x10	1	m
Material 26	1	35	101600-08-COL-12181_26_01	SA1020	DN 125x10	1	m
Material 27	1	36	101600-08-COL-12181_27_01	SA1020	DN 125x10	1	m
Material 28	1	37	101600-08-COL-12181_28_01	SA1020	DN 125x10	1	m
Material 29	1	38	101600-08-COL-12181_29_01	SA1020	DN 125x10	1	m
Material 30	1	39	101600-08-COL-12181_30_01	SA1020	DN 125x10	1	m
Material 31	1	40	101600-08-COL-12181_31_01	SA1020	DN 125x10	1	m
Material 32	1	41	101600-08-COL-12181_32_01	SA1020	DN 125x10	1	m
Material 33	1	42	101600-08-COL-12181_33_01	SA1020	DN 125x10	1	m
Material 34	1	43	101600-08-COL-12181_34_01	SA1020	DN 125x10	1	m
Material 35	1	44	101600-08-COL-12181_35_01	SA1020	DN 125x10	1	m
Material 36	1	45	101600-08-COL-12181_36_01	SA1020	DN 125x10	1	m
Material 37	1	46	101600-08-COL-12181_37_01	SA1020	DN 125x10	1	m
Material 38	1	47	101600-08-COL-12181_38_01	SA1020	DN 125x10	1	m
Material 39	1	48	101600-08-COL-12181_39_01	SA1020	DN 125x10	1	m
Material 40	1	49	101600-08-COL-12181_40_01	SA1020	DN 125x10	1	m
Material 41	1	50	101600-08-COL-12181_41_01	SA1020	DN 125x10	1	m



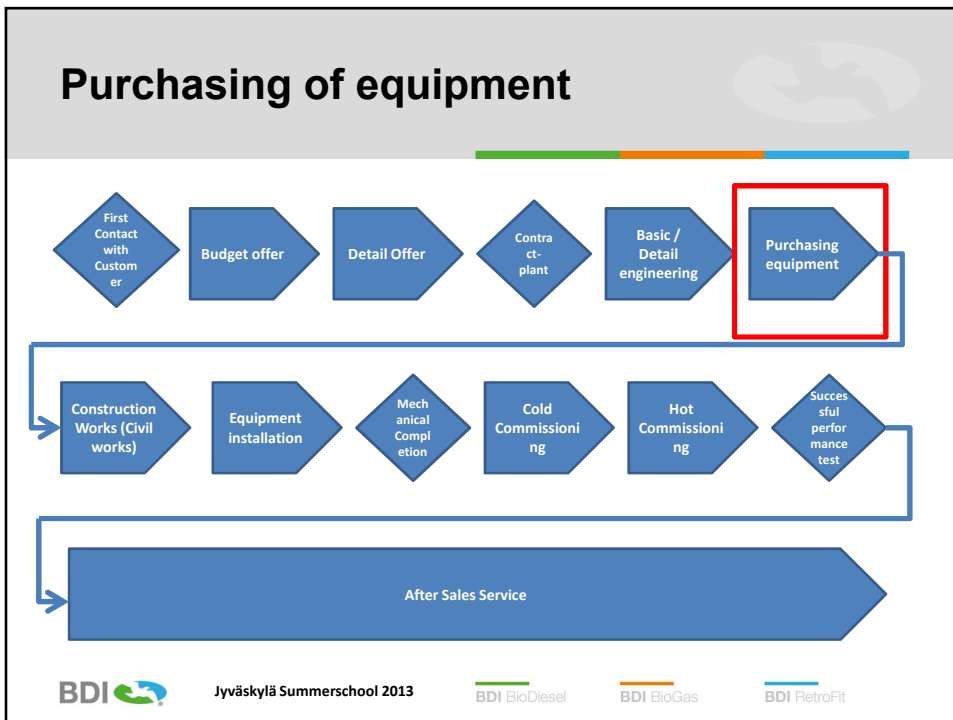
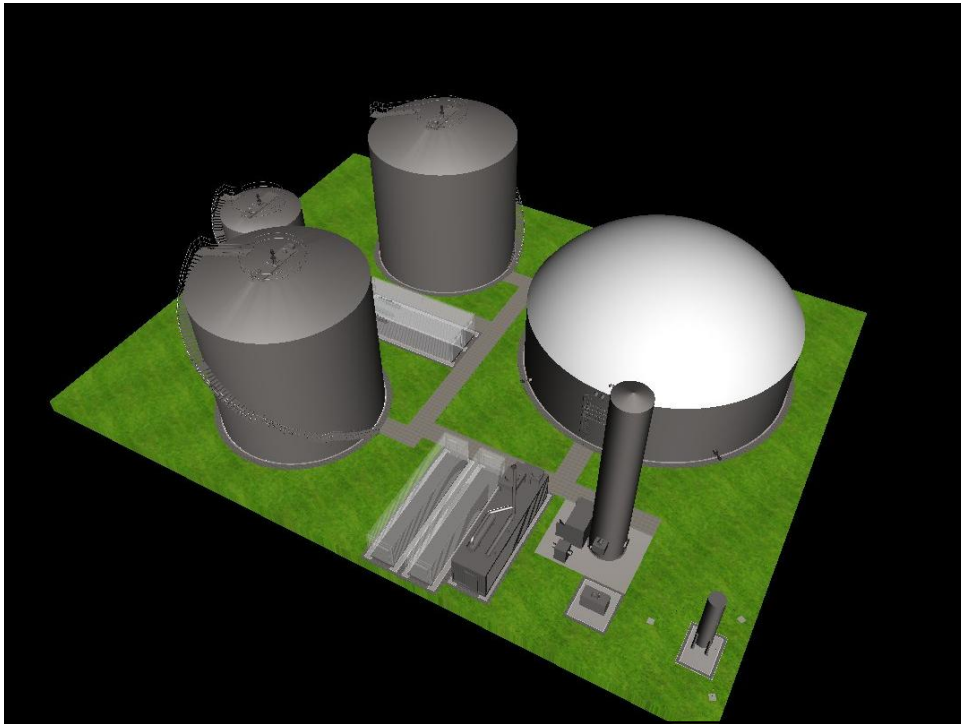
Materialist Navis Works 3D Model

Piping – Isometric drawing



Insulation





Example purchase of agitator

OFFER FROM FINAL CHOSEN SUPPLIER

Mechanical Data: Approved by BDI

TECHNICAL CHARACTERISTICS

Power	1000
Capacity	1000
Speed	1000
Material	SS316
Shaft diameter	50
Shaft length	1000
Impeller diameter	1000
Impeller type	4-blade
Impeller material	SS316
Impeller thickness	10
Impeller pitch	100
Impeller clearance	10
Impeller offset	0
Impeller angle	90
Impeller shape	Rectangular
Impeller width	1000
Impeller height	1000
Impeller depth	1000
Impeller volume	1000000
Impeller weight	10000
Impeller moment of inertia	1000000
Impeller natural frequency	1000
Impeller damping ratio	0.05
Impeller critical speed	1000
Impeller operating speed	1000
Impeller safety factor	1.5
Impeller design life	10000
Impeller maintenance interval	1000
Impeller replacement cost	10000
Impeller disposal cost	1000
Impeller total cost	10000

Operating Data: Approved by BDI

SIEMENS

APPROVED FOR PURCHASING

see final approval of AG/RS

Example purchase of agitator

Motor data sheet

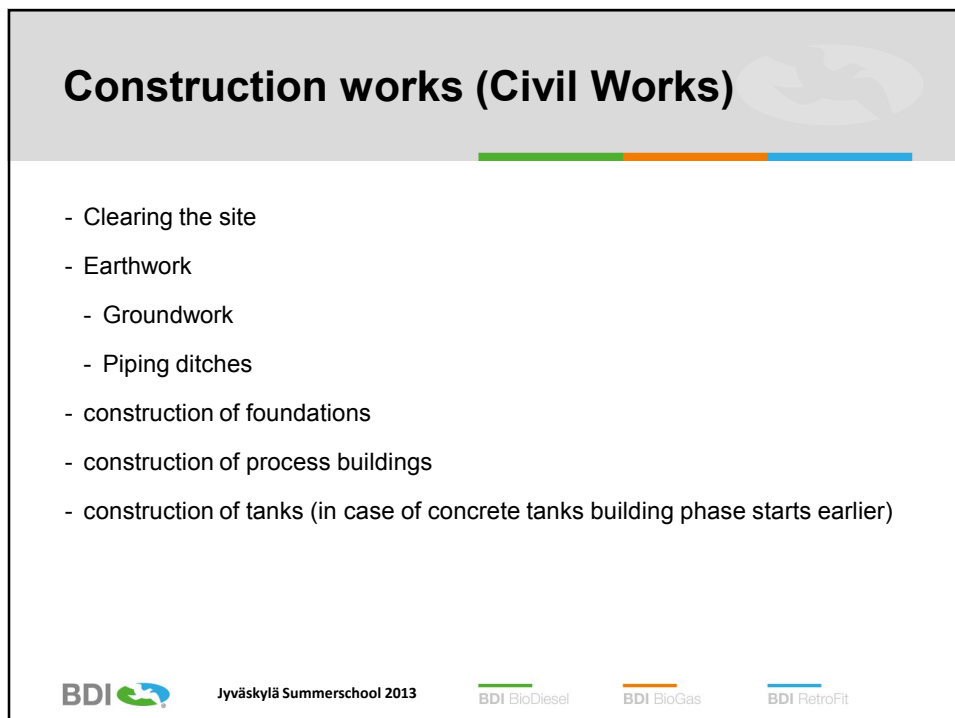
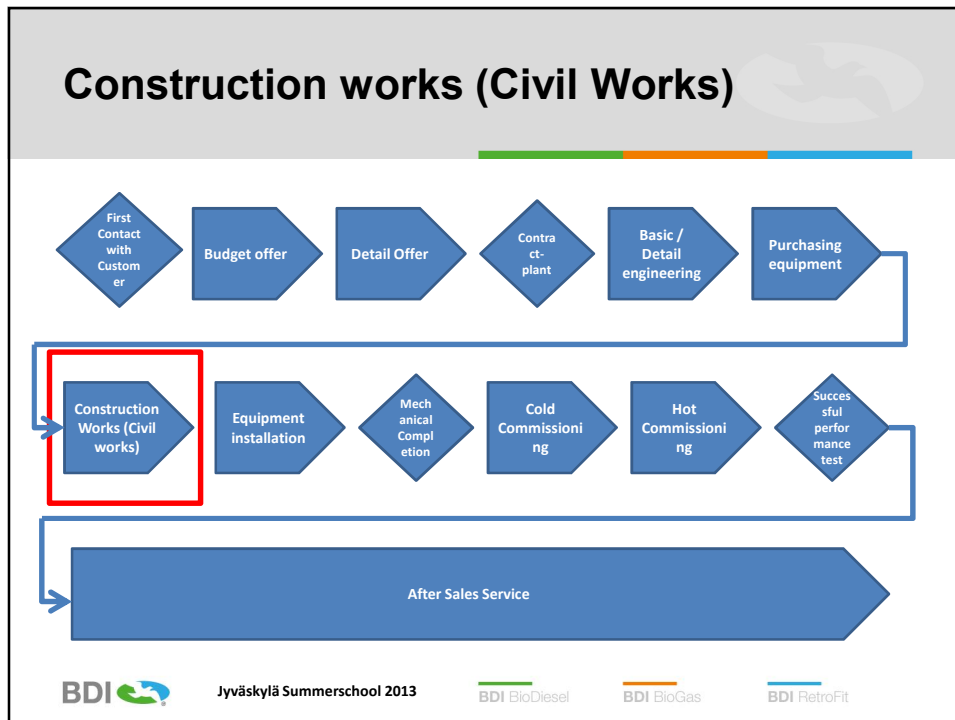
SIEMENS

APPROVED FOR CONSTRUCTION

Information to BDI

Dimension sheet

APPROVED FOR CONSTRUCTION



Construction works



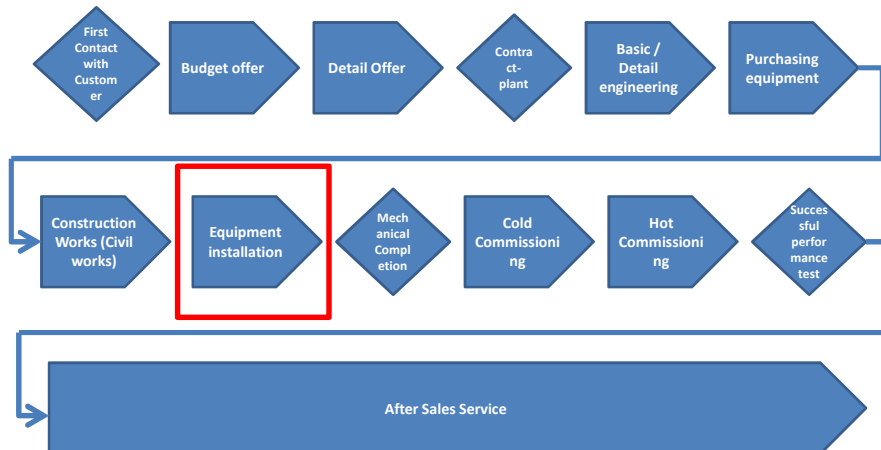
Jyväskylä Summerschool 2013

BDI BioDiesel

BDI BioGas

BDI RetroFit

Equipment installation



Jyväskylä Summerschool 2013

BDI BioDiesel

BDI BioGas

BDI RetroFit

Equipment Installation

- Pipe work
- Equipment installation
 - Pumps
 - Tanks
 - Heat exchangers
 - Instruments
 - Agitators
 -
- Electrical installation
 - Wiring
 - Cabinets



Jyväskylä Summerschool 2013

BDI BioDiesel

BDI BioGas

BDI RetroFit

Pipe installation



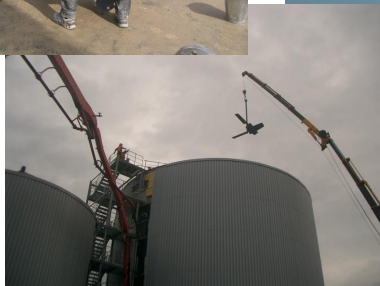
Jyväskylä Summerschool 2013

BDI BioDiesel

BDI BioGas

BDI RetroFit

Agitator installation



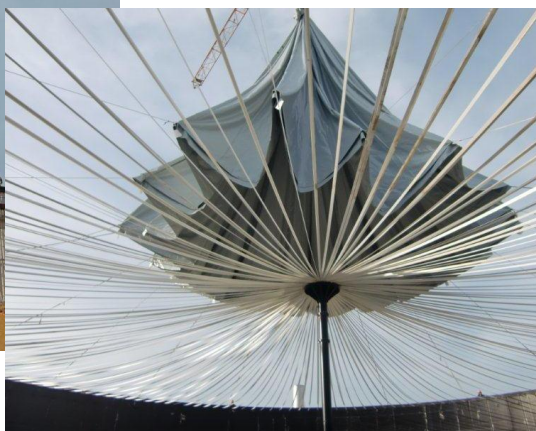
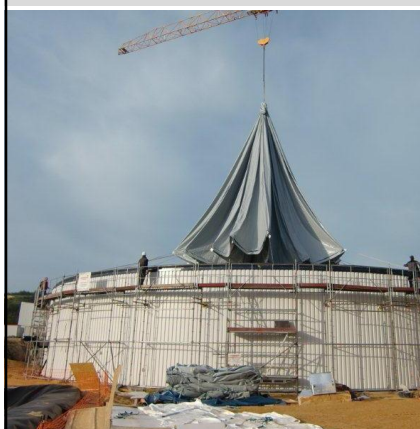
Jyväskylä Summerschool 2013

BDI BioDiesel

BDI BioGas

BDI RetroFit

Intallation of gas holder



Jyväskylä Summerschool 2013

BDI BioDiesel

BDI BioGas

BDI RetroFit

Insulation works



Jyväskylä Summerschool 2013

BDI BioDiesel

BDI BioGas

BDI RetroFit

CHP installation

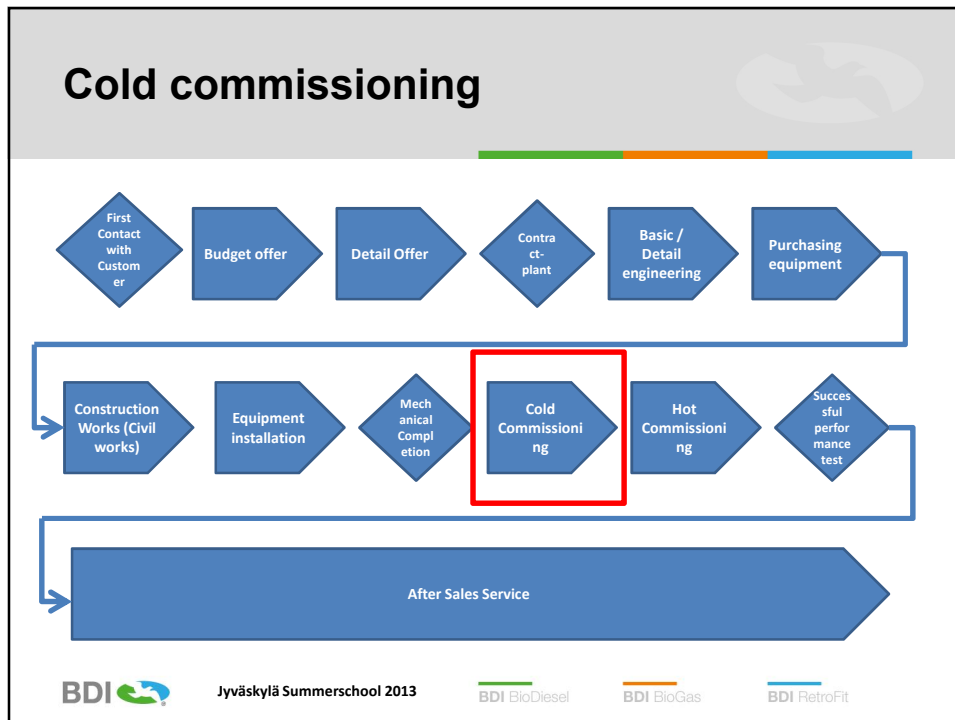


Jyväskylä Summerschool 2013

BDI BioDiesel

BDI BioGas

BDI RetroFit



Cold commissioning


Testing of mechanical and electrical functionality after electrical and mechanical completion (PID Check, pressure testing, leak tests, ...)

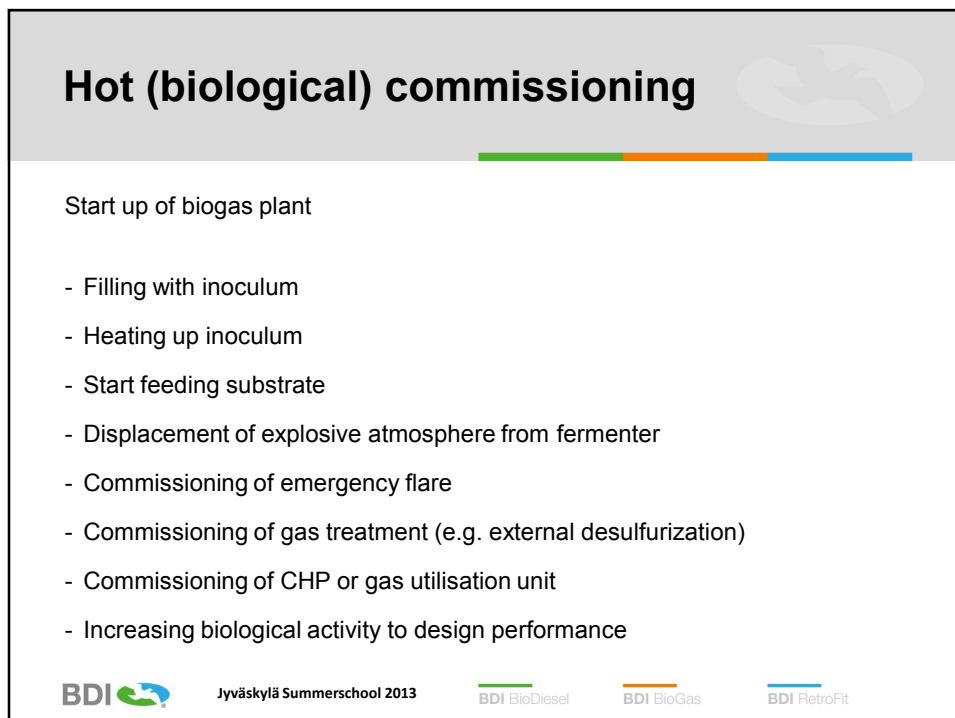
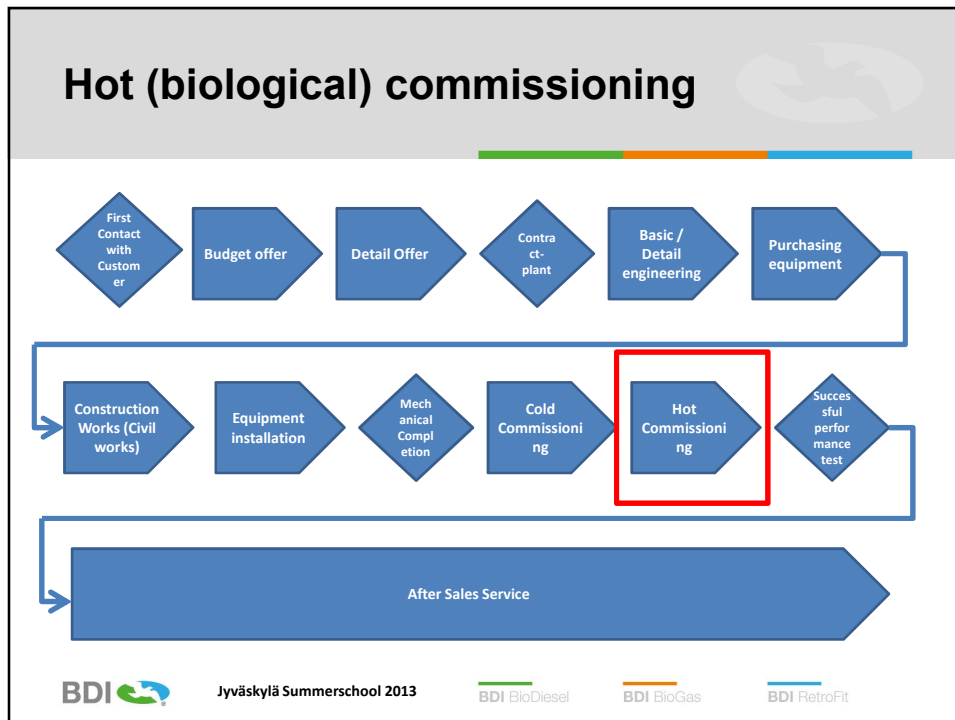
external

- FAT-Test (Factory acceptance test) for PCS

On site

- Installation of PCS
- Signal check
- Rotation direction check
- Test of automatic valves
-

BDI  Jyväskylä Summerschool 2013 BDI BioDiesel BDI BioGas BDI RetroFit



Filling and heating up inoculum

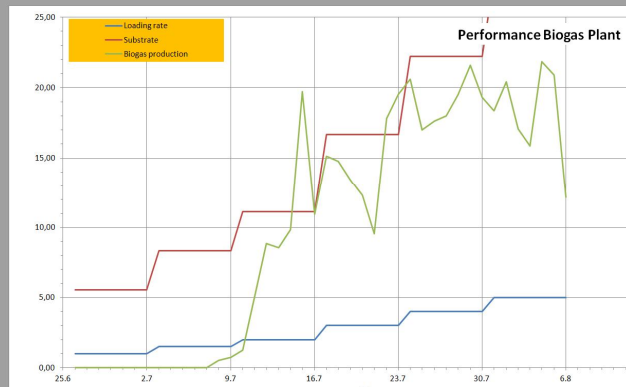
- Filling the digester with a sufficient quantity of inoculum
- Inoculum should be adapted to process conditions and feedstock
- Heating up the inoculum (external heat source is required)
- Quality check of inoculum (impurities, chemical parameters, ...)



Jyväskylä Summerschool 2013

Feeding plan

Feeding Plan			
Preliminary	Valid until	TS Substrate	15.0%
	15.07.2013	VS Substrate	13.5%
Methane Tank			
date	loading rate kg _{DCP} / m ³ d	substrate m ³ /d	substrate m ³ /h
26.Jun	1,00	6	0,2
27.Jun	1,00	6	0,2
28.Jun	1,00	6	0,2
29.Jun	1,00	6	0,2
30.Jun	1,00	6	0,2
01.Jul	1,00	6	0,2
02.Jul	1,00	6	0,2
03.Jul	1,50	8	0,3
04.Jul	1,50	8	0,3
05.Jul	1,50	8	0,3
06.Jul	1,50	8	0,3
07.Jul	1,50	8	0,3
08.Jul	1,50	8	0,3
09.Jul	1,50	8	0,3
10.Jul	2,00	11	0,5
11.Jul	2,00	11	0,5
12.Jul	2,00	11	0,5
13.Jul	2,00	11	0,5
14.Jul	2,00	11	0,5
15.Jul	2,00	11	0,5
16.Jul	2,00	11	0,5
17.Jul	3,00	17	0,7
18.Jul	3,00	17	0,7



Jyväskylä Summerschool 2013

BDI BioDiesel

BDI BioGas

BDI RetroFit

Commisioning emergency flare



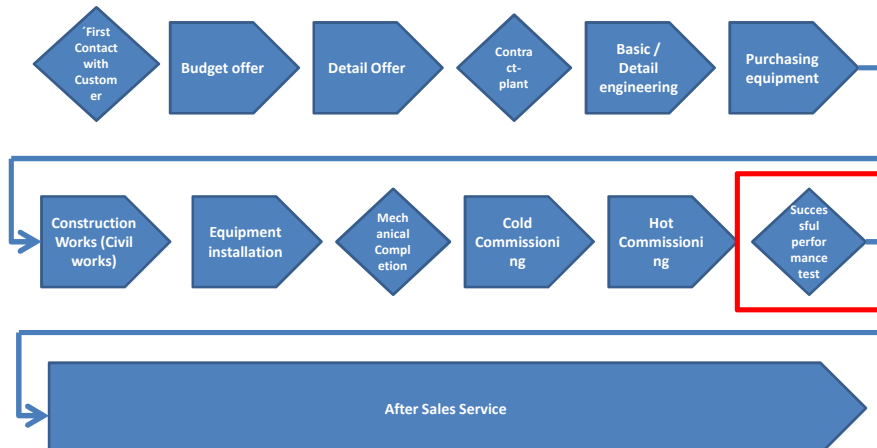
Jyväskylä Summerschool 2013

BDI BioDiesel

BDI BioGas

BDI RetroFit

Performance Test / Plant hand over



Jyväskylä Summerschool 2013

BDI BioDiesel

BDI BioGas

BDI RetroFit

Performance Test / Plant hand over

- Hand over conditions for the biogas plant are defined in the contract
- Usually the functionality and capacity of the plant has to proven by the plant manufacturer in a performance test
- Parameters of performance test are defined in the contract



Jyväskylä Summerschool 2013

BDI BioDiesel

BDI BioGas

BDI RetroFit

After Sales Support

- After hand over of the plant to the customer the warrenty period starts
- During this period the After Sales department takes care about guarantee items
- Furthermore the After Sales department provides services like:
 - Spare parts
 - Maintenance
 - Repair works (out of guarantee)
 - Hotline services



Jyväskylä Summerschool 2013

BDI BioDiesel

BDI BioGas

BDI RetroFit

www.bdi-bioenergy.com **BDI** 

from **waste**
energy⁰¹

Reinhold Waltenberger / reinhold.waltenberger@bdi-bioenergy.com
BDI-Bioenergy International AG/ Parkring 18 / A-8074 Grambach / Austria

BDI  Jyväskylä Summerschool 2013   