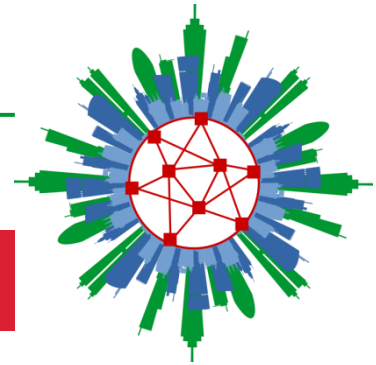




Техник Технологийн  
Дээд сургууль

SuMoCoS

Sustainability and Mobility  
in the Context of Smart Cities



# INTRODUCING A “SMART” CONCEPT IN ENGINEERING CURRICULUM

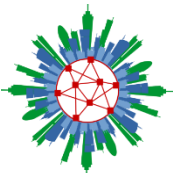
Bayarmaa Ts., Bolormaa D., Lodoiravsal Ch., Enkhdul T.

# Contact



Ability  
rt Cities

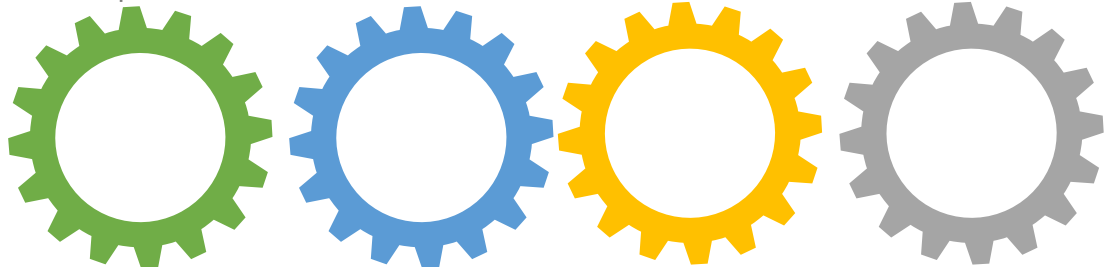




# THE NEED FOR REVISION OF ENGINEERING CURRICULUM

■ Industry 4.0

■ 21<sup>st</sup> century skillsets



■ Education 4.0

■ Society 5.0



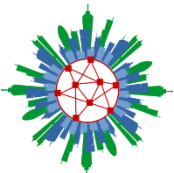
SELF-AWARENESS  
LITERACY  
COMMUNICATION  
SOCIAL/DIVERSITY  
EMPATHY  
RESILIENCE  
MINDSET  
ADAPTABILITY  
ENTREPRENEURIAL  
ADAPTABILITY  
COLLABORATION

WorkReady

BE LIFE READY



Institute of Engineering and Technology



# Introducing a “SMART” concept in multidisciplinary project

- Programs were selected to introduce multidisciplinary project (MDP)
  - Electronics Engineering (NUM)
  - Environmental Engineering (NUM)
  - Electrical Engineering (IET)
  - Construction Engineering (IET)



MDP tasks were defined

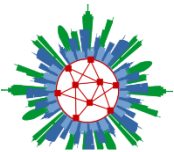
1. Identify environmental problem and confirm them with experimental data
2. Design and construct a smart building according to requirement

Comparison of learning outcomes of Programs



Identified common skills to enhance through MDP

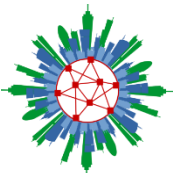




# ALIGNMENT OF LEARNING OUTCOMES OF ENGINEERING PROGRAMS

Skills/attributes	Electronics Engineering	Environmental Engineering	Electrical Engineering	Construction Engineering
<b>System thinking</b>	-	✓	✓	✓
Critical thinking	✓	-	-	-
Creative thinking	✓	-	-	-
<b>Problem-solving skills</b>	✓	✓	✓	✓
Innovative thinking	✓	✓	-	-
Global mindset	-	✓	-	✓
<b>Resilient</b>	✓	✓	✓	-
<b>Teamwork and collaboration</b>	✓	✓	✓	✓
Entrepreneur skills	✓	-	✓	-
Open minded	✓	-	-	✓





# Enhancing Skillsets Implementation: Multi-Disciplinary Student Projects

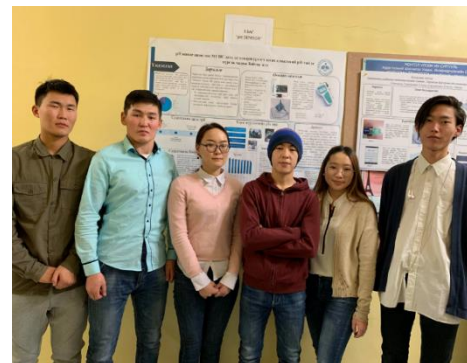
## STAGE 1. Define environmental issue and its confirmation

The following skillsets have been infused in this Multi-Disciplinary Project (MDP):

Students are able to:

- Form effective team
- Manage and participate actively & collaboratively in teams
- Design appropriate communication strategies
- Identify and formulate problems
- Conduct experimental inquiry
- Attest problem by analyzing data and writing report
- Present project findings, recommendations & solutions through oral presentation

## *MDP Student Presentation*



## *Output of MDP*



Adobe Acrobat Document

**Team 1**



Adobe Acrobat Document

**Team 2**



Adobe Acrobat Document

**Team 3**



Adobe Acrobat Document

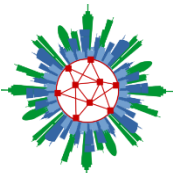
**Team 4**



Adobe Acrobat Document

**Team 5**





# Enhancing Skillsets Implementation: Multi-Disciplinary Student Projects

## STAGE 2. DESIGN AND CONSTRUCT A SMART BUILDING ACCORDING TO REQUIREMENT

### Project task:



Size on the ground – 30m<sup>2</sup>

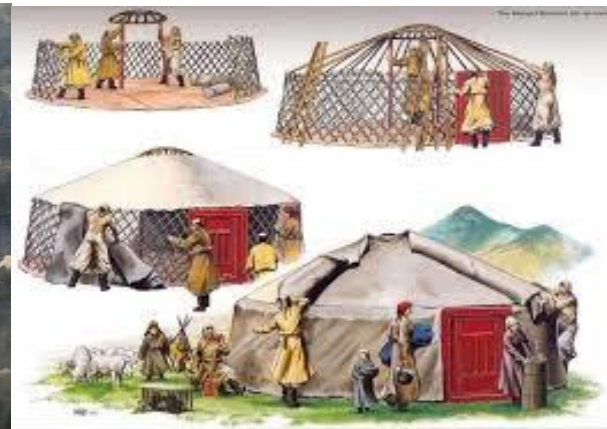
Construction material:  
fire-resistant, breathing,  
min heat loss

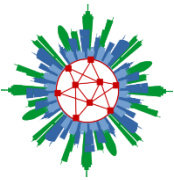
80% of energy  
consumption  
– solar energy

Electrical heating  
system (flooring)

Grey water  
system

Sensor selection  
(temperature  
control, and other  
parameters (RH,  
temp, gases to  
control))





# Introducing a Green/Smart Building concept

- To familiarize students with green and smart concept visited to construction materials manufacturing and construction automation companies:



Basaltwool



Smart Craft



IT Zone



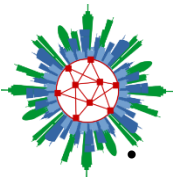
Systems Engineering Mongolia

- And visited each universities' facilities



Institute of Engineering and Technology





# Team work

- During implementation of project activities students were able to develop their own team rules and delegated work based on their assigned roles and functions to ensure effective teamwork
- Every week students were required to present their research activities and results and conduct discussion

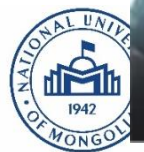


Knowledge & Experience sharing

Team work



Team discussion /Every week/

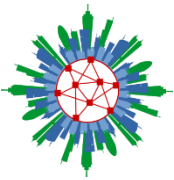




# MDP resolution

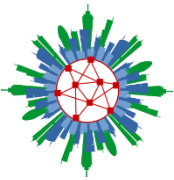
- 3 teams – 3 idea → final design





# Calculation of energy consumption

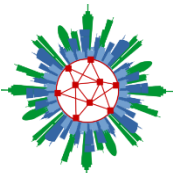
№	Equipments	Equipment Power consumption (W)	Summer		Winter	
			Using hour in day (min)	Power (W)	Using hour in day (min)	Power (W)
1	Water heater	1500	120	3000	120	3000
2	Floor heater	1200			1080 (16 hour)	19200
3	Well pump	2000	10	300	10	300
4	Humidifier	30	1440	720	1440	720
5	Lights	40	240	160	240	240
6	Kitchen electric tools	600	120	1200	120	1200
	Total power			5380		24580



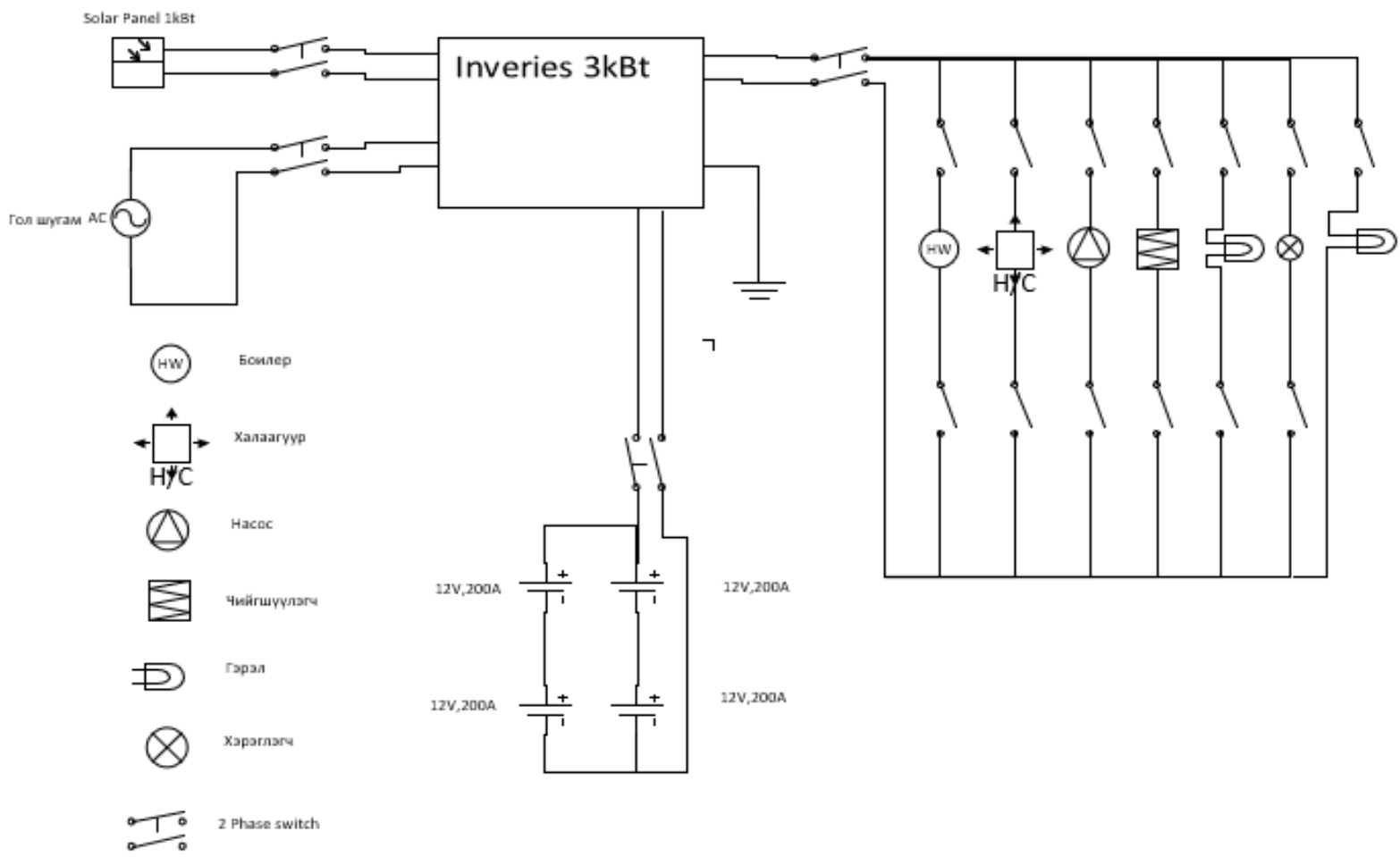
# Calculation of energy consumption

Power		Battery 24V, (P=5.4kW)	
80%	100%	60%	100%
2kW	2.5kW	225A.h	375A.h
		400A.h 12V	
3kW		200A.h: 2 in series, 2 parallel	

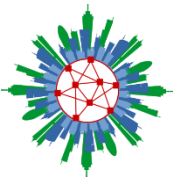
- Mono panel 250W 120\$\*4=480\$
- Poly panel 250W 105\$\*4=420\$



# Electrical installation scheme

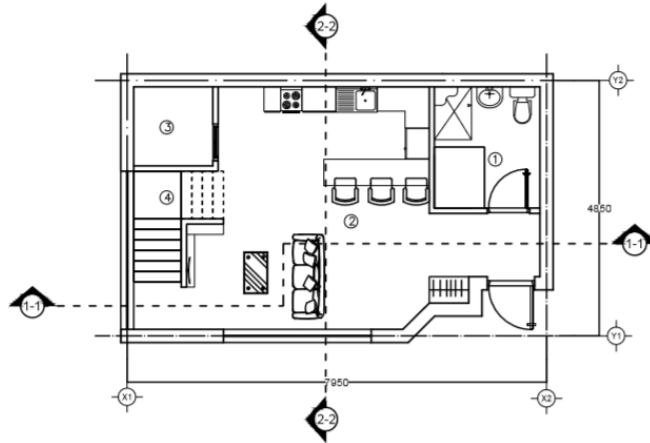




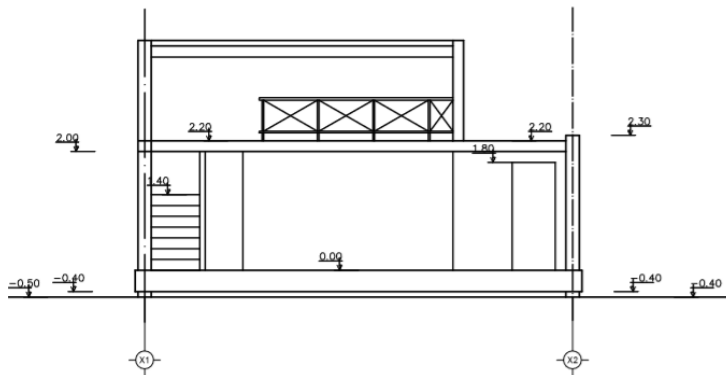


# Construction drawings

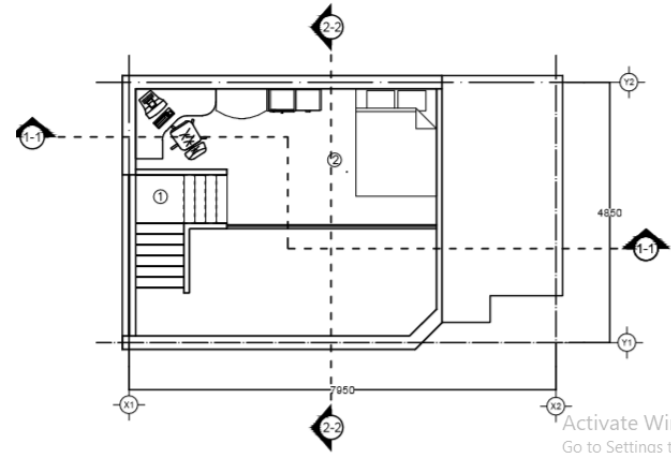
Технологийн байгуулалт M1:100



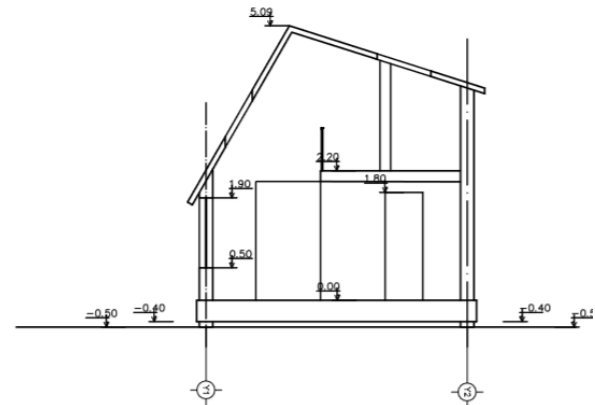
Огтлол 1-1 M1:100



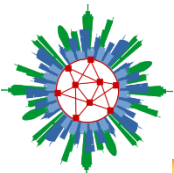
Технологийн байгуулалт M1:100



Огтлол 2-2 M1:100

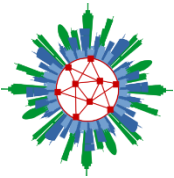


Activate Win  
Go to Settings to



# Construction process





# CONCLUSION AND RECOMMENDATION

- MDP was successfully implemented in order to introduce smart and green concept in engineering programs through the application of theoretical knowledge in real-world situation.
- Implementation of MDP were enhanced soft skills of engineering students;
  - Teamwork and communication,
  - Time management
  - Collaboration with different discipline
- Students were able to understand:
  - other engineering discipline,
  - real-life situation and need
- Not only students' soft skills and knowledge improved also faculty members of different discipline were collaborated in order to finish this MDP