Solar/Wind Hydrogen Fuelling Station at IIT

IPRO 304b Project Plan
February 4, 2005

Instructors: Said Al-Hallaj, Javad Abbasian
TA: Kristofer Kiszynski

Team Members

Niyanta Arora
Alex Bartman
Michael Condei
George Derrick
Abdoulaye Diao
Joseph Gottardo
Kendra Hardin
Alija Hubjer
Matthew Isoda
Aydra Kalynchuk
Dimitre Kolev
Adam Mancina
Amy McDowell
Mahdi Mohammad
Bilques Qureshi
Wojciech Sierka
Douglas Stauber
Edwin Vargas
Mark Witkowski

Objective

The objective of this project is to design a renewably powered hydrogen fuelling station at IIT to be part of the Illinois Hydrogen Highway. Based on past recommendations a project site will be selected for the fuelling station. This site will also include a wind turbine and solar panel array to capture renewable energy. The principles of process design will be used to layout hydrogen production, storage, and implementation of renewable energy technologies. The stations will meet all local codes for hydrogen storage, production, and usage. This station will be designed in conjunction with the House of the Future, which is part of IIT's Sustainable Village.

Background

This project is part of a state-wide effort to create a hydrogen transportation infrastructure to encourage hydrogen use in Illinois transportation. This effort will support the widespread deployment of environmentally friendly technology called the hydrogen-powered fuel cell. Hopefully, this initiative will help move us toward a full hydrogen economy limiting the use of fossil fuels.

Hydrogen is the most abundant element in the universe. It does not naturally exist in large quantities or in high concentrations on Earth, so it must be produced from other compounds. Hydrogen can be produced from fossil fuels; renewable sources such as wind, solar, or biomass; nuclear or solar-powered thermonuclear reactions; and solar photolysis or biological methods. Various methods of production have unique needs in

terms of energy and generate unique by-products or emissions. Between 55-60% of the hydrogen being produced in the world today is produced by steam reformation. Hydrogen is also produced via water electrolysis using electricity supplied by coal, nuclear, solar, and wind technologies.

Research Methodology

The goals of this IPRO will be met using the following techniques:

- Researching current technologies and codes
- Locating Project Site
- Determining best technologies for project
- Design of station, hydrogen production, and mechanical systems
- Presenting proposal for renewably powered hydrogen fuelling station

Expected Results

Hydrogen Production and Storage Team

- Research hydrogen production methods and decide on viable options
- Work with renewable energy team to size hydrogen production components and storage including tank specs and costs
- Determine compressor specifications for our application and, if possible, determine costs
- Design hydrogen transportation system including pipes, interconnections, safety/relief valves, hydrogen venting system and include appropriate specificatiosn
- Provide complete fuelling system schematics and write final proposal

Renewable Energy and Simulation Team

- Specify and determine the size of the renewable energy components for hydrogen generation and electricity needs.
- Determine the cost of components, other engineering work and installation of the system.
- Take wind measurements at the potential site of the wind turbine and construct a plot showing the wind data for the final report
- Compile information and write final proposal

IPRO 301 Coordination, Location, Layout and Design Team

- Choose a site on IIT's campus for the fuelling station including comprehensive reasoning as to why the site was chosen
- Design the station to house the components specified by the other teams and that is aesthetically pleasing
- Work with the IPRO 301 team so that the fuelling station and House of the Future are not only compatible, but also complement each other
- Create AutoCAD models and/or renderings of fuelling station
- Build physical scale model of fuelling station
- Compile information and write final proposal

Code and Safety Team

- Determine safety codes acceptable to the City of Chicago
- Assist other teams in identifying applicable codes
- Compile information

Project Budget

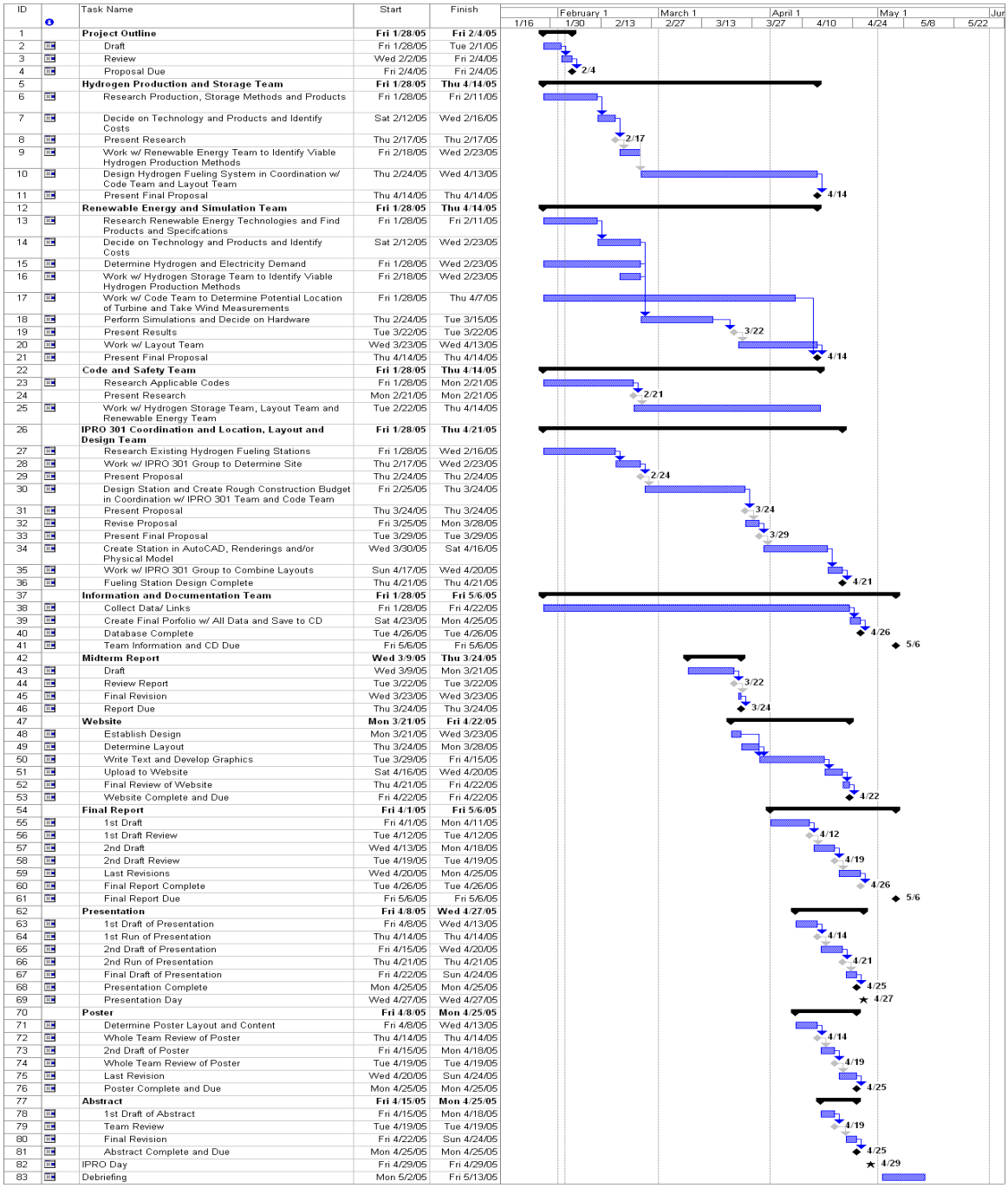
Model Costs - $150
Code Books - $150

Individual Team Member Assignments

Niyanta Arora - IPRO 301 Coordination, Layout and Design Team Leader
Alex Bartman - Hydrogen Production and Storage Team Leader
Michael Condei - Renewable Energy and Simulation
George Derrick - Renewable Energy and Simulation
Abdoulaye Diao - Code and Safety
Joseph Gottardo - Renewable Energy and Simulation
Kendra Hardin - Renewable Energy and Simulation Team Leader, IPRO Team Leader
Alija Hubjer - IPRO 301 Coordination, Layout and Design
Matthew Isoda - Code and Safety Team Leader
Aydra Kalynchuk - Code and Safety
Dimitre Kolev - Hydrogen Production and Storage
Adam Mancina – IPRO 301 Coordination, Layout and Design
Amy McDowell - Hydrogen Production and Storage
Mahdi Mohammad - Hydrogen Production and Storage
Bilques Qureshi – Controller Logic
Wojciech Sierka - Renewable Energy and Simulation
Douglas Stauber - IPRO 301 Coordination, Layout and Design
Edwin Vargas – IPRO 301 Coordination, Layout and Design, Meeting Minutes

Mark Witkowski - Hydrogen Production and Storage

Schedule Tasks and Milestone Events



ID	Task Name	Start	Finish
1	**Project Outline**	**Fri 1/28/05**	**Fri 2/4/05**
2	Draft	Fri 1/28/05	Tue 2/1/05
3	Review	Wed 2/2/05	Fri 2/4/05
4	Proposal Due	Fri 2/4/05	Fri 2/4/05
5	**Hydrogen Production and Storage Team**	**Fri 1/28/05**	**Thu 4/14/05**
6	Research Production, Storage Methods and Products	Fri 1/28/05	Fri 2/11/05
7	Decide on Technology and Products and Identify Costs	Sat 2/12/05	Wed 2/16/05
8	Present Research	Thu 2/17/05	Thu 2/17/05
9	Work w/ Renewable Energy Team to Identify Viable Hydrogen Production Methods	Fri 2/18/05	Wed 2/23/05
10	Design Hydrogen Fueling System in Coordination w/ Code Team and Layout Team	Thu 2/24/05	Wed 4/13/05
11	Present Final Proposal	Thu 4/14/05	Thu 4/14/05
12	**Renewable Energy and Simulation Team**	**Fri 1/28/05**	**Thu 4/14/05**
13	Research Renewable Energy Technologies and Find Products and Specifcations	Fri 1/28/05	Fri 2/11/05
14	Decide on Technology and Products and Identify Costs	Sat 2/12/05	Wed 2/23/05
15	Determine Hydrogen and Electricity Demand	Fri 1/28/05	Wed 2/23/05
16	Work w/ Hydrogen Storage Team to Identify Viable Hydrogen Production Methods	Fri 2/18/05	Wed 2/23/05
17	Work w/ Code Team to Determine Potential Location of Turbine and Take Wind Measurements	Fri 1/28/05	Thu 4/7/05
18	Perform Simulations and Decide on Hardware	Thu 2/24/05	Tue 3/15/05
19	Present Results	Tue 3/22/05	Tue 3/22/05
20	Work w/ Layout Team	Wed 3/23/05	Wed 4/13/05
21	Present Final Proposal	Thu 4/14/05	Thu 4/14/05
22	**Code and Safety Team**	**Fri 1/28/05**	**Thu 4/14/05**
23	Research Applicable Codes	Fri 1/28/05	Mon 2/21/05
24	Present Research	Mon 2/21/05	Mon 2/21/05
25	Work w/ Hydrogen Storage Team, Layout Team and Renewable Energy Team	Tue 2/22/05	Thu 4/14/05
26	**IPRO 301 Coordination and Location, Layout and Design Team**	**Fri 1/28/05**	**Thu 4/21/05**
27	Research Existing Hydrogen Fueling Stations	Fri 1/28/05	Wed 2/16/05
28	Work w/ IPRO 301 Group to Determine Site	Thu 2/17/05	Wed 2/23/05
29	Present Proposal	Thu 2/24/05	Thu 2/24/05
30	Design Station and Create Rough Construction Budget in Coordination w/ IPRO 301 Team and Code Team	Fri 2/25/05	Thu 3/24/05
31	Present Proposal	Thu 3/24/05	Thu 3/24/05
32	Revise Proposal	Fri 3/25/05	Mon 3/28/05
33	Present Final Proposal	Tue 3/29/05	Tue 3/29/05
34	Create Station in AutoCAD, Renderings and/or Physical Model	Wed 3/30/05	Sat 4/16/05
35	Work w/ IPRO 301 Group to Combine Layouts	Sun 4/17/05	Wed 4/20/05
36	Fueling Station Design Complete	Thu 4/21/05	Thu 4/21/05
37	**Information and Documentation Team**	**Fri 1/28/05**	**Fri 5/6/05**
38	Collect Data/ Links	Fri 1/28/05	Fri 4/22/05
39	Create Final Porfolio w/ All Data and Save to CD	Sat 4/23/05	Mon 4/25/05
40	Database Complete	Tue 4/26/05	Tue 4/26/05
41	Team Information and CD Due	Fri 5/6/05	Fri 5/6/05
42	**Midterm Report**	**Wed 3/9/05**	**Thu 3/24/05**
43	Draft	Wed 3/9/05	Mon 3/21/05
44	Review Report	Tue 3/22/05	Tue 3/22/05
45	Final Revision	Wed 3/23/05	Wed 3/23/05
46	Report Due	Thu 3/24/05	Thu 3/24/05
47	**Website**	**Mon 3/21/05**	**Fri 4/22/05**
48	Establish Design	Mon 3/21/05	Wed 3/23/05
49	Determine Layout	Thu 3/24/05	Mon 3/28/05
50	Write Text and Develop Graphics	Tue 3/29/05	Fri 4/15/05
51	Upload to Website	Sat 4/16/05	Wed 4/20/05
52	Final Review of Website	Thu 4/21/05	Fri 4/22/05
53	Website Complete and Due	Fri 4/22/05	Fri 4/22/05
54	**Final Report**	**Fri 4/1/05**	**Fri 5/6/05**
55	1st Draft	Fri 4/1/05	Mon 4/11/05
56	1st Draft Review	Tue 4/12/05	Tue 4/12/05
57	2nd Draft	Wed 4/13/05	Mon 4/18/05
58	2nd Draft Review	Tue 4/19/05	Tue 4/19/05
59	Last Revisions	Wed 4/20/05	Mon 4/25/05
60	Final Report Complete	Tue 4/26/05	Tue 4/26/05
61	Final Report Due	Fri 5/6/05	Fri 5/6/05
62	**Presentation**	**Fri 4/8/05**	**Wed 4/27/05**
63	1st Draft of Presentation	Fri 4/8/05	Wed 4/13/05
64	1st Run of Presentation	Thu 4/14/05	Thu 4/14/05
65	2nd Draft of Presentation	Fri 4/15/05	Wed 4/20/05
66	2nd Run of Presentation	Thu 4/21/05	Thu 4/21/05
67	Final Draft of Presentation	Fri 4/22/05	Sun 4/24/05
68	Presentation Complete	Mon 4/25/05	Mon 4/25/05
69	Presentation Day	Wed 4/27/05	Wed 4/27/05
70	**Poster**	**Fri 4/8/05**	**Mon 4/25/05**
71	Determine Poster Layout and Content	Fri 4/8/05	Wed 4/13/05
72	Whole Team Review of Poster	Thu 4/14/05	Thu 4/14/05
73	2nd Draft of Poster	Fri 4/15/05	Mon 4/18/05
74	Whole Team Review of Poster	Tue 4/19/05	Tue 4/19/05
75	Last Revision	Wed 4/20/05	Sun 4/24/05
76	Poster Complete and Due	Mon 4/25/05	Mon 4/25/05
77	**Abstract**	**Fri 4/15/05**	**Mon 4/25/05**
78	1st Draft of Abstract	Fri 4/15/05	Mon 4/18/05
79	Team Review	Tue 4/19/05	Tue 4/19/05
80	Final Revision	Fri 4/22/05	Sun 4/24/05
81	Abstract Complete and Due	Mon 4/25/05	Mon 4/25/05
82	IPRO Day	Fri 4/29/05	Fri 4/29/05
83	Debriefing	Mon 5/2/05	Fri 5/13/05