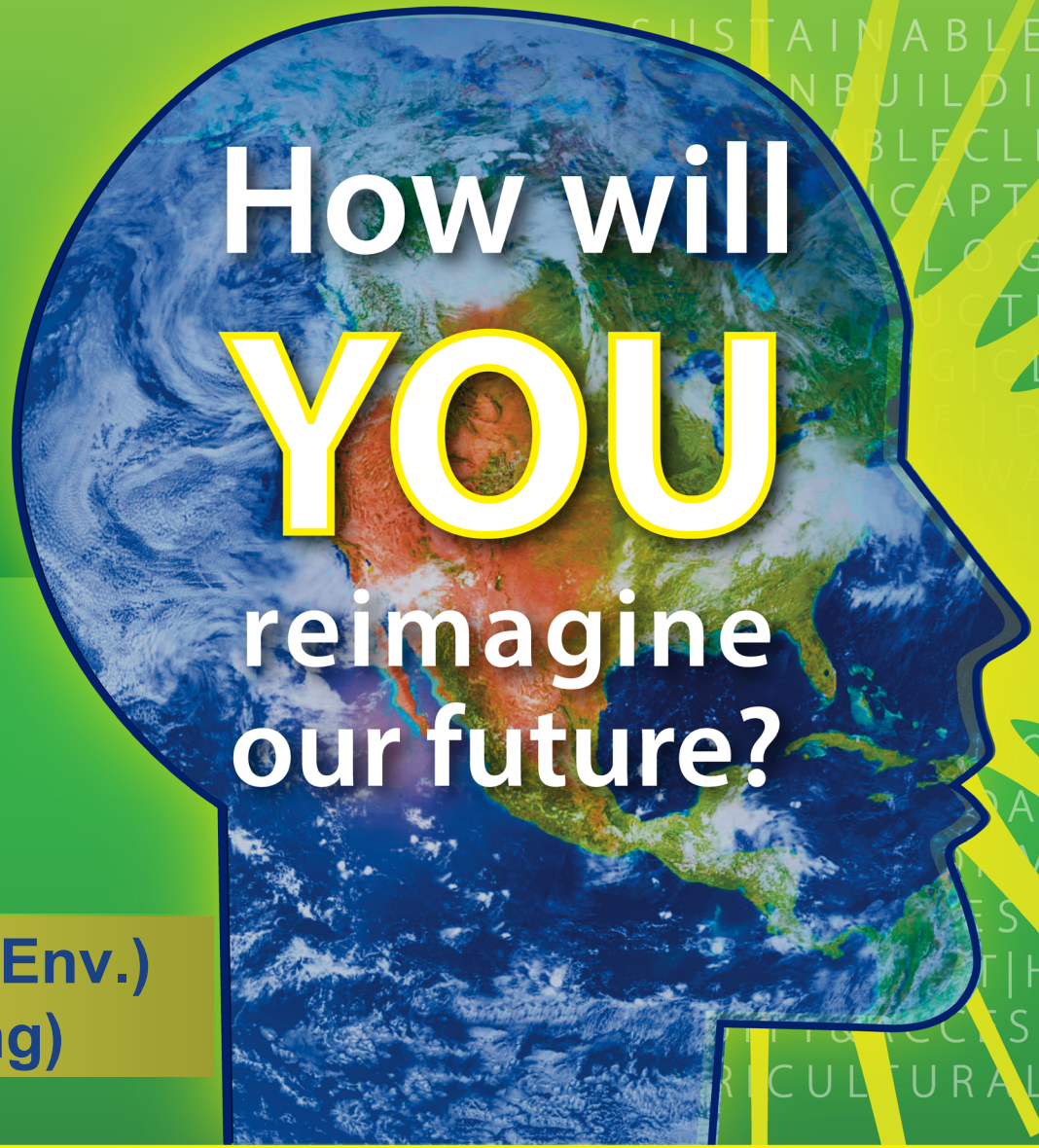
ILLINOIS GREEN FUND
STUDENT SUSTAINABILITY COMMITTEE

3rd ANNUAL Reimagine OUR FUTURE

Undergraduate Sustainability COMPETITION



Prof. Warren Lavey (Earth, Society & Env.)
Prof. Leon Liebenberg (Engineering)

Your idea could be worth $2000 and have an impact on the future!

Reimagine Our Future: What this competition is all about

The Challenge

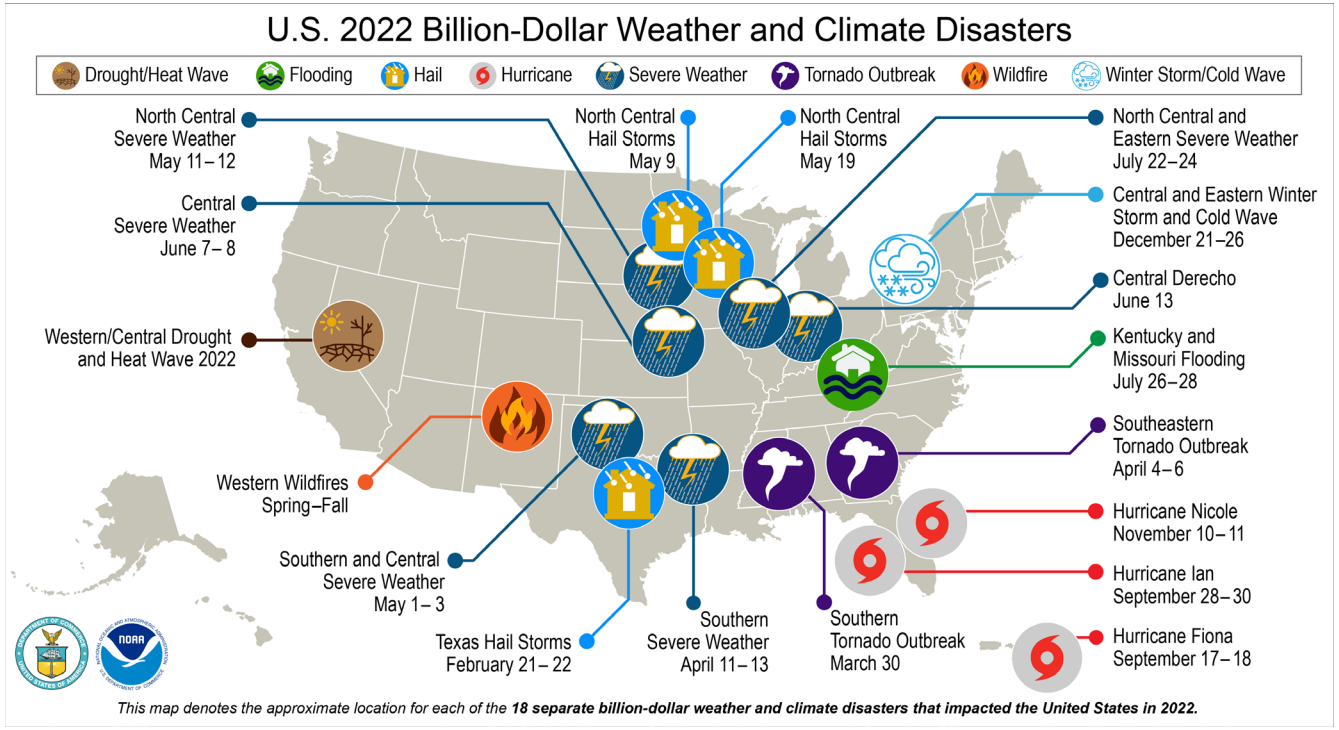
The global sustainability crisis is an opportunity for humanity to learn to flourish without compromising the natural systems upon which we depend.

Many global sustainability challenges!

Global climate change; persistent poverty; food and water insecurity; lack of quality of education; multiple dimensions of inequities; loss of biodiversity; etc.

Your Mission

Develop, alone or in a team, a bold and innovative plan or solution that promotes one or more of the United Nations' Sustainable Development Goals (SDGs).



UN Sustainable Development Goals

The United Nations 17 Sustainable Development Goals (or SDGs). https://sdg.data.gov/

Finding a problem to solve

What changes would you like to see?

What is the magnitude (scope) of the problem? What is distinct about the problem?

What events caused this problem? How long has it existed? Why is it a problem?
Who has been involved? When and how was it discovered? Where is it located?

What changes in surroundings, equipment, procedures, or personnel occurred that could possibly be related to the problem?

What are the specific causes of the problem? How are these factors related?

Does the problem pose a threat to people, the organization, the community, the environment?
In what way? Does it have long-term or short-term effects?

How complex is the problem? How are the different aspects related?
Is the problem connected with other problems?

Can some of the factors be dealt with separately? How would this affect the overall problem?

1. **Problem Definition**
2. Idea Generation
3. Idea Evaluation
4. Implementation

Idea Generation (“Ideation”)

Collect information. Search the Internet

Zoom out: See the big picture first, avoid getting lost in details

Withhold your judgment

Try and build an abstract model (symbols, equations, etc.)

Ask BIG questions

Have a will to doubt

Try to work backwards to find a solution path

Zoom in

Explore directions that appear plausible

Try and find root causes

Use an analogy whenever you can think of one

Follow your emotions!

1. Problem Definition
2. **Idea Generation**
3. Idea Evaluation
4. Implementation

Idea evaluation

Discuss your problem and your ideas with friends

Listen to the ideas of others

Rank your ideas

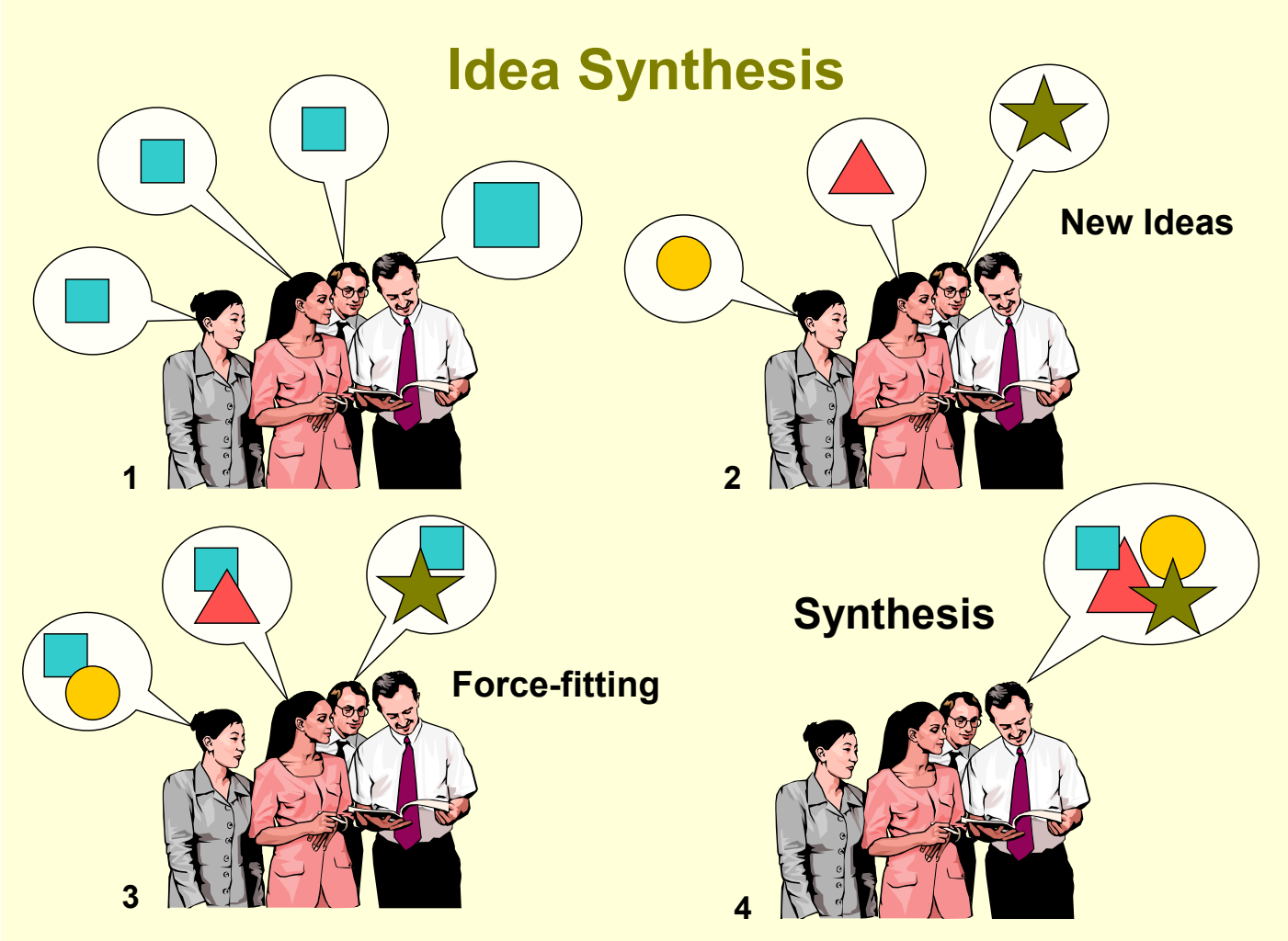
Look for quality, not quantity. Make ideas better

Make “wild” ideas more practical

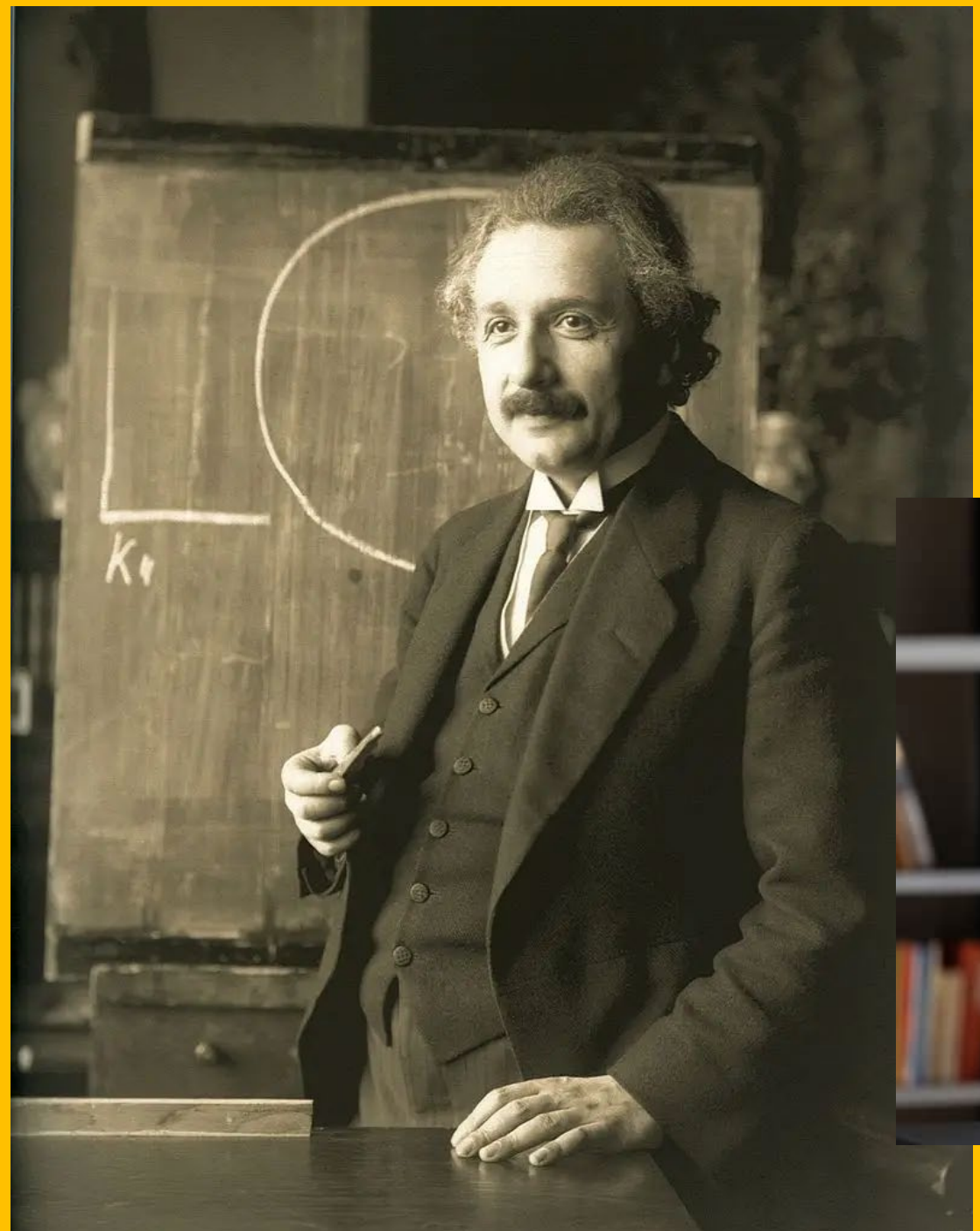
Continue to defer negative judgment

Synthesize and optimize ideas!

1. Problem Definition
2. Idea Generation
3. **Idea Evaluation**
4. Implementation



TALK WITH AN EXPERT



Developing your idea into a submission

Your work will be graded by specialists and non-specialists

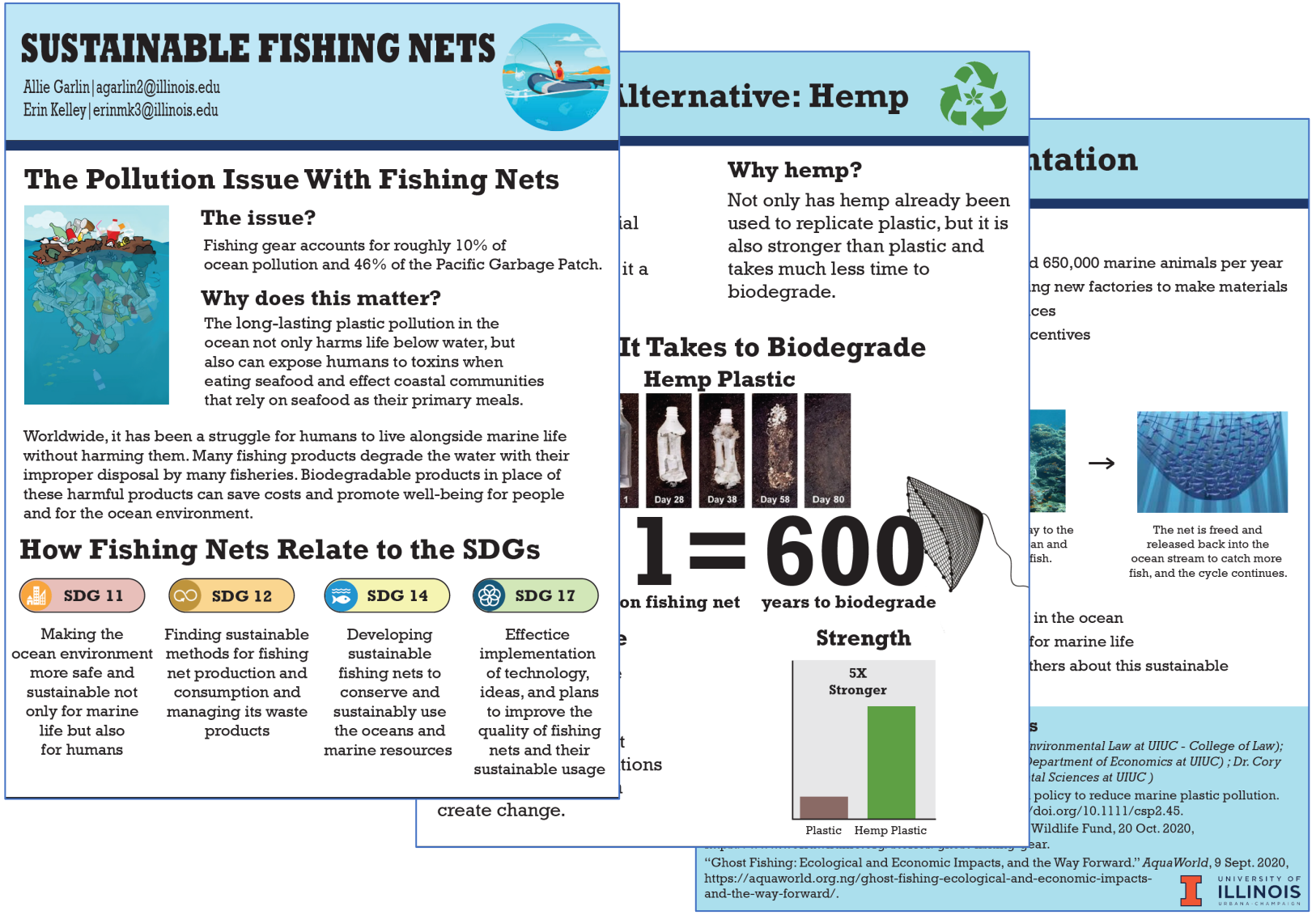
Judging Criteria:

All entries will be evaluated in terms of the five criteria below for a maximum overall score of 60 points:

Point Value	Criteria	Description
0-20	Novelty	An original (new, fresh, innovative, ground-breaking) idea or synthesis of existing ideas into a new strategy that creatively advances one or more of the SDGs. Winning submissions will have that elusive "wow factor," eliciting feelings of excitement and admiration! (These are projects that the judges would like to recommend to the Gates Foundation for funding!)
0-10	Feasibility	A convincing case is made for implementability. Implementation might rely on, say, existing or new technology; proven or new social organizations, markets, or science.
0-10	Scalability/Replicability	The idea can be scaled up and widely replicated.
0-10	Connection to SDGs	The analysis takes account of all relevant SDGs, of the ways in which they are relevant, and of the relationships among them as they pertain to the chosen sustainability problem.
0-10	Compelling Communication	The submission is written with clarity, is visually engaging, and is easy to follow. The submission has a powerful and compelling narrative.

Communicate your idea

- Be concrete, not abstract
- Avoid passive voice
- Use strong verbs to tell a story
- Banish filler, Get to the point
- Use graphics or photos to enhance explanations or context
- Keep things SIMPLE (but not too simple!)



SUSTAINABLE FISHING NETS

Allie Garlin | agarlin2@illinois.edu
Erin Kelley | erinmk3@illinois.edu

The Pollution Issue With Fishing Nets

The issue?

Fishing gear accounts for roughly 10% of ocean pollution and 46% of the Pacific Garbage Patch.

Why does this matter?

The long-lasting plastic pollution in the ocean not only harms life below water, but also can expose humans to toxins when eating seafood and effect coastal communities that rely on seafood as their primary meals.

Worldwide, it has been a struggle for humans to live alongside marine life without harming them. Many fishing products degrade the water with their improper disposal by many fisheries. Biodegradable products in place of these harmful products can save costs and promote well-being for people and for the ocean environment.

How Fishing Nets Relate to the SDGs

SDG 11 — Making the ocean environment more safe and sustainable not only for marine life but also for humans

SDG 12 — Finding sustainable methods for fishing net production and consumption and managing its waste products

SDG 14 — Developing sustainable fishing nets to conserve and sustainably use the oceans and marine resources

SDG 17 — Effectice implementation of technology, ideas, and plans to improve the quality of fishing nets and their sustainable usage

lternative: Hemp

Why hemp?

Not only has hemp already been used to replicate plastic, but it is also stronger than plastic and takes much less time to biodegrade.

It Takes to Biodegrade

Hemp Plastic

Day 28 Day 38 Day 58 Day 80

1 = 600

on fishing net — years to biodegrade

Strength

5X Stronger

Plastic Hemp Plastic

create change.

ntation

d 650,000 marine animals per year
ng new factories to make materials
ces
centives

The net is freed and released back into the ocean stream to catch more fish, and the cycle continues.

in the ocean
for marine life
thers about this sustainable

nvironmental Law at UIUC - College of Law); epartment of Economics at UIUC) ; Dr. Cory tal Sciences at UIUC)
policy to reduce marine plastic pollution. /doi.org/10.1111/csp2.45.
Wildlife Fund, 20 Oct. 2020,
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LITHIUM EXTRACTION FROM GEOTHERMAL BRINES

TEAM 6 -AMAN MEHTA / ARYA HARIA / IS
amanm2@illinois.edu / aharia2@illinois.edu / ipurwar2@illinois.

THE CHALLENG

Lithium (Li), a non-renewable earth metal, is mined around the world for Lithium-Ion Batteries, at the expense of:

1. Water Usage - 2 million liters of water used for 1 ton of Lithium.
2. CO2 Emissions - 15 tonnes of CO2 for 1 ton of Lithium.
3. Soil, Land, Air and Water Contamination - Threat to indigenous communities.

FIGURE 1 - ENVIRONMENT

IS LITHIUM REALLY THAT IMPORTANT

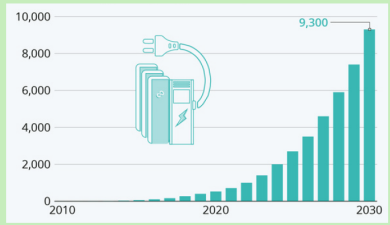


FIGURE 2 - INCREASING DEMAND OF LITHIUM [STATISTA.COM]

1. Lithium demo
2. Lithium is in t systems.
3. Battery Syste Vehicles (EVs storage.
4. Batteries fac
5. Renewable e limited witho

SUSTAINABILITY DEVELOPMENT

6 CLEAN WATER AND SANITATION

7 AFFORDABLE AND CLEAN ENERGY

The solution to the Lithium mining probl which doesn't **contaminate water, doesn** is still relatively **affordab**

THE SOLUTION

LITHIUM EXTRACTION FROM GEOTH

GEOTHERMAL BRINE: Geothermal brine is a hot and co solution, having circulated throug geothermal areas, and is enriche as lithium, boron, and potassium.

THE IDEA:

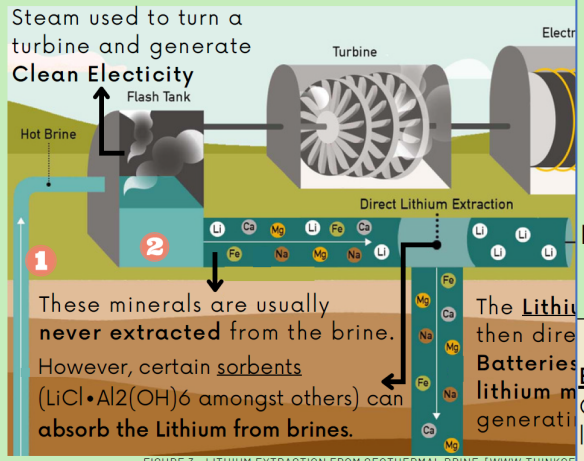


FIGURE 3 - LITHIUM EXTRACTION FROM GEOTHERMAL BRINE [WWW.THINKGE

6 CLEAN WATER AND SANITATION
- **Eliminating lithium mining** - reduced
- Reduced water, land and air **contam**

7 AFFORDABLE AND CLEAN ENERGY
- **90% extraction efficiency** with **negligib** capacity over cycles
- **Clean energy** generated and passed to

13 CLIMATE ACTION
- Reduced **carbon emissions** from convent
- Overall, **lithium extraction becomes envi**

In context: $\frac{0.0005kg}{liter} \times \frac{420liters}{s} \times 91\% = \frac{0.19kg}{s}$ **of Lithi**

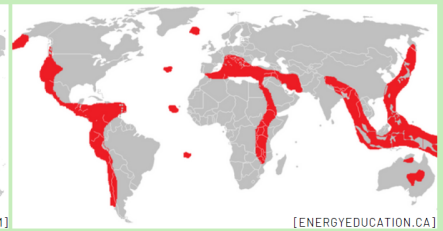
It takes 42s to absorb enough Lithium (8kg) f battery.

IMPLEMENTATION

FEASIBILITY AND SCALABALITY :

[REUTERS.COM]

FIGURE 4 - LITHIUM DEPOSITS AROUND THE WORLD



[ENERGYEDUCATION.CA]

FIGURE 5 - GEOTHERMAL ENERGY PRODUCTION AROUND THE WORLD

The **correlation** between the Li deposits and the geothermal energy production shows the potential to **scale this technology and extract Li at each of those locations.** Given the **high impact and return on investment** of the above solution, governments are supporting this project to reach the **net-zero target** increasing the **feasibility of installation.**

CHALLENGES

Economical and social: Heavy monetary investment to set brine and factories. Geothermal exploration can be expensive. Both **can become cheaper** over the long run and if done on a **large enough scale. Geographical relocation of communities and land** to install plants.

Technological: Salt ions in brine **interfere** with extraction process, however, current **research is improving** those methods.

FUTURE PROSPECTS

Alongside Li, **other metals** such as **Nickel and Cobalt** which are required for battery production can also be extracted from geothermal brines. Additionally, **instead of using coal energy**, geothermal energy can now be used by the battery manufacturing factories to reduce the total emissions in the manufacturing process.

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ReImagine OUR FUTURE
Undergraduate Sustainability COMPETITION

Phytoremediation Mats

Erin Nibeck & Jason Li | enibeck2 & jasonl12
Team 21

Water is a human right

In the face of climate change induced calamities and large-scale water waste, the demand for clean fresh water is increasing and the supply is ever dwindling. Finding ways to improve water quality is a vital step in making clean water accessible to all, improving biodiversity of aquatic life, and fighting the impacts of pollution on the environment.

Common Water Pollutants We Aim To

Phosphates & Nitrates — Phosphates and Nitrates are common lead to eutrophication, degrading water quality, decreasing biod into the water.

Heavy Metals — Heavy Metals in water are often toxic and cons serious negative health effects.

Bacteria — Bacteria in water can lead to infection by deadly dise

Suspended Solids — Large particles that degrades water quality growth.

Our Solution

A surefire way to combat water pollution is to simply **remove harmful water.** We propose phytoremediation—the use of plants to remove or the environment— as an inexpensive yet effective solution to the muc hand.

We propose **a modular, floating phytoremediation mat system to tre** We recommend using *Cyperus Papyrus* (Papyrus), *Phragmites Austral Typha spp.* (Cattails) as the phytoremediators due to their ability to su efficiency, fast growth rate, replicability, and widespread native range the versatility of the design, any plant species can be used with the m

We also hope to **promote sustainable use** with our solution. The mats constructed from reused textiles, which is a prevalent waste type in d Furthermore, the biomass of the floating mats can be regularly harves as for construction materials, food, biofuel, and mat substrate.

Our Solution

1 Efficiency

The efficacy of phytoremediation in constructed wetlands has already been shown through extensive research, but we hope to implement it in new, increasingly effective ways. The simple, self-replicating design of the mat system makes it easy and inexpensive to implement in developing countries, where it is the most needed. Additionally, we hope to implement the design in heavily polluted lakes, lagoons, and municipal wastewater.

2 Replicability & Scalability

The replicability and scalability of the design is a key component to efficiency of the solution. By designing the mats using accessible materials and components produced from existing mats, the cost of many components becomes negligible and construction of future mats becomes easier as time goes on.

3 Multifaceted Uses

Outside of addressing water pollution, our design provides additional benefits including serving as a natural habitat & food source for native species and the incorporated plants being able to sequester carbon from the atmosphere.

Renders Courtesy of Peter Nardulli

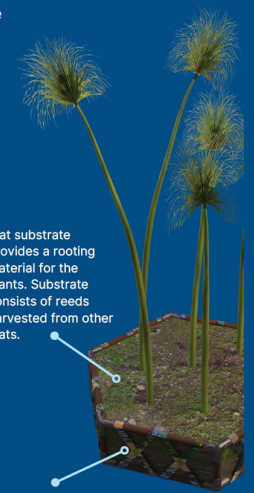
Representation of mat implementation. Ideally, hundreds to thousands of mats would be implemented on large bodies of water, cleaning large volumes of water and creating many plants to be harvested

Projected pollutant removal rat
Phragmites Australis. High poll
mats will make even the most p

Pollutants	Papyrus
Suspended Solids	32.46%
Phosphorus	50.00 %
Coliforms (Bacteria)	98.08%
Heavy Metals*	~ 40 - 90%

Breakdown of projected cost p
price per unit will enable cost-
numerous mats for one body o

Material	C
Wood Frame	~
Textiles	N
Substrate	N
Plants	N
Construction Cost	~



Mat substrate provides a rooting material for the plants. Substrate consists of reeds harvested from other mats.

Wood frame to provide the basic structure of the mat. Cost calculations based on length of 2ft per side and height of 0.5ft.

*Previous research has shown that the removal rate ranges from 40 - 90% depending on the specific heavy metal
**All costs are rough estimates. Wood cost is estimated based on ~$.5 per ft of wood. Construction cost is estimated operating cost of ~20%. All other materials are assumed to be easily accessible and cost negligible.

Implementation

Partnerships

For large scale applications, there will need to be a large effort to assemble, maintain, and harvest the mats.
Thus, partnering with world governments and private water corporations will be beneficial for both the funds and maintenance required to implement the solution.

Why Invest?

- Access to clean water is a human right
- Cheaper and easier to implement than formal water treatment options
- Water is necessary for both municipal and industrial applications
- Plants can be harvested and used for a variety of other purposes

Future Considerations

Our proposed solution needs further vetting and testing to confirm the feasibility and effectiveness of implementation, which can be done through preliminary, controlled experiments. A majority of the obstacles facing effective implementation of the mats will be the ongoing costs and design improvements, which can be addressed in a case-by-case basis. Different implementations should also be considered, such as farming foodstuff with the mats or designing them as a landscape art installation.

This is ultimately a short-term solution for a much larger problem; we project implementation in any given area will last a few months and will remain active for one to three years, during which effectiveness will be measured with water tests to track the amounts of the key pollutants we are targeting.

Water Pollution Relation to SDGs

6 CLEAN WATER AND SANITATION

Creating and making clean water more accessible for human consumption around the globe

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

Finding new ways to use common textile waste and biomatter for sustainable purposes

14 LIFE BELOW WATER

Increasing biodiversity of aquatic life by preventing eutrophication, increasing the quality of the water, and creating new habitats

Special Thanks to Dr. Paul Davidson, UIUC, pdavidso@illinois.edu & Peter Nardulli for their time

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Native Plant Connections

Etienne Sirois (sirois2@illinois.edu)

Key SDGs: 11, 13, 15

The Challenge:

Native plants have survived in their natural habitats for thousands
adapted to survive without human intervention. They have the pote
and ecological choice for homeowners and businesses looking for s
options. However, there are substantial challenges to widespread u
landscape design.

There are currently three main challenges to increased incorporat
landscape design:

1. Awareness of Advantages
   Many are still not aware of the advantages of planting native
   currently focuses on grass lawns and non-native plants that
   fertilizers, and labor to maintain.

2. Availability of Native Plants
   There is lack of availability of native plants at even the most
   Native plants that are currently offered are not optimized to
   landscape styles that are so popular today.

3. Native Plant Maintenance
   People do not want plants that will take over entire gardens
   in their own habitat, may have a tendency for overgrowth. T
   those wanting low maintenance landscaping.

Solution:

Designed with specific consideration for the United States

The solution I present is the sale of native plants, packaged for spe
regions and property sizes. This solution would connect residential
landscape designers to optimized and specifically cultivated plants
regions.

This solution focuses on the sale of plants, rather than seeds. Altho
packs are currently available online, live plant packs would offer m
toward meeting the goal of increased use of native plants in landsc

This proposed solution would address the current challenges of lac
benefits of planting native plants, lack of availability of native plant
address native plant maintenance challenges.

Customers can learn about plants native to their area and spread t
about the benefits. Landscapers will be encouraged to include nati
designs. Ecological learning will be sparked as people contribute to
rewarded with tangible and rewarding results.

Native plant farmers will benefit from increased sales, as custome
increases with low-cost and personalized plant options. Landscape
maintained. Native animal populations will return as their habitats

SDG 11: Sustainable Cities and Communities	SDG 13: Climate Action
Gardens of native plants require less energy and less water usage to keep plants healthy. Since these native plants are so well adapted to their regions, the plants will maintain themselves and regulate the area where they are planted. Developing this solution with upfront investment will create a sustainable process for plant production in the future.	Native plants can be grown and produced in their destination location meaning less transport, and therefor fewer emissions, are required. In addition, since native plants are already well-adapted to their environments, they can adapt to risin temperatures and drought more easi

Implementation:

Left Image:
Indoor plant production
Right Image:
Outdoor Plant Production
Both facilities could provide space for native plants.

A simple transition using existing resources and processes.

Implementation:
Using existing growers and greenhouses, transition some of the resources and facilities currently used by production of other plants to growing native ones that are exported to specific locations.

As plant production is a highly developed and specialized with lots of specific technologies, transition would be smooth with the many required systems already in place.

Customization of plants:
- Low to high maintenance
- Flowering or leafy
- Seedlings or fully mature
- Small or bulk packs

By tailoring products to each customer, we can make the product more appealing.

Progression and Assistance:
This is a solution that could be handled fully within the private sector. Native Plant Connections would act as liaison organization connecting all three parts of the equation (customers, products, and installation) and handling payments and contracts.

Although partnership with the government through subsidization for growing native plants would be helpful to advancing the goal, it is not necessary. The only main obstacle for implementation is ensuring we have the interest of plant producing companies to increase production of native plants.

Required Resources:
Water for plants
Electricity for growth lighting
Employees to maintain and supervise the process
Technology design and infrastructure to connect the native plants to customers
Initial investment and funding to encourage plant growers to dedicate a section of production to native plants

Program success:
As this program has an environmental solutions focus and is, therefore, extremely large-scale, it is difficult to set specific parameters that can be measured. However, one solution for measuring the potential for success, would be to first try the project on a small-scale within a neighborhood, for example. Marketing and offering the native plants to a specific area and then checking back on how many people took advantage of the offering would give an idea of potential for program success on a larger scale.

Special thanks to *Commissioner Kimberly Worthington, City of Chicago Department of Environmental, Health, and Safety Management, Deputy Commissioner worthington2501@gmail.com*

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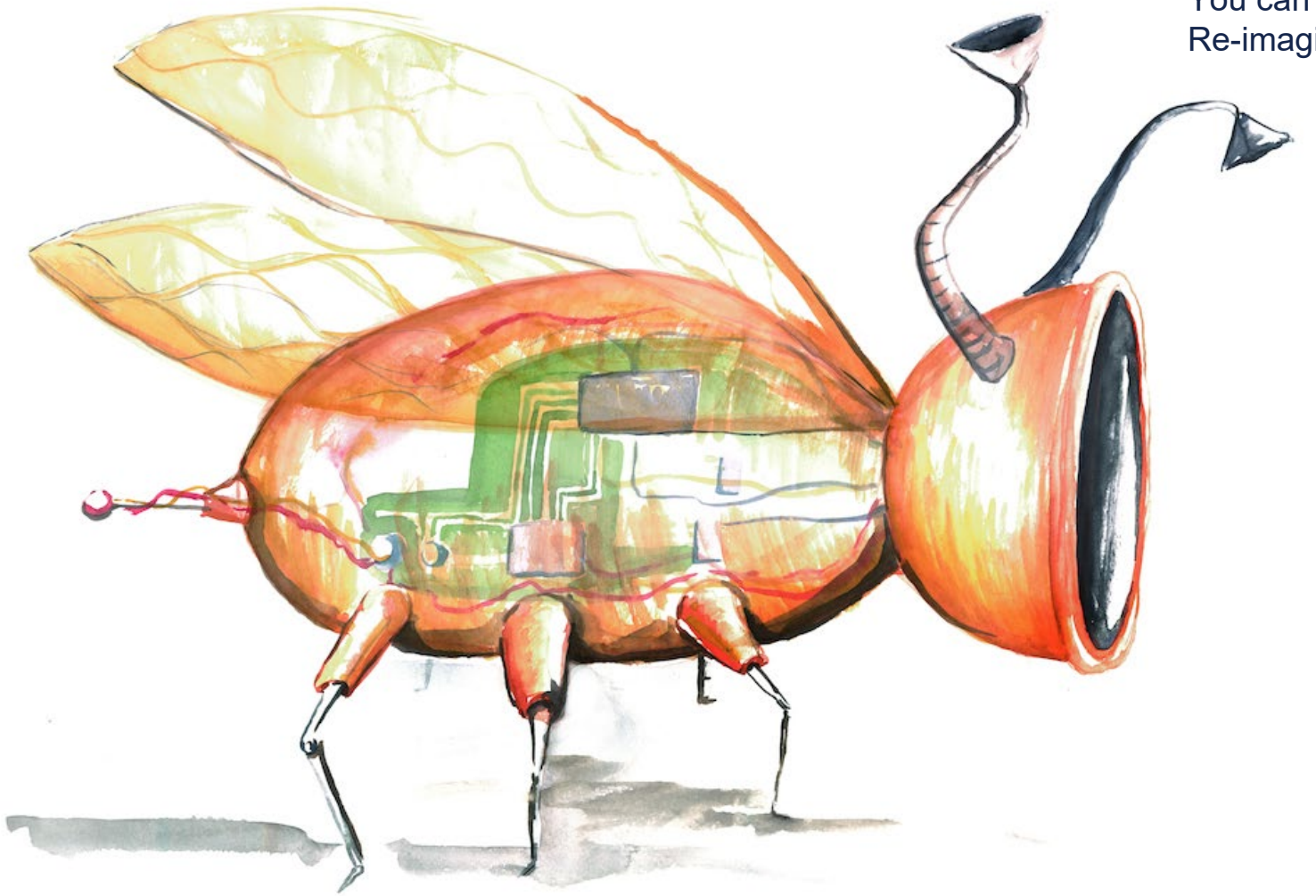
Tell a great “story”



You can’t have better futures without better dreams
Re-imagine the future you want