Hydrogen System

Pre-project

This report covers a pre-project for a Hydrogen System, which is one of more components that should be able to deliver energy to an overall Energy Hub solution. The pre-project has followed the EUDP process where Rich Picture, Storytelling, Story Cards and Preliminary Use Cases have been used as tools to define the system environment and the system-to-be. The system-to-be is further summarized into a System Description, which describes the system that eventually should be developed. The pre-project includes also a stake-holder matrix that categorizes all the stake holders and finally a development plan for the launch phase.

Team 4 (Anna, Dennis, Lasse and Knud)

27-09-2010

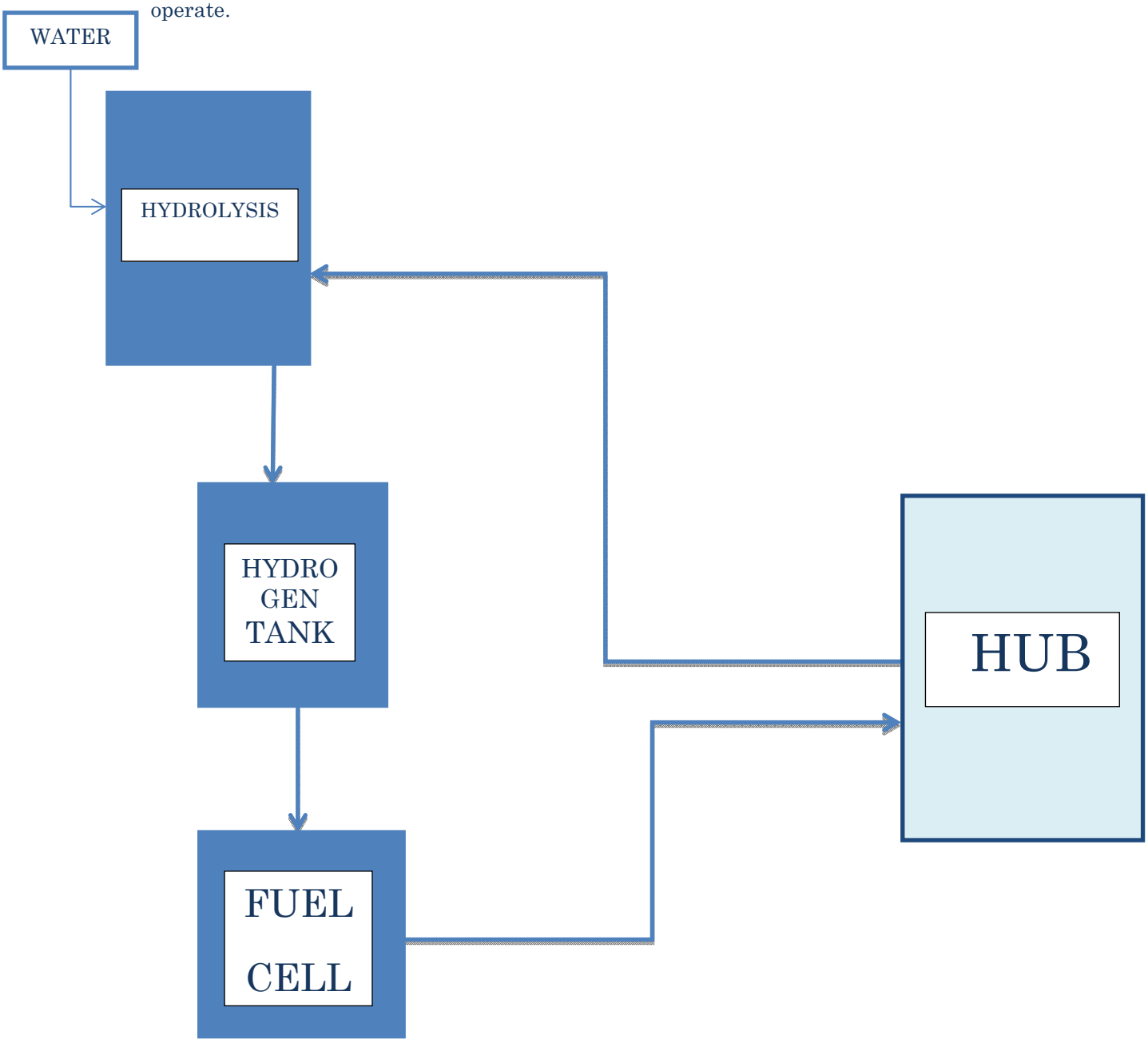
HYDROGEN SYSTEM

Pre-project

Contents

RICH PICTURE

Below Rich Picture shows the environment in which the Hydrogen system should operate.



STORYTELLING

The story below describes a typical day for an end-user that operates in the environment for the system-to-be and starts to give an idea of some of the more general requirements to be fulfilled.

Hydrogen in the daily life

On one of the cold dark winter mornings John Doe wakes up a bit before his alarm rings. He is listening to the wind howling. He knows that right now the wind turbines outside produce more energy than actually is needed for the moment.

Instead of laying in bed and trying to gather the courage to get out of the warm bed and step on the cold floor, like the other cold winter days, he gets up straight away. He goes to the kitchen to make some coffee, the floor is warm and room temperature is just fine. He smiles to himself because due to his newly purchased hydrogen fuel cell system he can easily control temperature in his electric heated house without worrying about extra energy costs or feel bad CO2 emissions.

He had previously scheduled his energy consuming events in the night time, with this new system it is not needed. He has his own small energy-system, which stores energy in the night, where his collaborating neighbour's wind turbine generates power, which can then be used during daytime.

He turns on the coffee machine and goes to the bathroom to get ready for the work. His electric toothbrush and his shaver are fully charged on green energy, and it makes him feel better as he feels like he made his attempt to help up the global warming situation.

After getting ready he goes to the kitchen to drink his freshly brewed coffee. As he has drunk his coffee he checks the energy levels produced by the hydrogen system.

On his way to work, he goes out into the garage and studies his new hydrogen equipment. The electrolysis is running smoothly – His neighbour's system hub controls whether there is a need for power or a surplus of power. He is just happy that his system knows when to start electrolysis and when to start producing energy, because it is the same two wires. The control hardware controls that firmly. He can safely leave his equipment alone. If the tank is empty, nothing happens, and it cannot get overfilled. due to all the sensors which take care of that.

He thinks about how glad he is for his new energy system. It is emission free but very efficient. In the future he should perhaps buy a hydrogen car as well.

STORY CARDS

The below story cards describes each a business functionality to be fulfilled.

STORYCARD	**Card number**: 1
Name: Hydrogen Production – Tank	**Date**: 16-09-2010
Project: Hydrogen System	**Initials**: Lasse
Story description: When the hydrogen tank is full the hydrogen production is stopped.	
Comments:	
Priority:	

STORYCARD	**Card number**: 2
Name: Energy Production – Tank	**Date**: 16-09-2010
Project: Hydrogen System	**Initials**: Lasse
Story description: When the hydrogen tank is empty the energy production is stopped.	
Comments:	
Priority:	

STORYCARD	**Card number**: 3
Name: Hydrogen production – Power	**Date**: 16-09-2010
Project: Hydrogen System	**Initials**: Lasse
Story description: The hydrogen fabrication is started or stopped automatically by the system hub depending on power available.	
Comments:	
Priority:	

STORYCARD	**Card number**: 4
Name: Manually Control	**Date**: 16-09-2010
Project: Hydrogen System	**Initials**: Lasse
Story description: John Doe can also start and stop the production manually.	
Comments:	
Priority:	

STORYCARD	Card number: 5
Name: Emergency Shutdown	Date: 16-09-2010
Project: Hydrogen System	Initials: Lasse
Story description: If any failure occurs the system will shut down without any security issues	
Comments:	
Priority:	

STORYCARD	Card number: 6
Name: Energy Production – Power	Date: 16-09-2010
Project: Hydrogen System	Initials: Lasse
Story description: The fuel cell is started or stopped automatically by the system hub depending on power needs.	
Comments:	
Priority:	

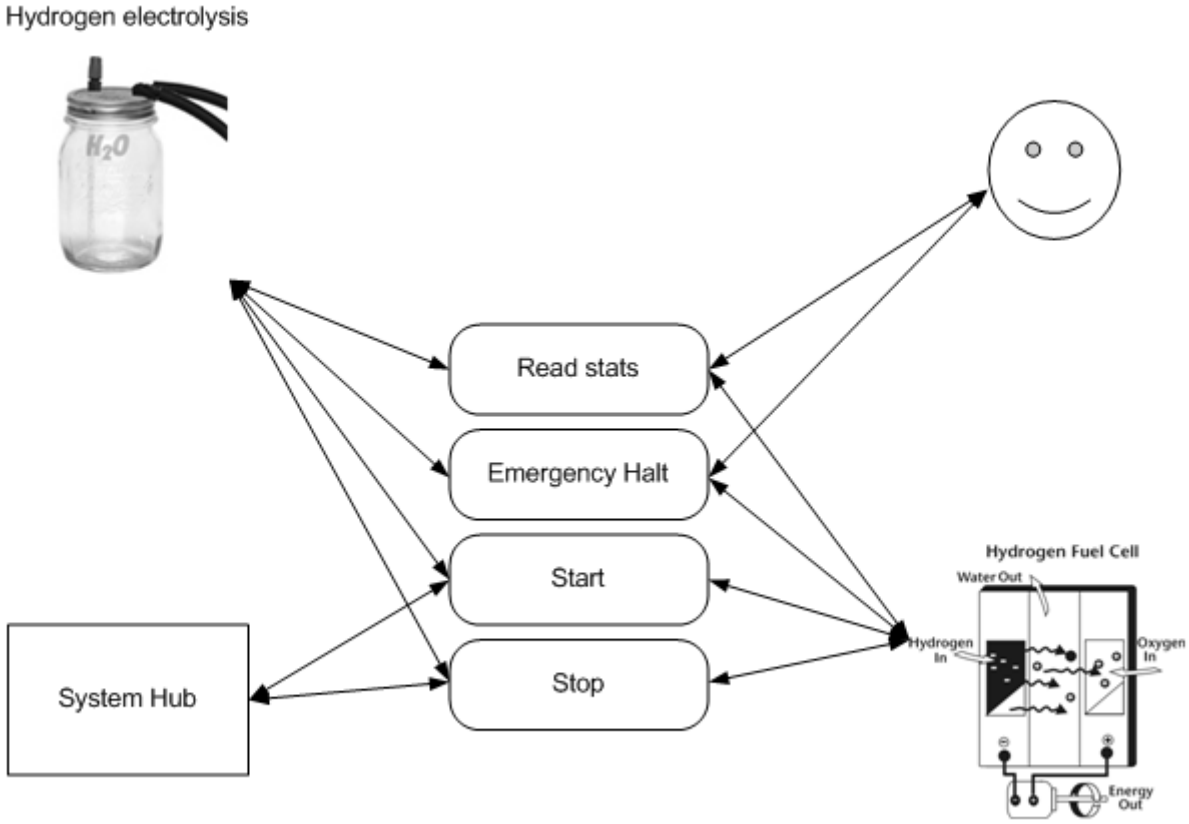
STORYCARD	Card number: 7
Name: Data log	Date: 16-09-2010
Project: Hydrogen System	Initials: Lasse
Story description: John Doe can later access logged data, and make spreadsheets.	
Comments:	
Priority:	

STORYCARD	Card number: 8
Name: Display	Date: 16-09-2010
Project: Hydrogen System	Initials: Lasse
Story description: Though gauges and meters' John Doe can follow the hydrogen and energy production.	
Comments:	
Priority:	

STORYCARD	Card number: 9
Name: Connection To Hub	Date: 16-09-2010
Project: Hydrogen System	Initials: Lasse
Story description: John can move his system and connect it another system hub in plug 'n play	
Comments:	
Priority:	

Preliminary Use Cases

Use Cases Diagram



Use Case Description

Read Stats

User asks for current stats (through UI)

1. System hub asks for data
2. System delivers stat from Hydrogen Fuel Cell and/or Hydrogen electrolysis
3. System hub deliverers data to John Doe through UI

Emergency Halt

1. User presses Emergency halt / Tank overfilled / Other alarms
2. System shuts down
3. System hub is notified

Start Hydrogen Production

1. Request from System Hub to start Hydrogen Production (use energy)
2. System starts Hydrogen production
3. System notifies System hub

Stop Hydrogen Production

1. Tank filled or System Hub request
2. System stops hydrogen production
3. System notifies System Hub

Start Energy production

1. System Hub request to produce energy
2. System starts energy production
3. System notifies System Hub

Stop energy production

1. The tank is empty or Request from System Hub
2. Energy production is stopped
3. System notifies System Hub

System Definition

The new system will control the Hydrogen system(s) and will by sensors and communication with the system Hub exploit the energy to its maximum.

The system, when there is a surplus of electricity, will store this energy into hydrogen and when the energy demand is high (and thereby the price) convert hydrogen back into electricity.

The system is only connected to the System Hub through its mains and a data connection according the System Hub standard.

The current data for example, hydrogen level, current production or consumption, voltage, amps can be seen from a UI-terminal or through gauges physically placed at the system.

The system shall run automatically commanded by the System Hub, but monitored by its own sensors - e.g. the System Hub cannot overfill the hydrogen tank.

The system shall of course be safe and should not require supervision.

The system must be programmable, for example to leave extra hydrogen in the tank for your future hydrogen car.

The system has to be able to withstand temperature variation from below freezing point to around 30°C.

Stakeholder Matrix

The identified stakeholders have been grouped into the matrix below.

	Has decision power	Has no decision power
Directly involved stakeholder	- H2Logix -Klaus Kolle -Morten Jakobsen -System HUB team -Interface Commitee	-Other teachers -Other teams
Not directly involved stakeholder	-Per Lysgaard -Project sponsor -Jan Nielsen (End-user)	-Jens Mortensen (el.lab)

Primary users
Secondary users
Tertiary users

Development Plan

Date	Task	Description
11/10 (Week 41)	Iteration 1	General Analyses
25/10 (Week 43)	Iteration 2	Update General Analysis General Architecture
08/11 (Week 45)	Iteration 3	Update General Analysis Update General Architecture Technical Platform
22/11 (Week 47)	Iteration 4	Update General Analysis Update General Architecture Update Technical Platform