# Sustainable Village

Illinois Institute of Technology

IPRO 301 – Spring 2005

ILLINOIS INSTITUTE OF TECHNOLOGY

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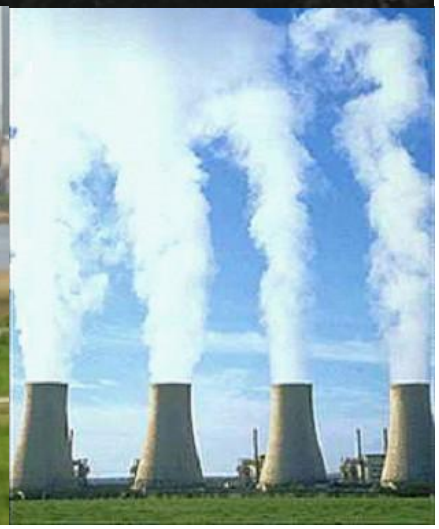
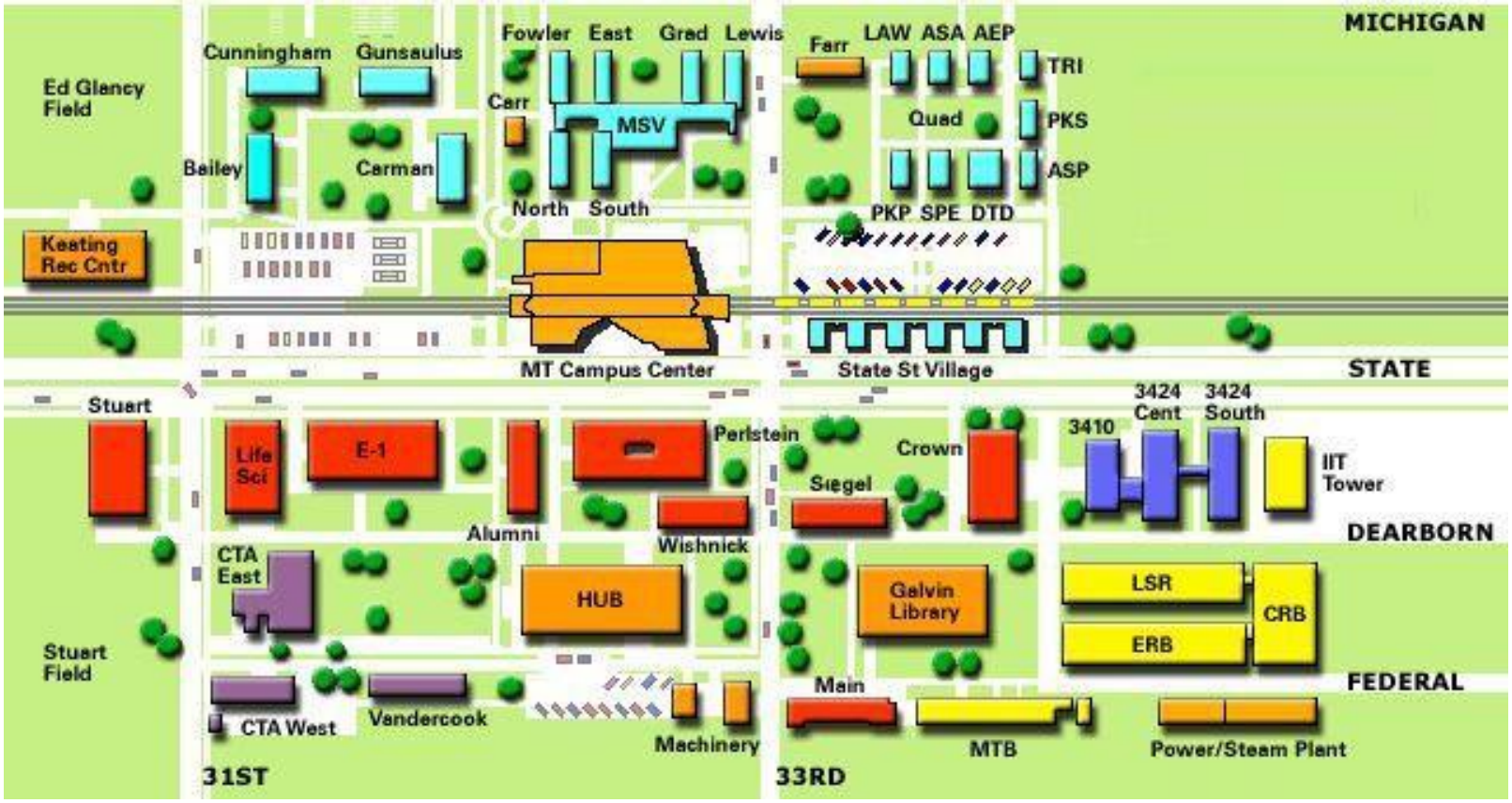
# Why Sustainability?



# Why Sustainability at IIT?



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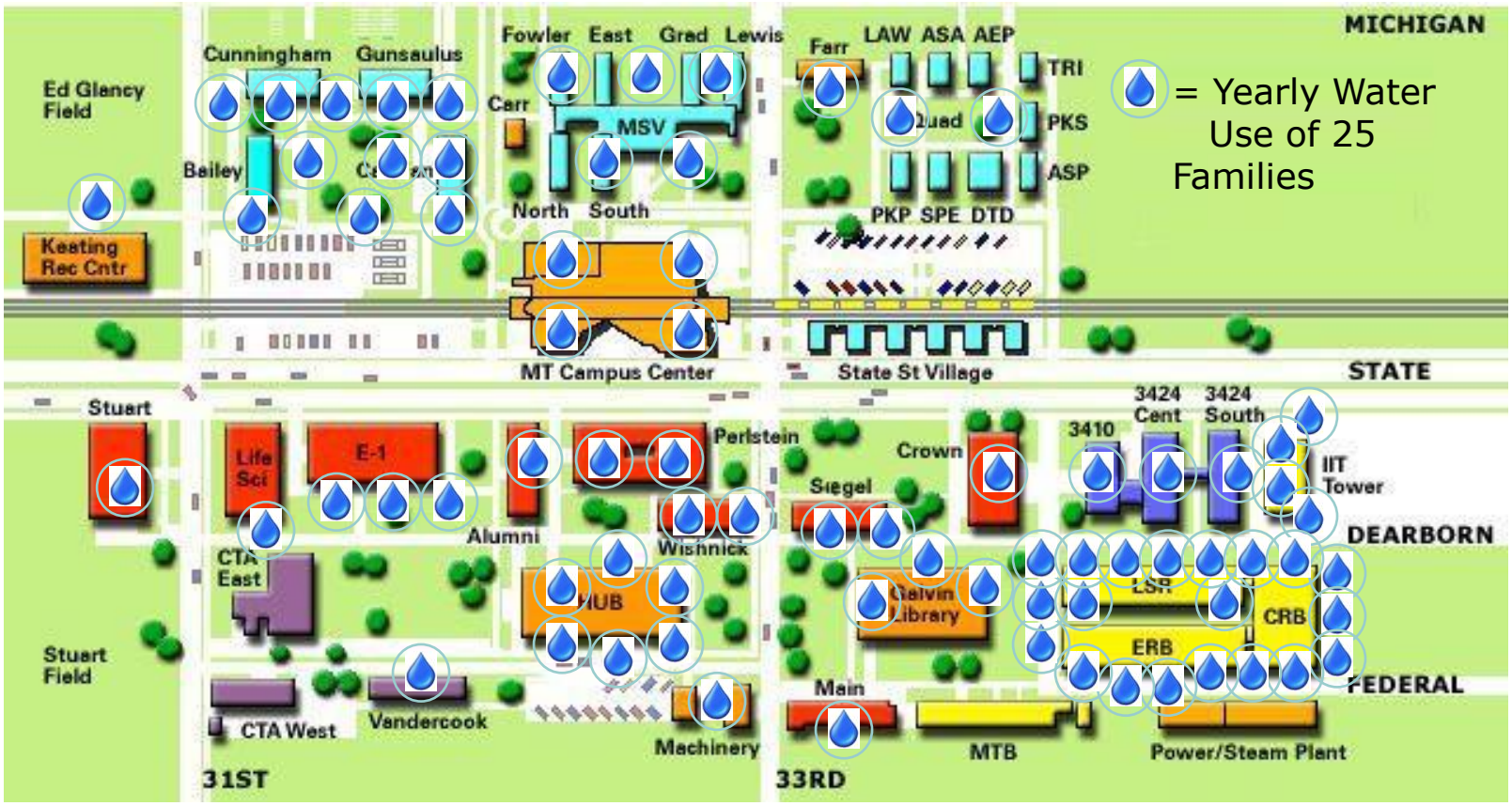
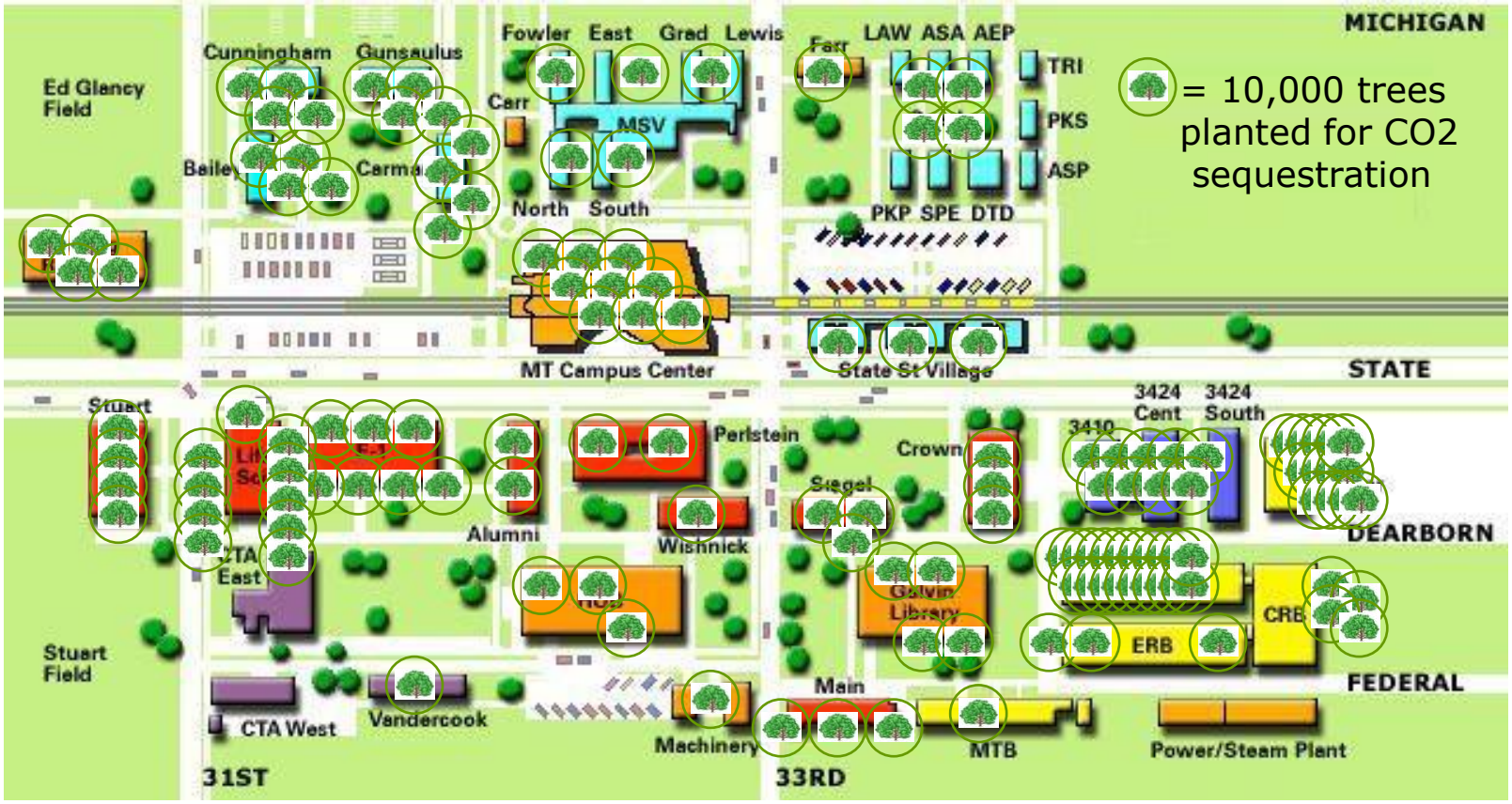



**The campus uses 127 million gallons of water each year above and beyond the daily needs of the students, faculty and staff.**

# Why Sustainability at IIT?




**To sequester the greenhouse gas emissions produced as a result of IIT's main campus, 1.3 million trees would have to be planted each year.**

# Teams

- IPRO 301:
  - Sustainability Team:
    - Research in Sustainability
    - Roadmap for IIT
  - House Team:
    - Design “House of the Future”
- IPRO 304b:
  - Renewable Hydrogen Fueling Station

# Sustainability Team

# What is Sustainability?

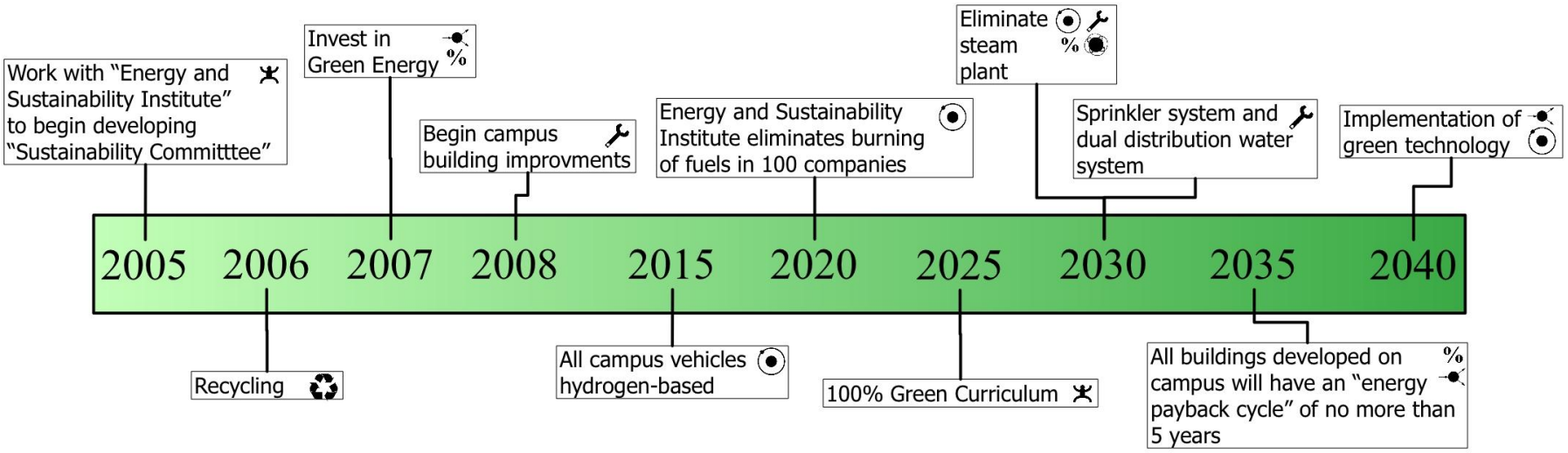
- Sustainable developments are those that "meet present needs without compromising the ability of future generations to meet their needs" (WECD, 1987)

- Focus on 3 Areas
  - Energy (Fuels / Electricity)
  - Environment (Air / Water)
  - Economy (Waste / People)

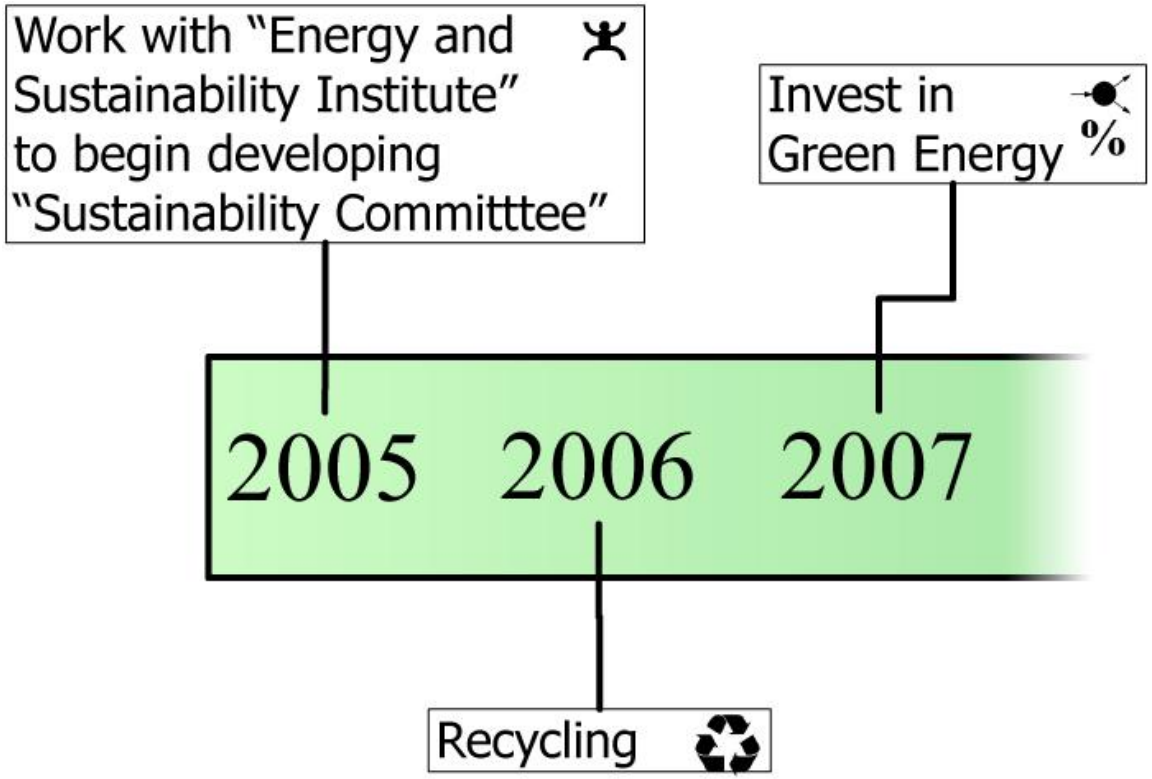
# Sustainable Philosophies

- Consumers to Producers
- Waste Stream Utilization
- Conserve, Optimize, Maintain
- Eliminate burning of Fuels
- Public participation
- % Treat Energy as Capital, not a Commodity
- Green Unit

# Roadmap


Work with "Energy and Sustainability Institute" to begin developing "Sustainability Committtee"
Invest in Green Energy
Begin campus building improvments
Energy and Sustainability Institute eliminates burning of fuels in 100 companies
Eliminate steam plant
Sprinkler system and dual distribution water system
Implementation of green technology
2005
2006
2007
2008
2015
2020
2025
2030
2035
2040
Recycling
All campus vehicles hydrogen-based
100% Green Curriculum
All buildings developed on campus will have an "energy payback cycle" of no more than 5 years

# Roadmap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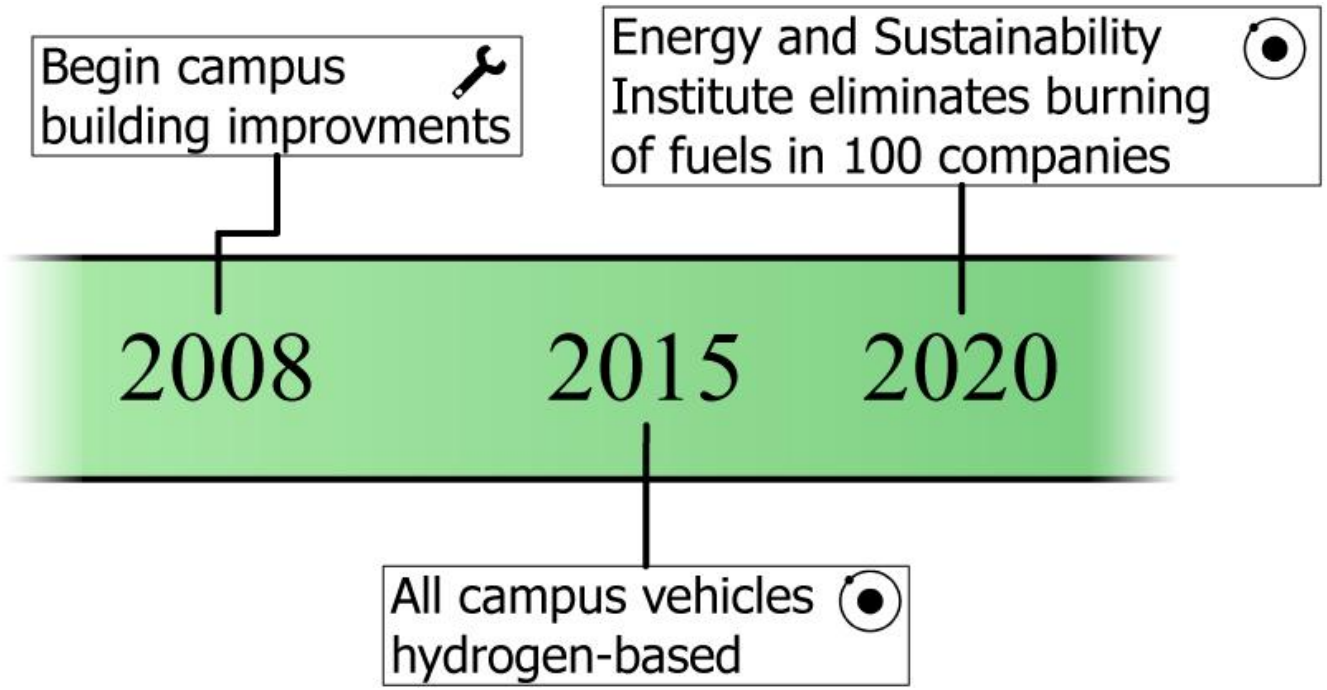
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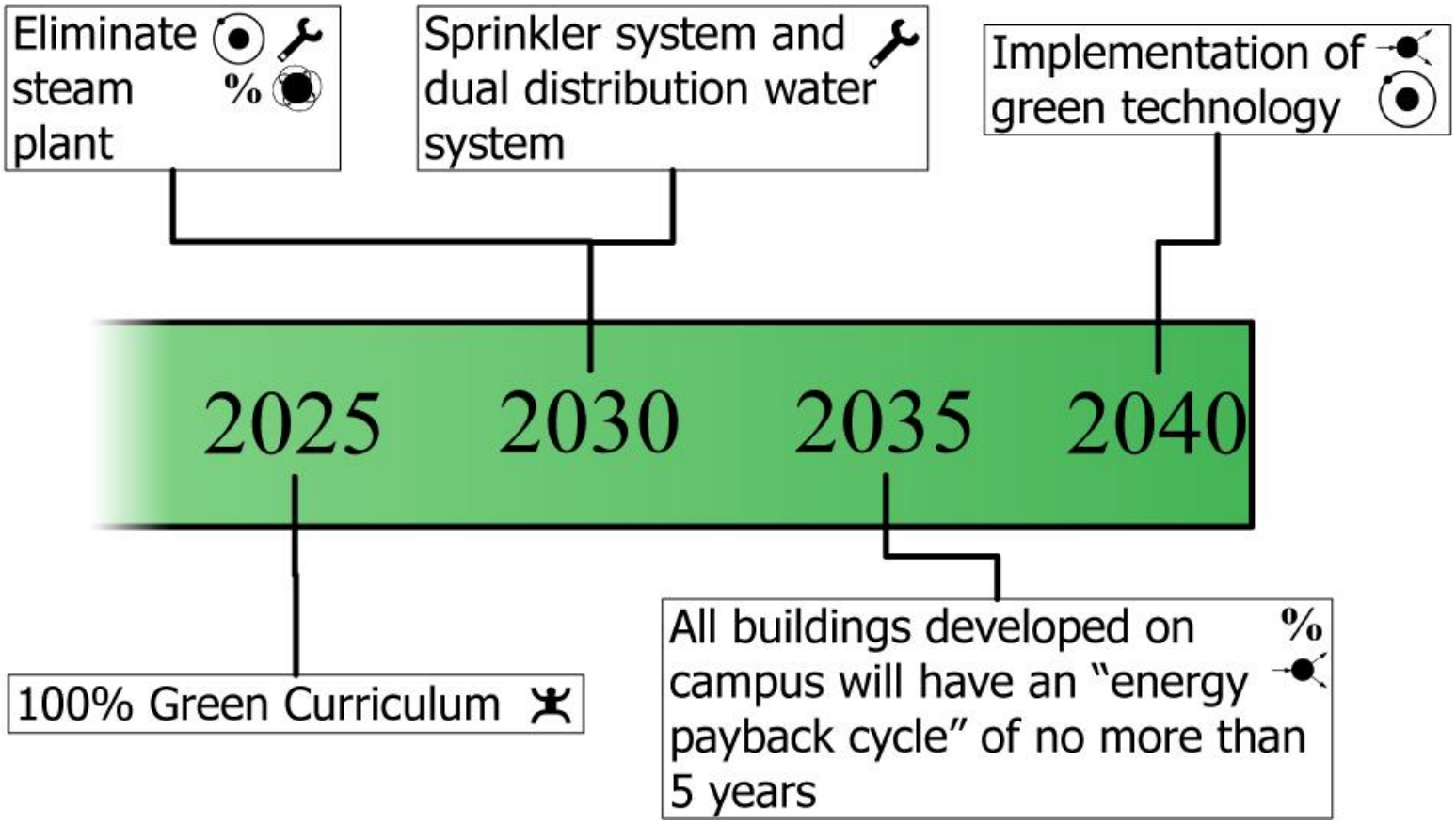
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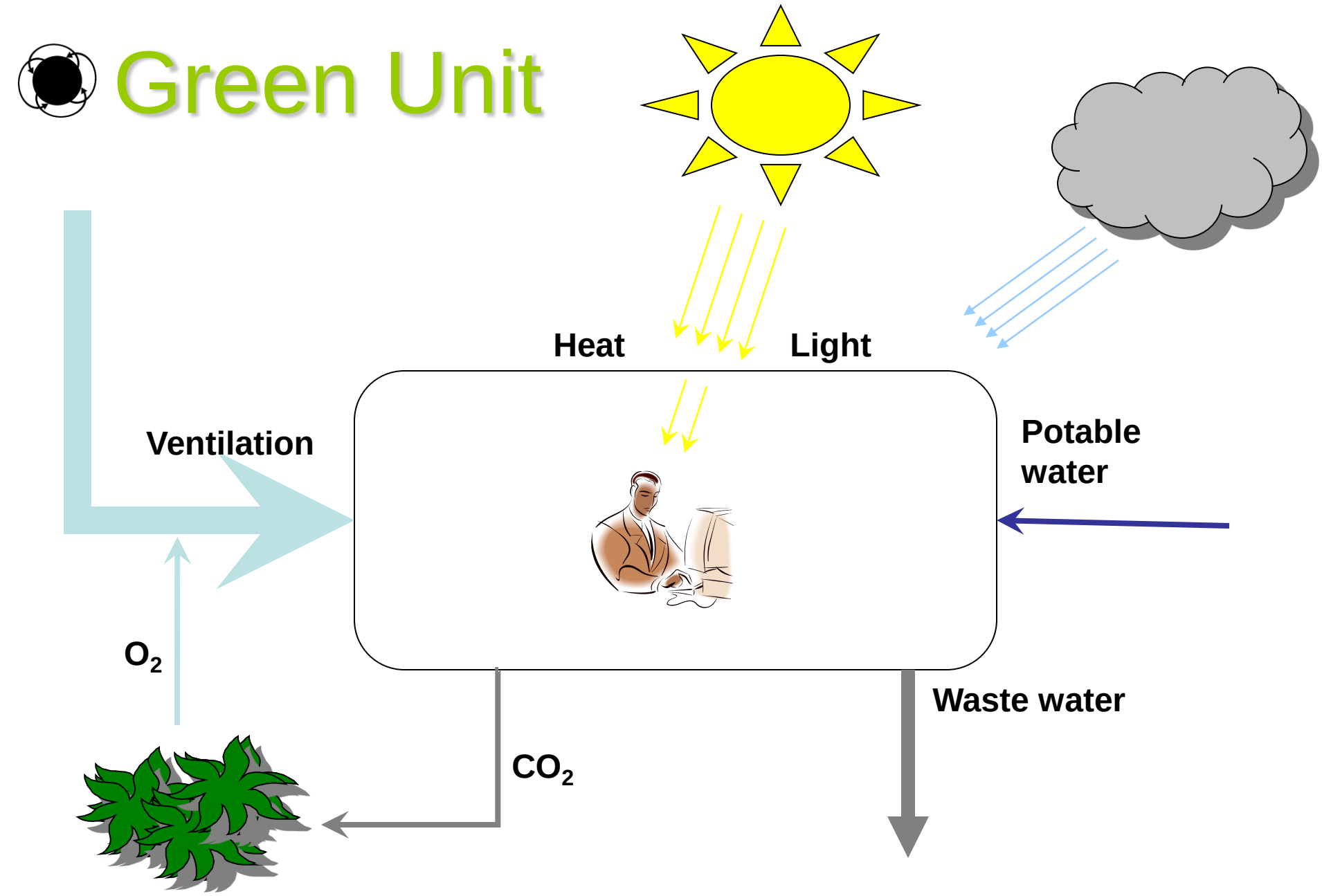
# Green Unit



# House Team

# Objectives

- Case Study for Future Sustainable Efforts at IIT
- Vision of Sustainable Measures for Surrounding Community
- Application of Green Unit Concept


Solar Chimney
Double skin façade
Photovoltaic panels
Greenery
Solar Thermal
Collectors
Test bed for
green products
Energy
efficient
windows
Changeable
exterior panels
Interior Lab to
test materials
Reclaimed
wood from site

# Additional Systems

- Storm Water Collection & Treatment
- Geothermal Heat Pump for Heating/Cooling
- Rapidly Renewable Materials
- Recycled Polymers for Paints & Cabinets

# Comparison to Typical House

- Net **Water** Consumption:
  - Traditional: 127,400 gallons/yr
  - Our House: 5,100 gallons/yr
- Net **Electricity** Consumption:
  - Traditional: 10,656 kWh/yr
  - Our House: -1,822 kWh/yr

# Comparison to Typical House

- **Materials** Reusable?
  - Traditional: NO
  - Our House: YES
- Year-round **Ventilation**?
  - Traditional: NO
  - Our House: YES

# Future Steps

- EnPRO
- Continue Dialog with Administration
- Publicity / Outreach
  - Website: www.iit.edu/~svillage

# Conclusion of IPRO

- Advisors are crucial
- Communication of Ideas and Visions
- Team Management
- Project Scope

# Thank you


- **Tellabs Foundation**
- Bill Abolt
- Nancy Hamill
- IIT Faculty and Staff Members
- Advisors

# Team Members

- **Students:**
  - Andrew Higashi
  - Anna Ninoyu
  - Bez Robinson
  - Evans Ogbebor
  - Jef Larson
  - Mike Staats
  - Philip Golucki
  - Siddha Pimputkar
  - Tony Thomas
- **Instructor:**
  - Prof. Said Al-Hallaj
- **Advisors:**
  - Anand Sathyan
  - Darcy Evon
  - Elena Savona
  - Joseph Clair
  - Kris Kiszynski

# Backup Slides

# Budget

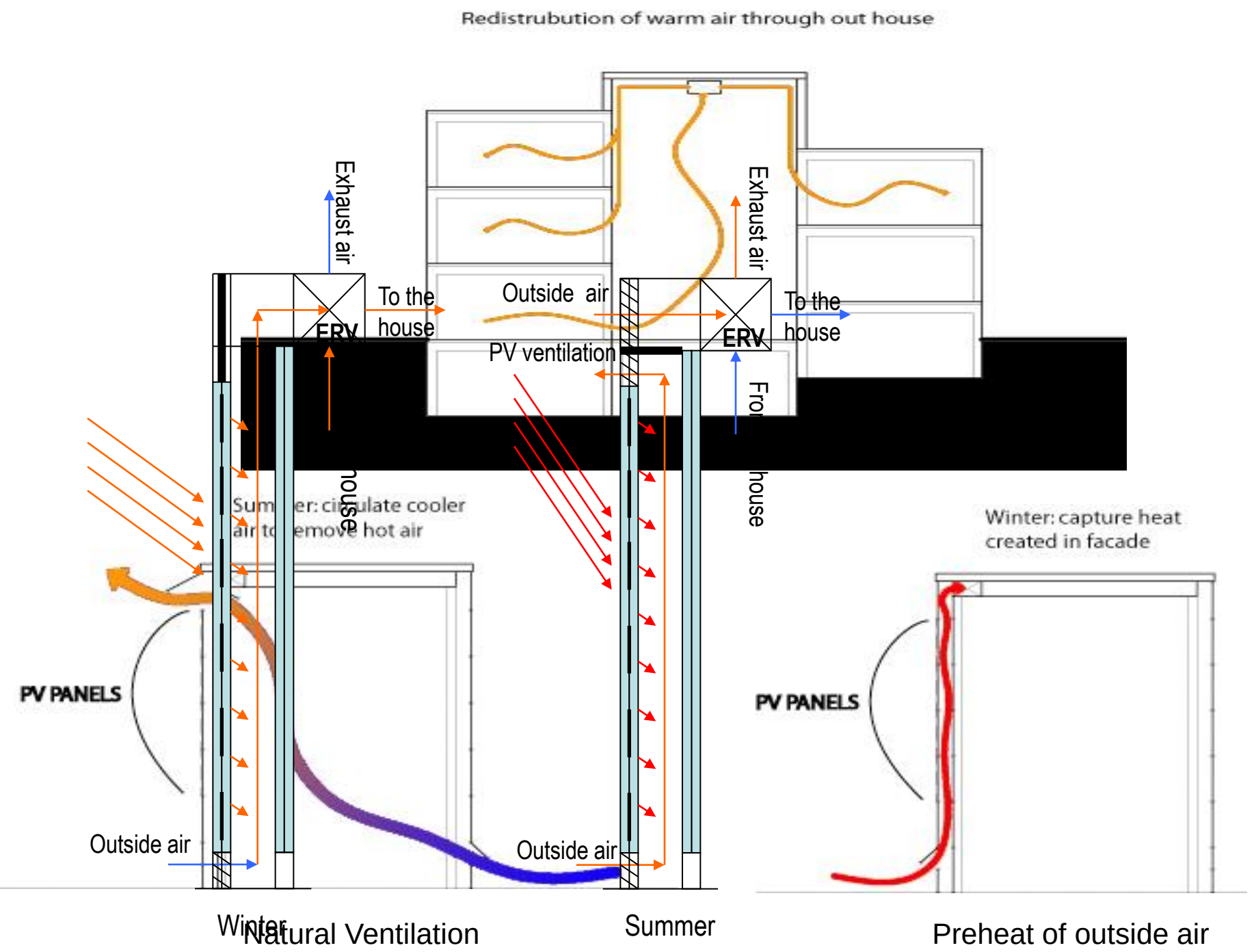
- Estimate: \$300 / $ft^2$
  (Average House: \$100-150 / $ft^2$)
- Total footage 4,200 $ft^2$ = \$1.26 million
- Estimated cost of special systems: \$91,000

# Comparison - Energy

| | House of the Future | | Traditional Home | |
|---|---|---|---|---|
| **Tot. Energy consumption** | | | 147.3 | MBTU/yr |
| **(Electricity)** | 7,500 | kWh/yr | 10,656 | kWh/yr |
| **(Natural Gas)** | 0 | | 72 | MBTU/yr |
| **Electricity production** | 9,322 | kWh/yr | 0 | kWh/yr |
| **Net Electricity consumption** | **-1,822** | kWh/yr | **10,656** | kWh/yr |

# Comparison - Water

| | House of the Future | Traditional Home |
|---|---|---|
| **Water used** | 32,777 gallons/yr | 127,400 gallons/yr |
| **Water collected** | 27,677 gallons/yr | 0 gallons/yr |
| **Net Water consumption** | **5,100** gallons/yr | **127,400** gallons/yr |




Natural Ventilation

Preheat of outside air

# Equaris Water System

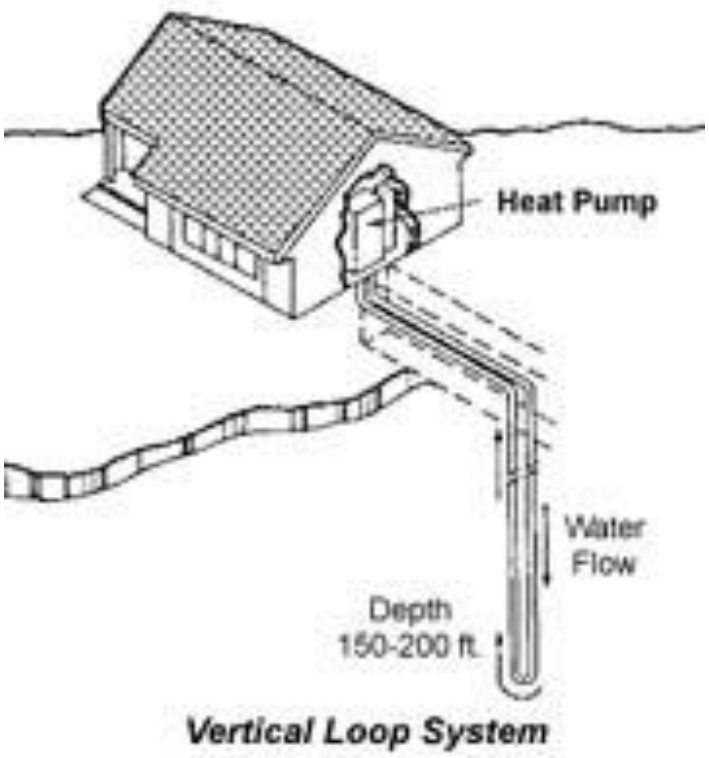
- Decentralized look at the water problem
- More sustainable than our current centralized solution
- Eliminates need for large plants, sewer and septic tank infrastructure
- Reduces depletion of water reserves, because people are more aware of water consumption

# Solargenix – CPC 2000

- Efficiency: 78%
  (System efficiency: 40%)
- Savings: 50-80%
- Temperature provided:
  40°- 98°C
- Cost:~$2,500/system

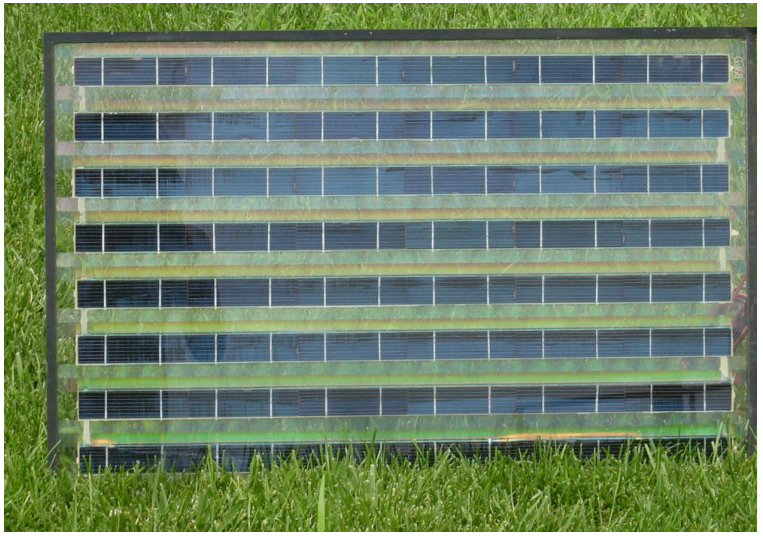
# Geothermal Heat Pump

- Potential savings: 30%-70%
- Cost: ~$3,500/ton
  - Output t: 115°F in winter, 45°F in summer
  - To the radiant floor for heating
  - To fan coils for cooling
  - Backup for solar water heating with optional Desuperheater

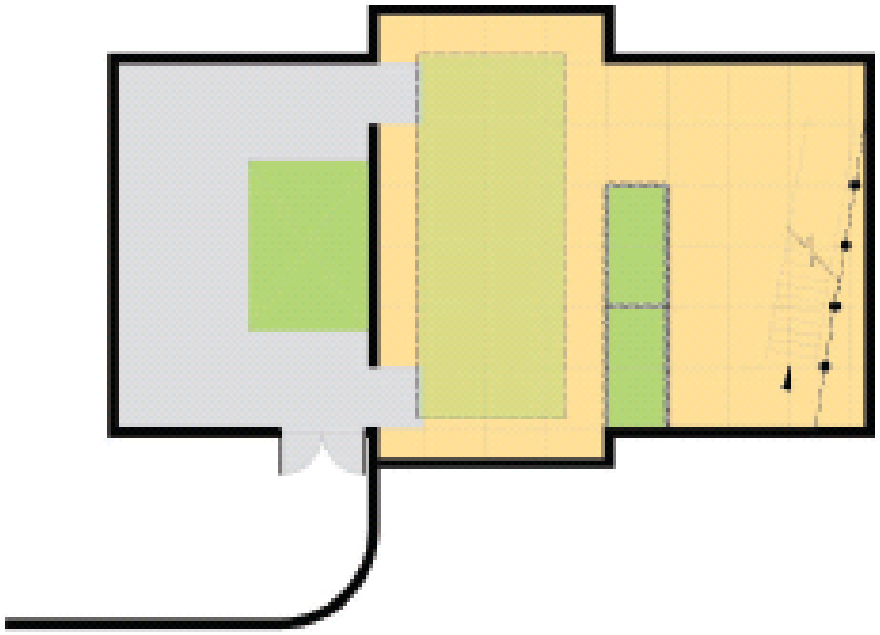


# Electricity

- Renewable Hydrogen Fueling station
- Additional building-integrated PV production = 3.6 MWh/year with 3.5 KW array in south façade
- Energy efficient appliances

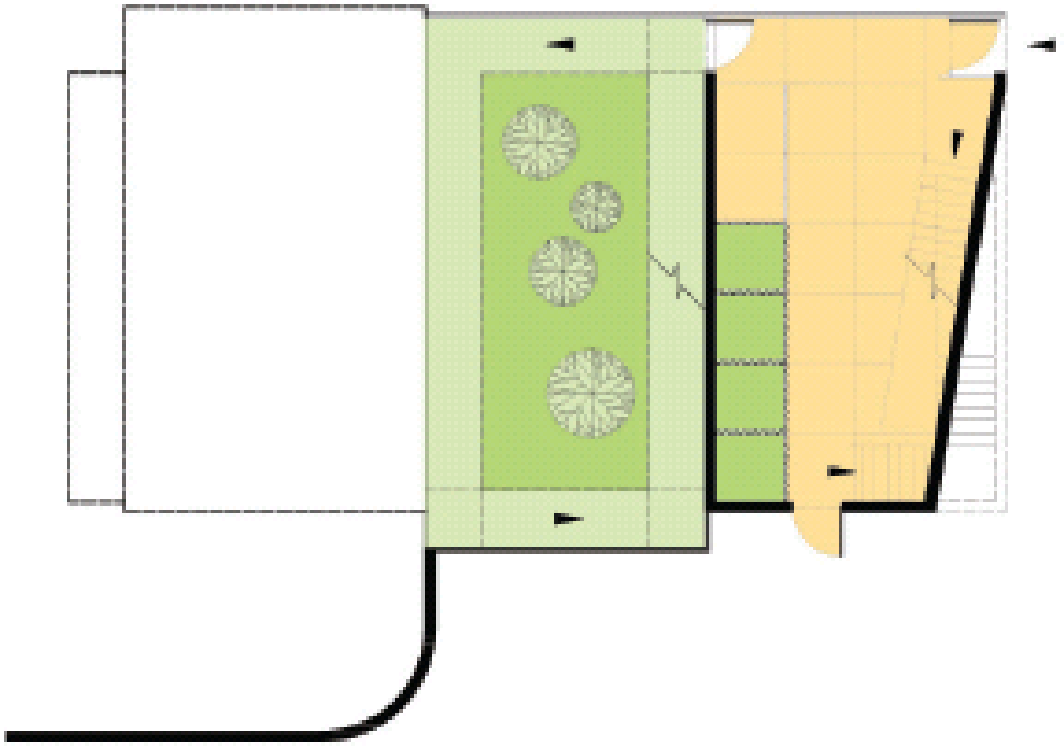


# Basement



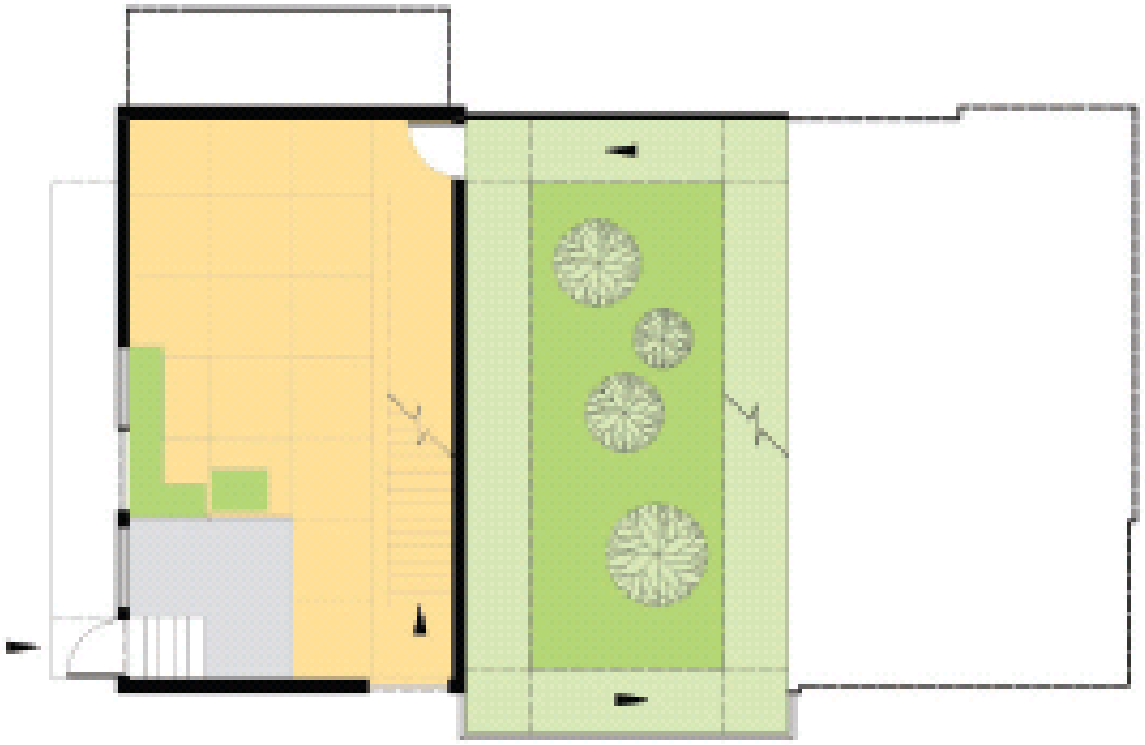
0 - BASEMENT

# Exhibit Space



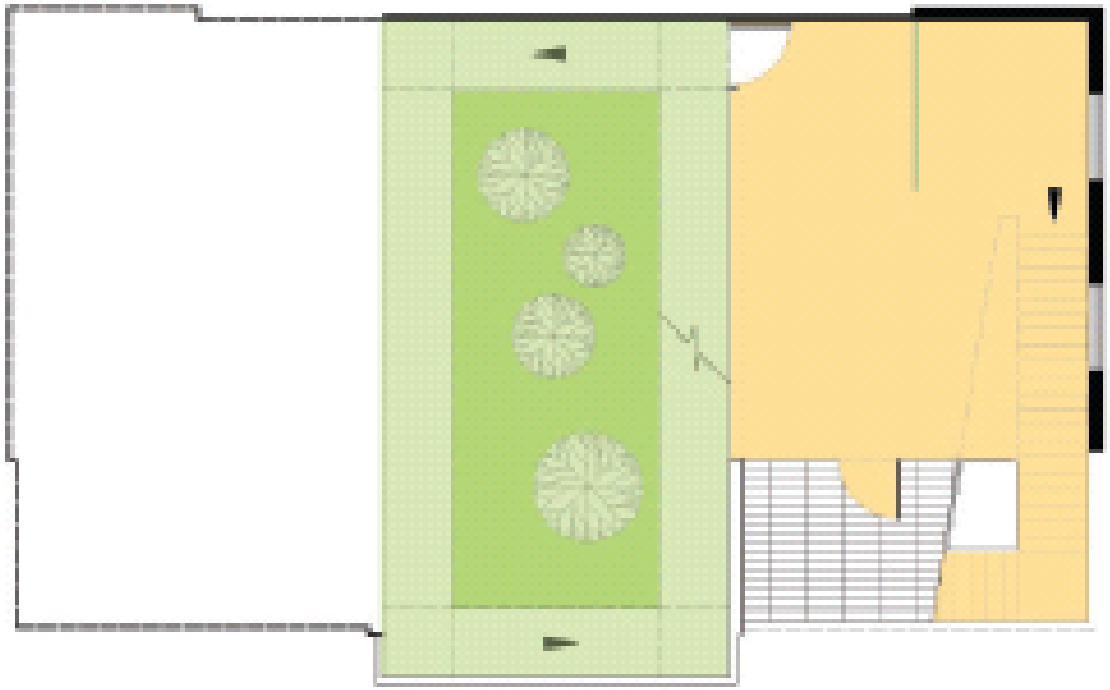
1 - EXHIBIT

# Kitchen / Living Room



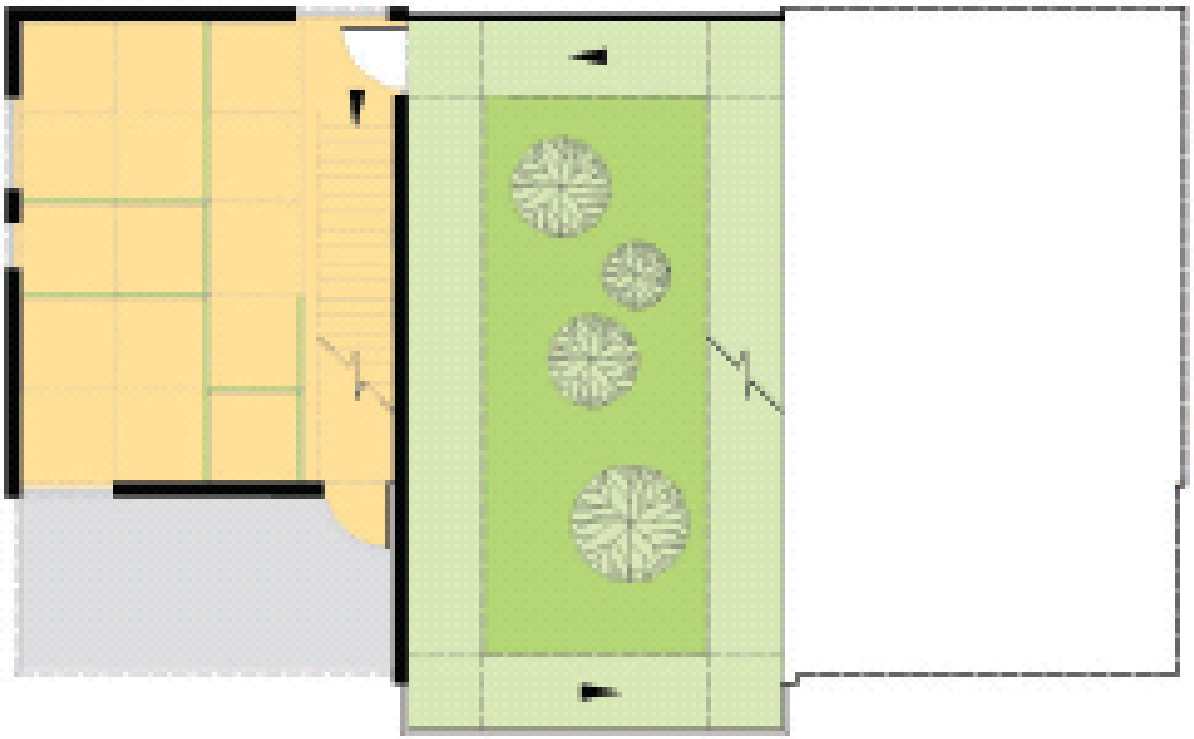
1.5 - KITCHEN/LIVING

# Common / Laboratory Area



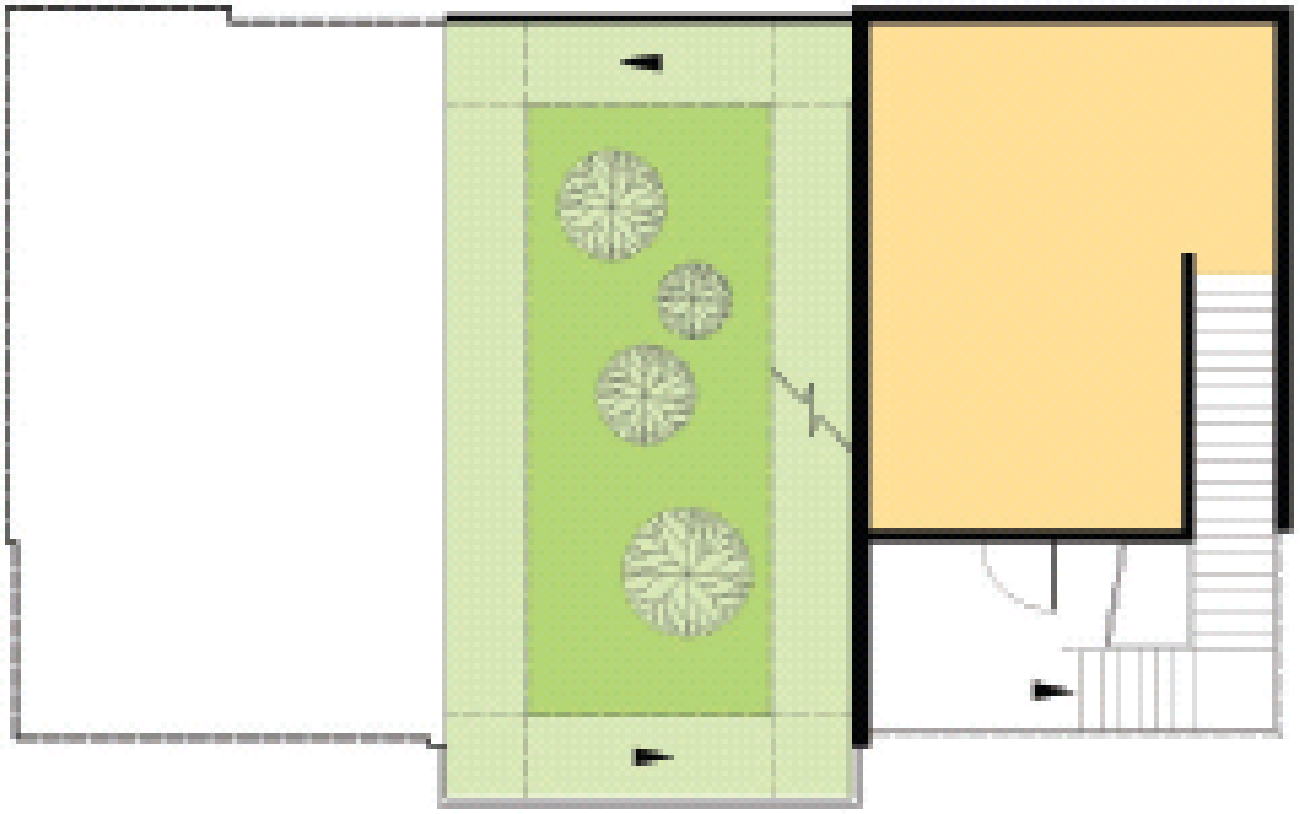
2 - COMMON/LAB

# Bed Room / Bath



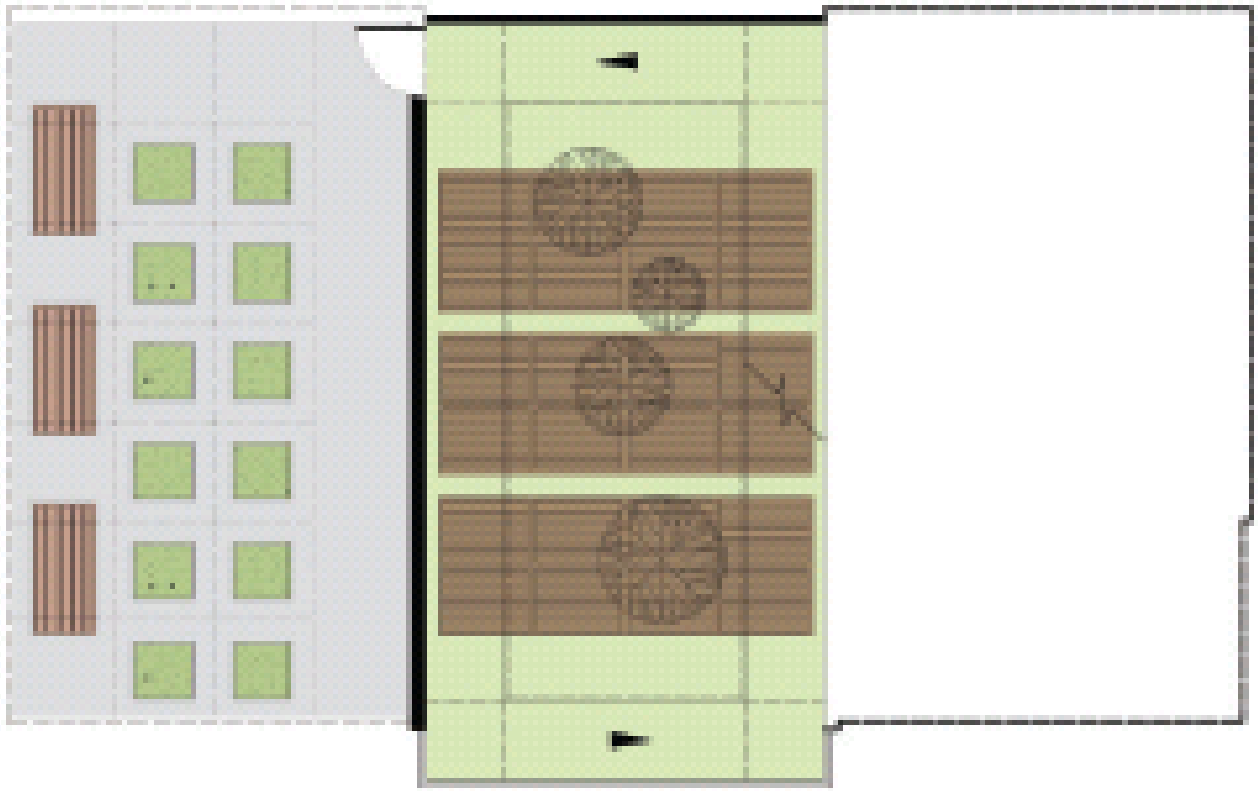
2.5 - BED/BATH

# Roof / Test Site



3 - ROOF/TEST SITE

# Rooftop



3.5 - ROOF/GREEN/
SOLAR THERMAL