SPARTAN SOLAR

Carbon Free San José State

Ron Swenson

Engineering 100 • Green Talk

26 April 2017

International Institute of Sustainable Transportation

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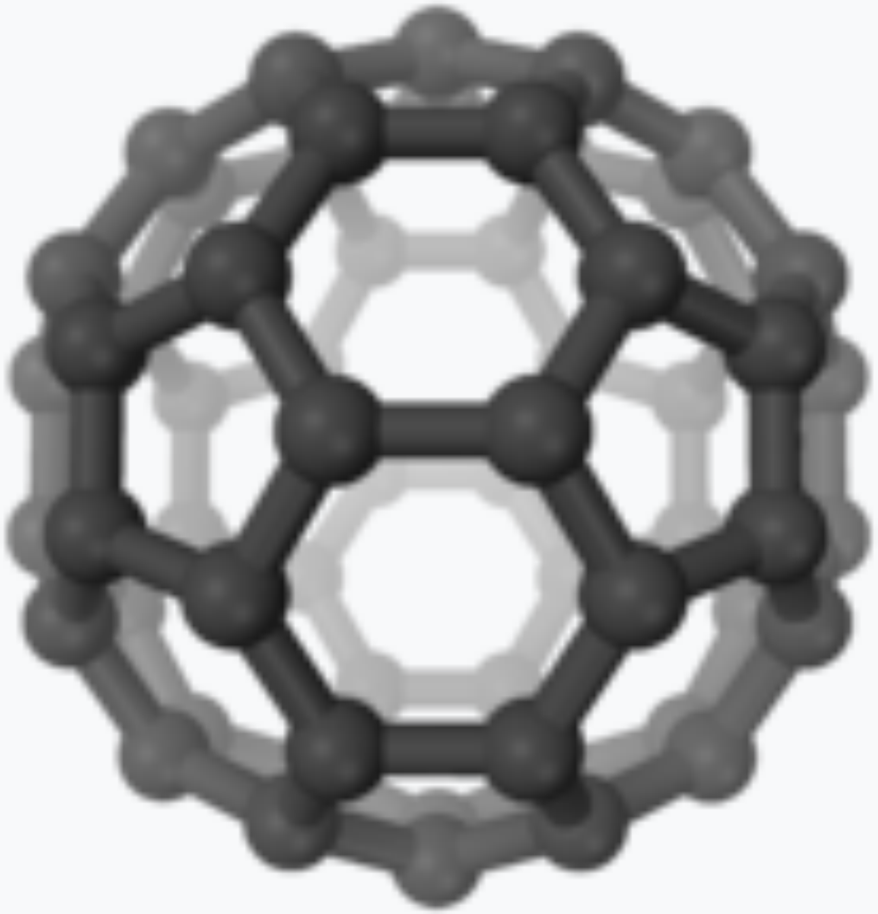
First I want to introduce you to Bucky Fuller

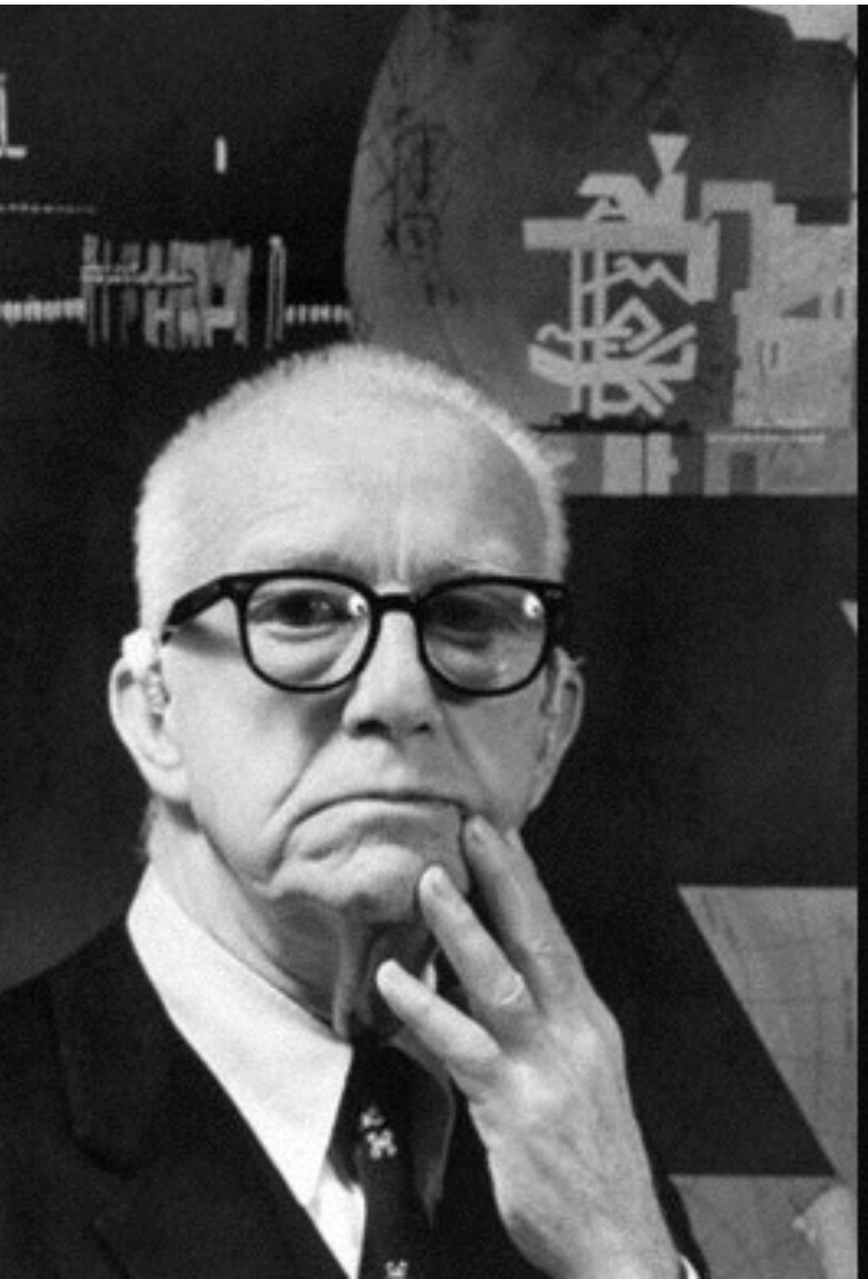
Carbon 60 is the foundation of nanotechnology

Buckminsterfullerene



Nanotech: please meet the soccer ball

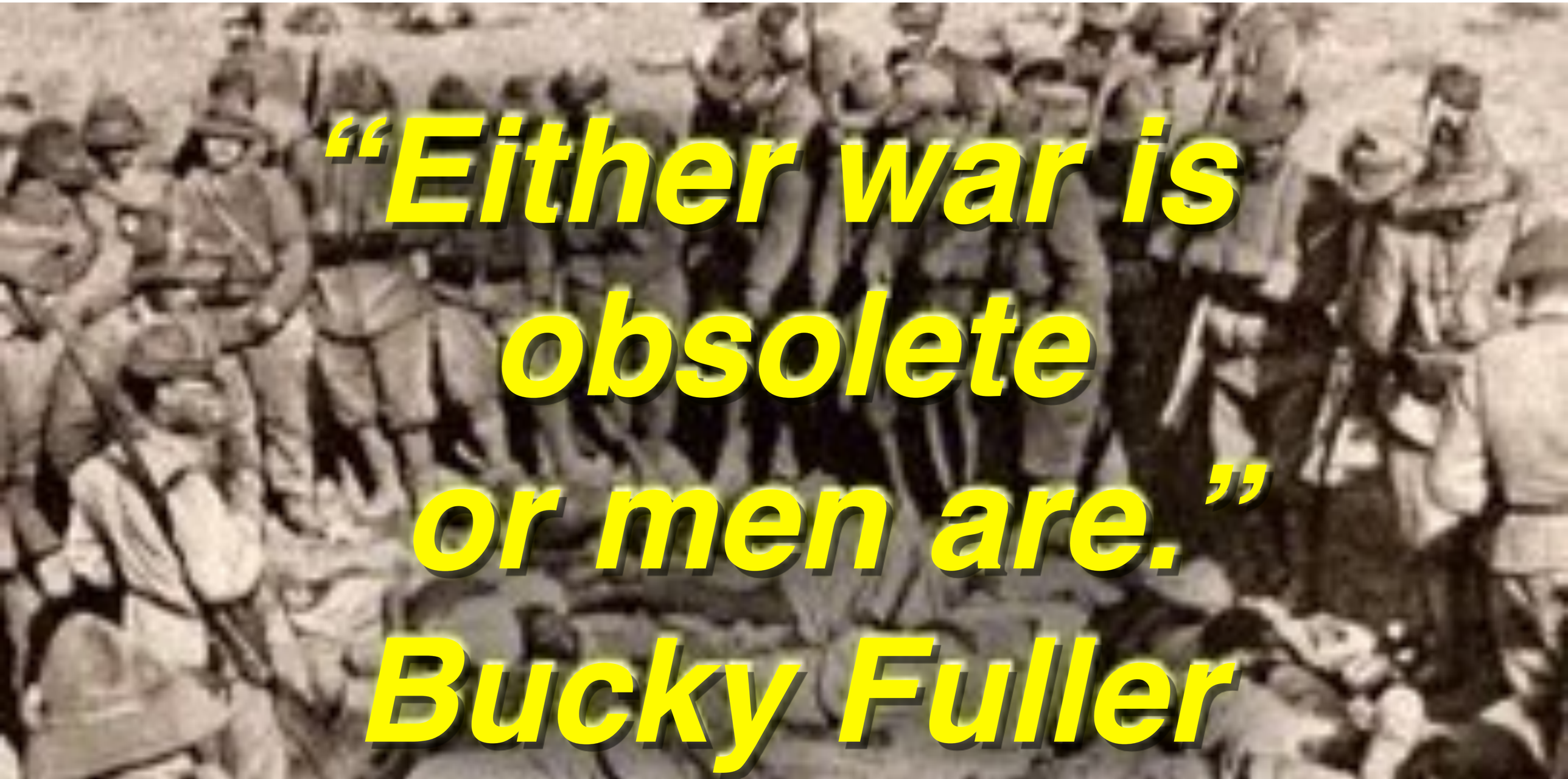
I was here 50 years ago when Bucky Fuller came by



It is now highly feasible to take care of everybody on Earth at a higher standard of living than any have ever known. It no longer has to be you or me. Selfishness is unnecessary. War is obsolete. It is a matter of converting the high technology from weaponry to livingry.

— *R. Buckminster Fuller* —

I was here 50 years ago when Bucky Fuller came by



So you can understand why I don’t use bullets!

The Assertion-Evidence Method

www.assertion-evidence.com

So you can understand why I don’t use bullets!

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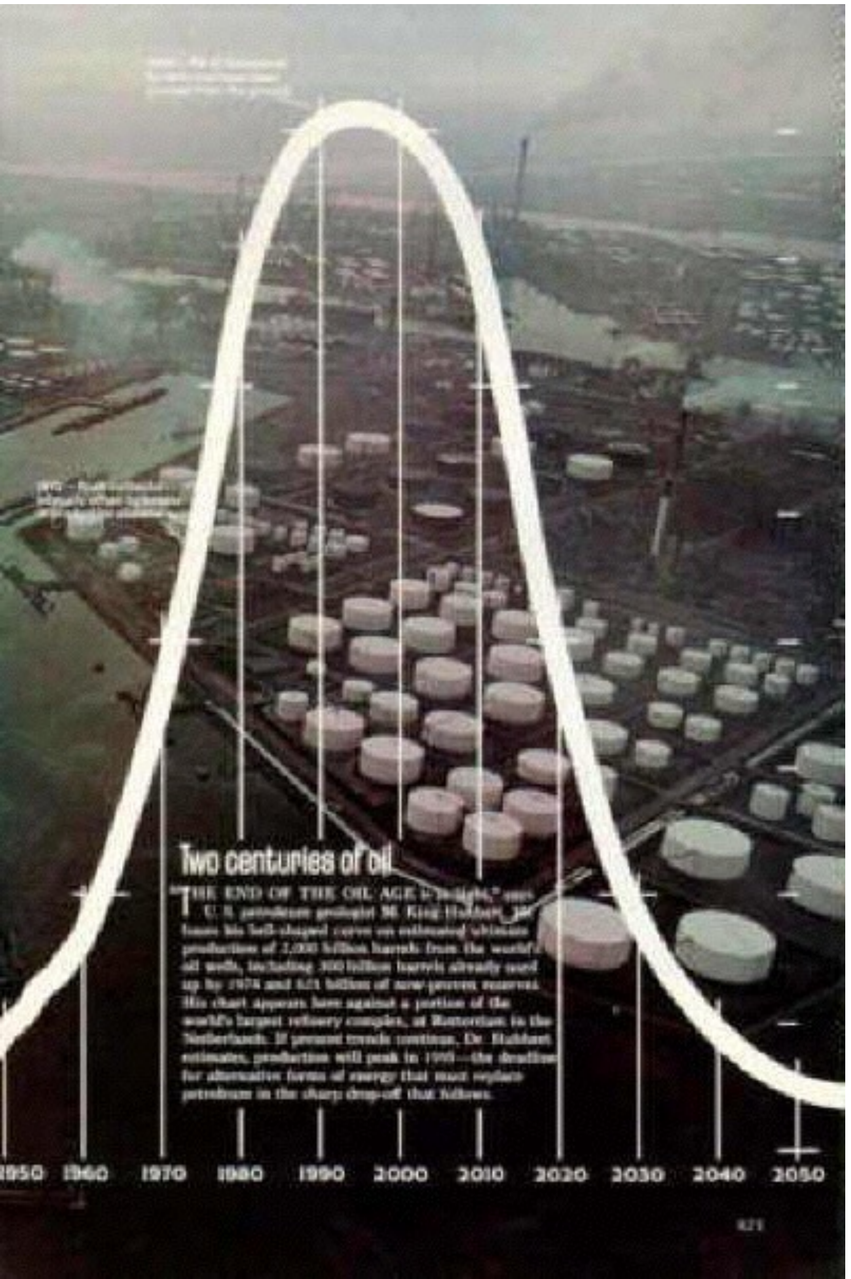
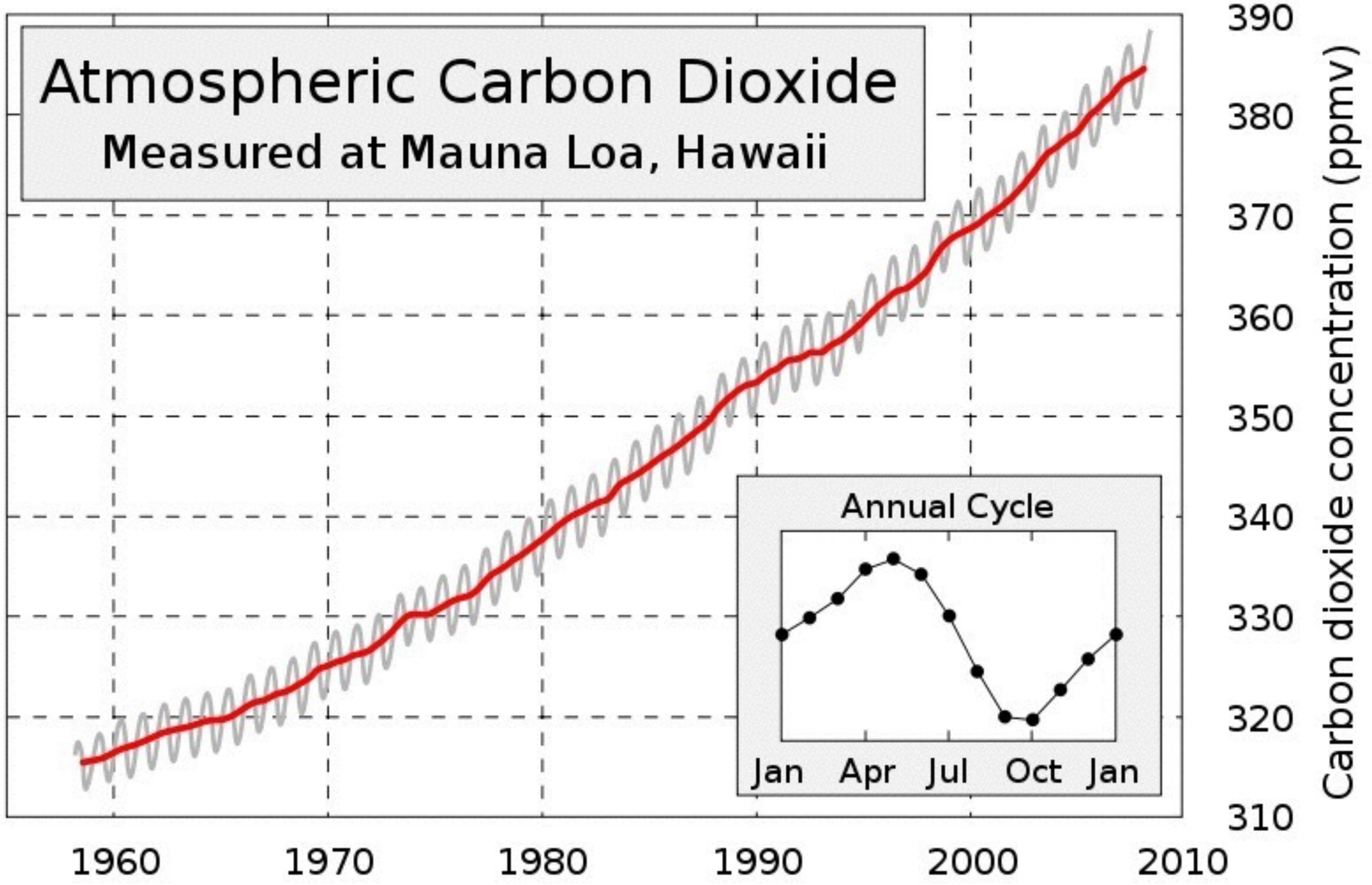
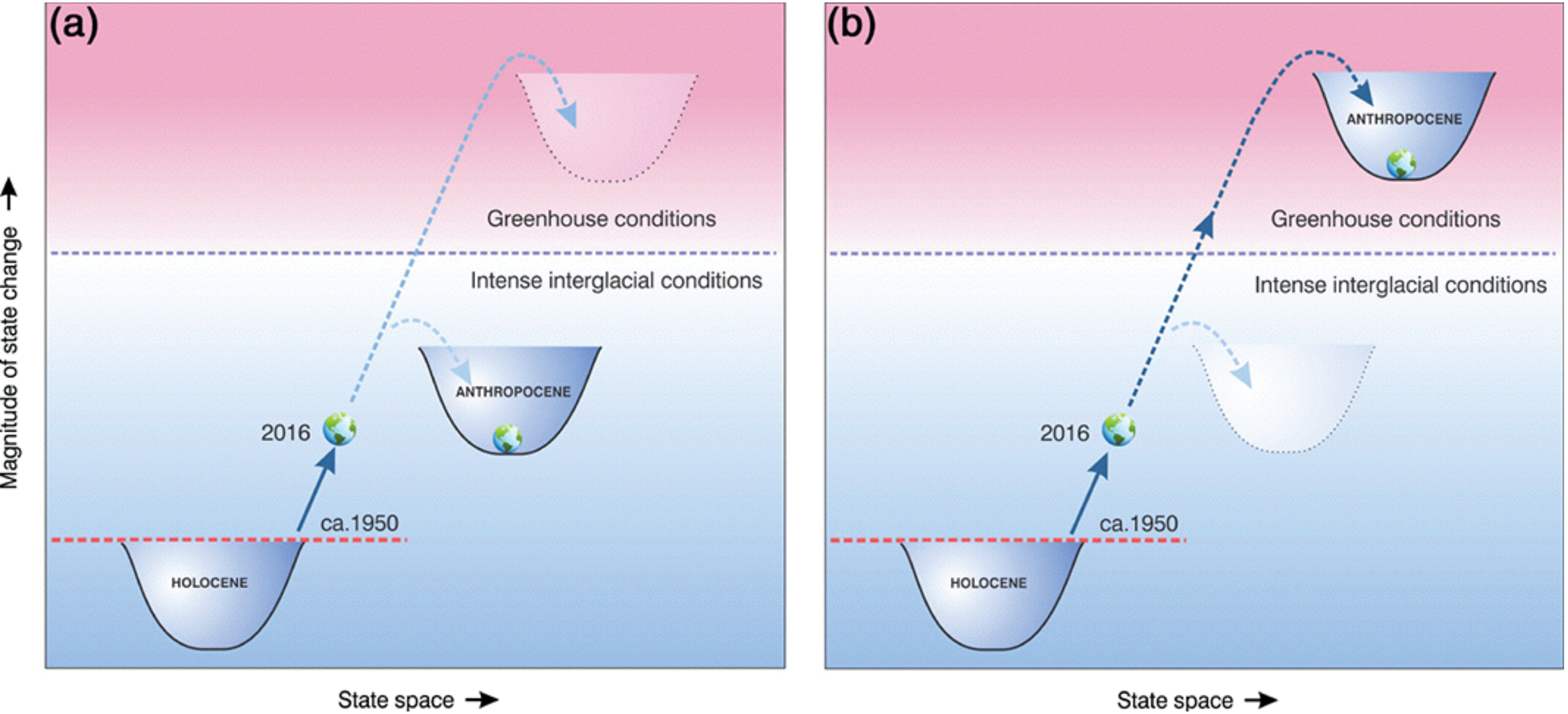
The Challenge

I’m here to say … we’ve got some tough sailin’ ahead





The climate will stabilize — with intense interglacial conditions or toward unknown greenhouse conditions



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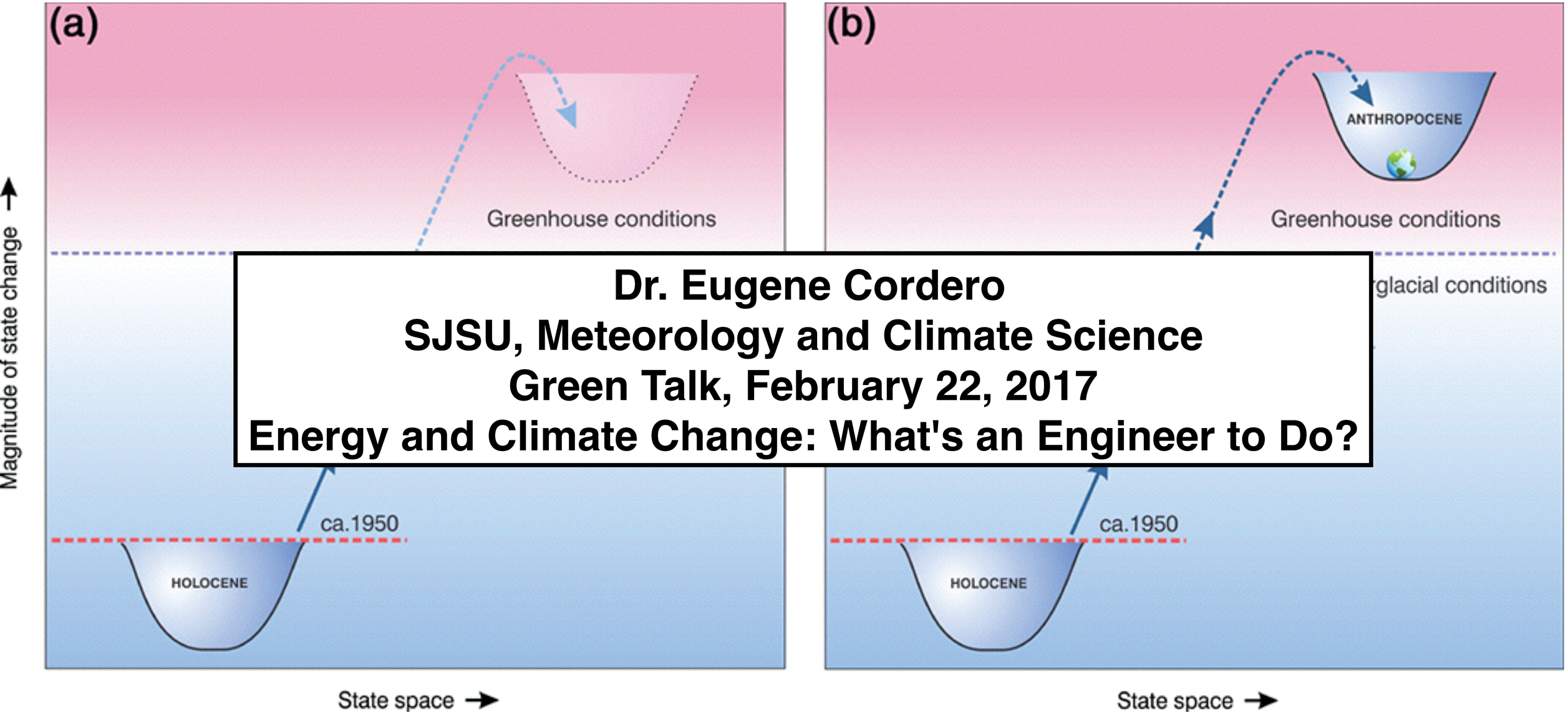


Dr. Eugene Cordero
SJSU, Meteorology and Climate Science
Green Talk, February 22, 2017
Energy and Climate Change: What's an Engineer to Do?

The March for Science helped to create awareness

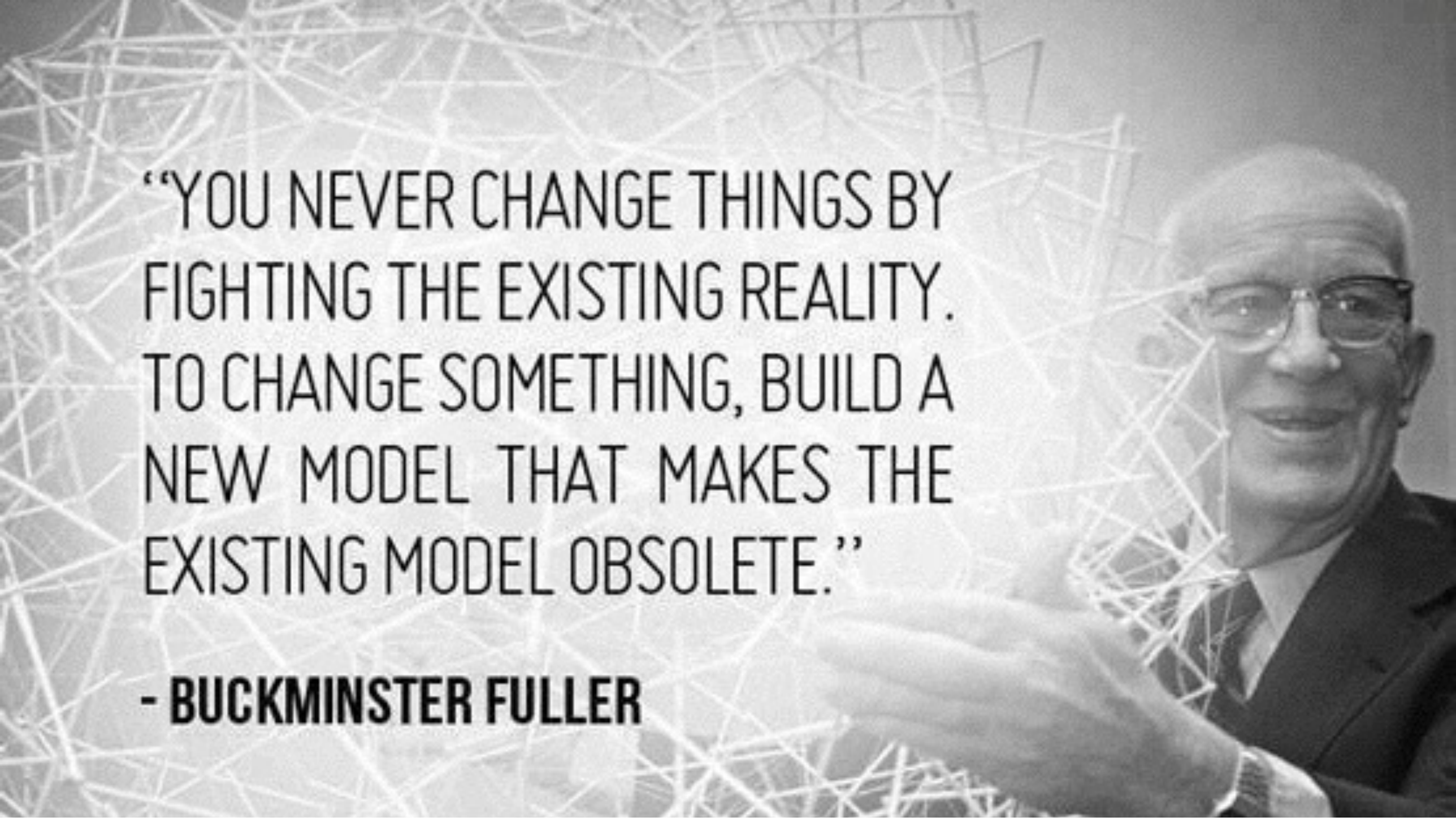
The March for Science helped to create awareness

The March for Science helped to create awareness

I would like us to focus on what Bucky had to say

The Opportunity

Bucky had something to say about this kind of thing


"YOU NEVER CHANGE THINGS BY FIGHTING THE EXISTING REALITY. TO CHANGE SOMETHING, BUILD A NEW MODEL THAT MAKES THE EXISTING MODEL OBSOLETE."
- BUCKMINSTER FULLER

Paris 2015 was a key step for Climate Change action

Governments

World leaders issued the Challenge in Paris

Cities, regions, islands & countries are doing it

100% RENEWABLES

Go100RE.net

100% Renewable Energy is reality today

Cities, regions, islands & countries are doing it

Cities, regions, islands & countries are doing it

News May 10

LAST COAL-FIRED PLANTS SHUT DOWN IN SOUTH AUSTRALIA AND SCOTLAND SHOW...

States & Regions, RE100, Energy Transition Platform, Compact of States and Regions

News Mar 20

SOUTH AUSTRALIA LAUNCHES NEW CLEAN ENERGY PLAN TO COMBAT GRID BLACK-OUT...

States & Regions, Under2

News Apr 05

CALIFORNIA AND SCOTLAND SIGN NEW CLIMATE AGREEMENT TO SUPPORT THE UNDER2...

Under2

Local climate & energy initiatives are growing

Local climate & energy initiatives are growing

"*Cities are the drivers of progress and innovation*, and through the Compact of Mayors, they can help nations set new, aggressive climate targets over the next year."

– Michael R. Bloomberg, UN Secretary-General's Special Envoy for Cities and Climate Change

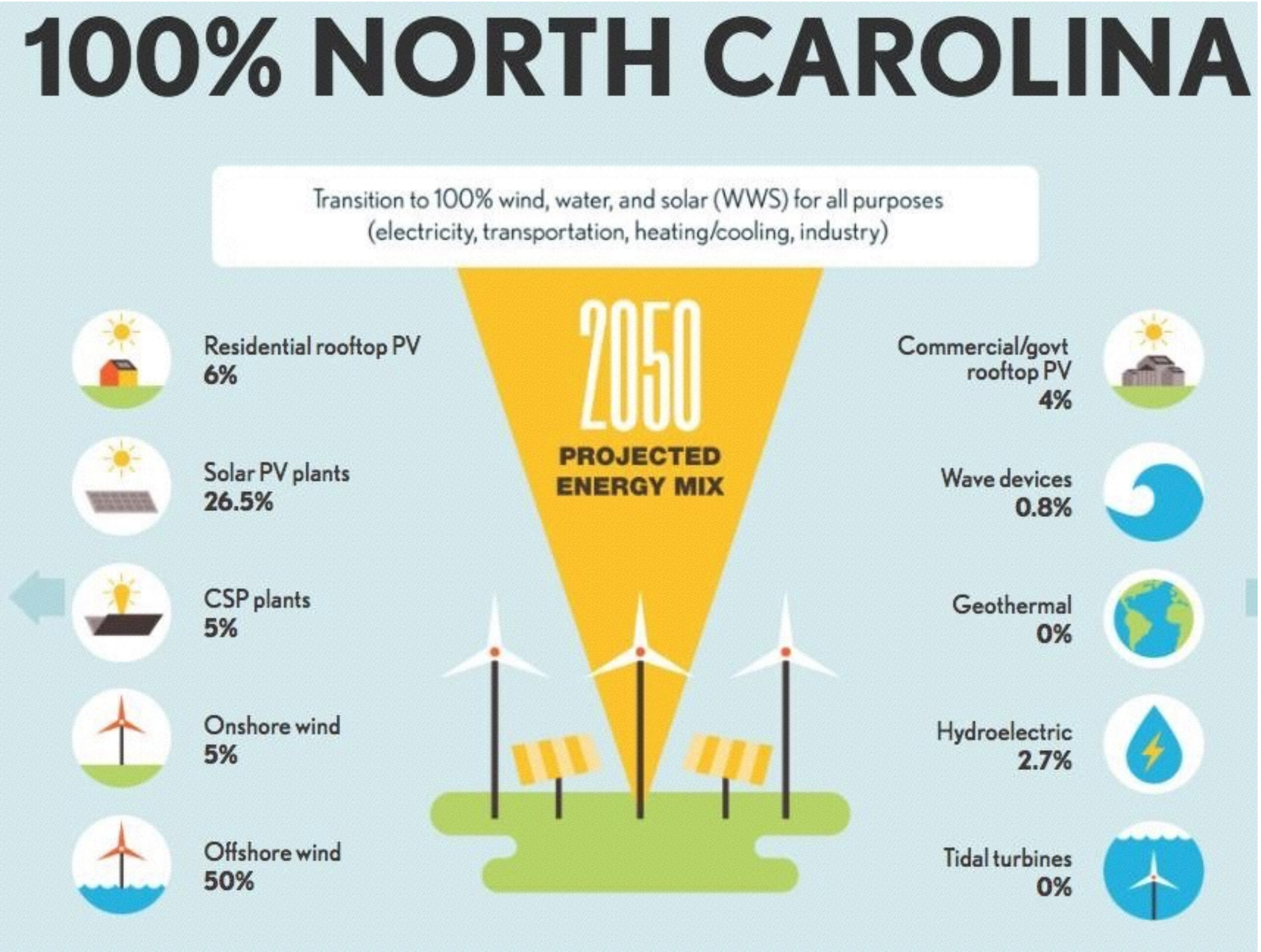
Reporting Partners

carbonn Climate Registry

NAZCA
Supporting the Lima-Paris Action Agenda

CDP
DRIVING SUSTAINABLE ECONOMIES

North Carolina has a bold vision for 100% RE



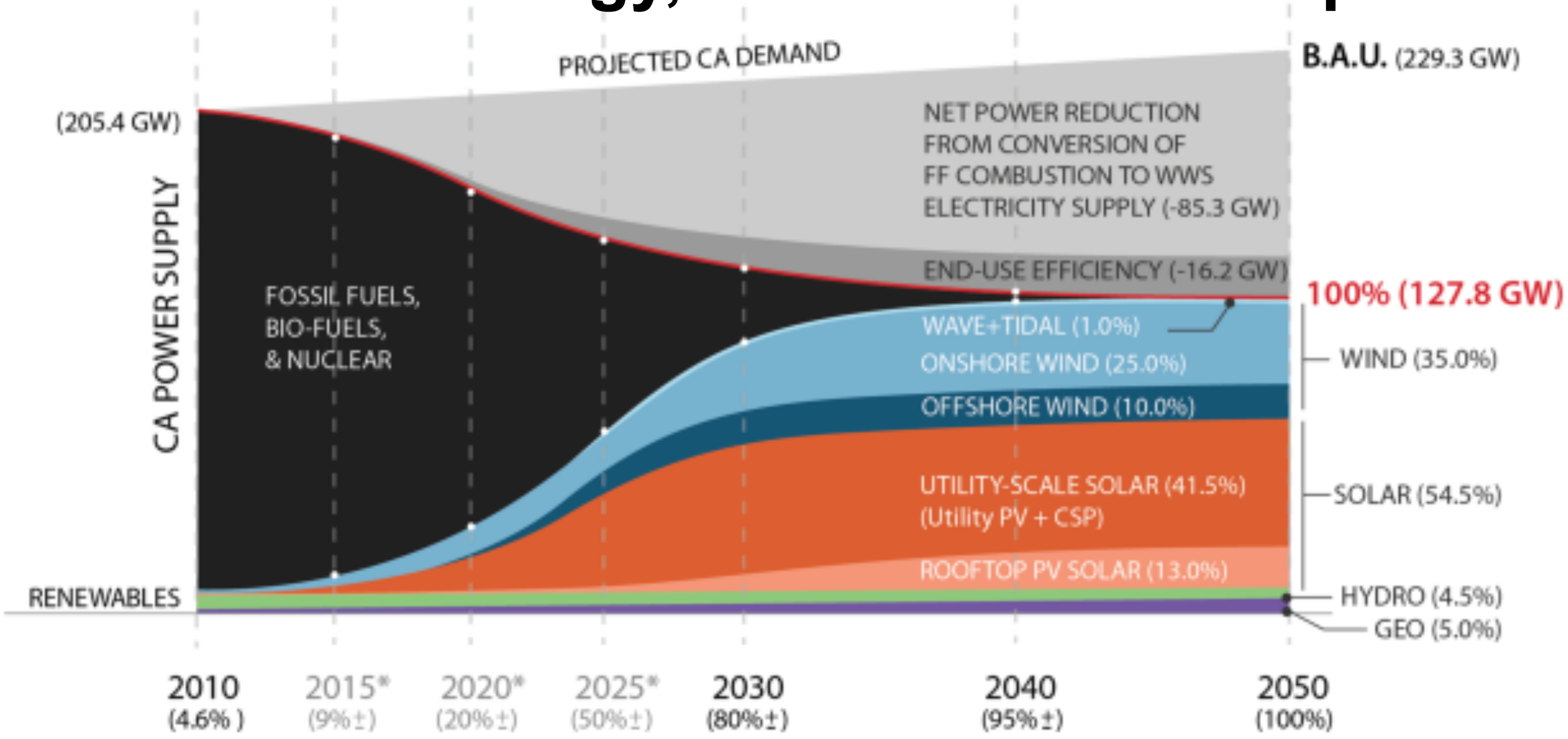
NORTH CAROLINA'S BOLD VISION FOR 100%

MARCH 17, 2017

North Carolina State Representatives Pricey Harrison (D-Guilford), John Autry (D-Mecklenburg), and Jean Farmer-Butterfield (D-Wilson) have introduced the first legislation ever in the North Carolina General Assembly to call for the State of North Carolina and the United States to set a...

THESOLUTIONSPROJECT

California has the political will to replace fossil fuels with renewable energy, which SJSU can tap into



Projected Energy Supply & Demand, **California**

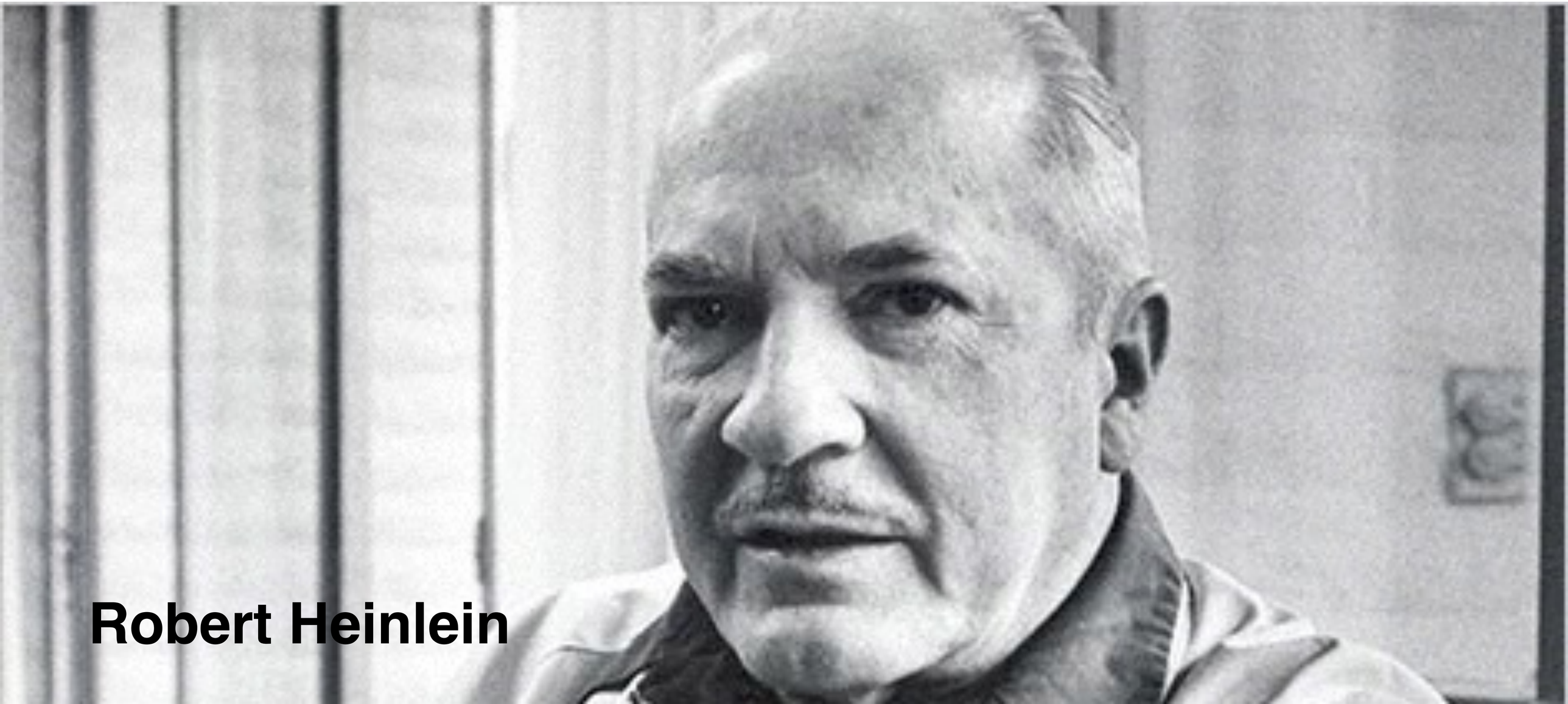
Senator de León has a new bill to push for 100% RE

Industry

“Industry is hard to decarbonize”

Jeffrey Sachs
UN Advisor

Always listen to experts. They'll tell you what can't be done and why. *Then do it.*



Robert Heinlein

I know one industry group that is doing it

SSAB

PRODUCTS STEEL SELECTOR SUPPORT SERVICES CONTACT US COMPANY

SUSTAINABILITY | SSAB AND SUSTAINABILITY | SUSTAINABLE OFFERING | SUSTAINABLE OPERATIONS | RESPONSIBLE PARTNER

Carbon-dioxide-free steel industry

SSAB, LKAB and Vattenfall are launching an initiative to solve the carbon dioxide problem in the Swedish steel industry. Together, the companies involved will initiate work to develop a steel production process that emits water rather than carbon dioxide.

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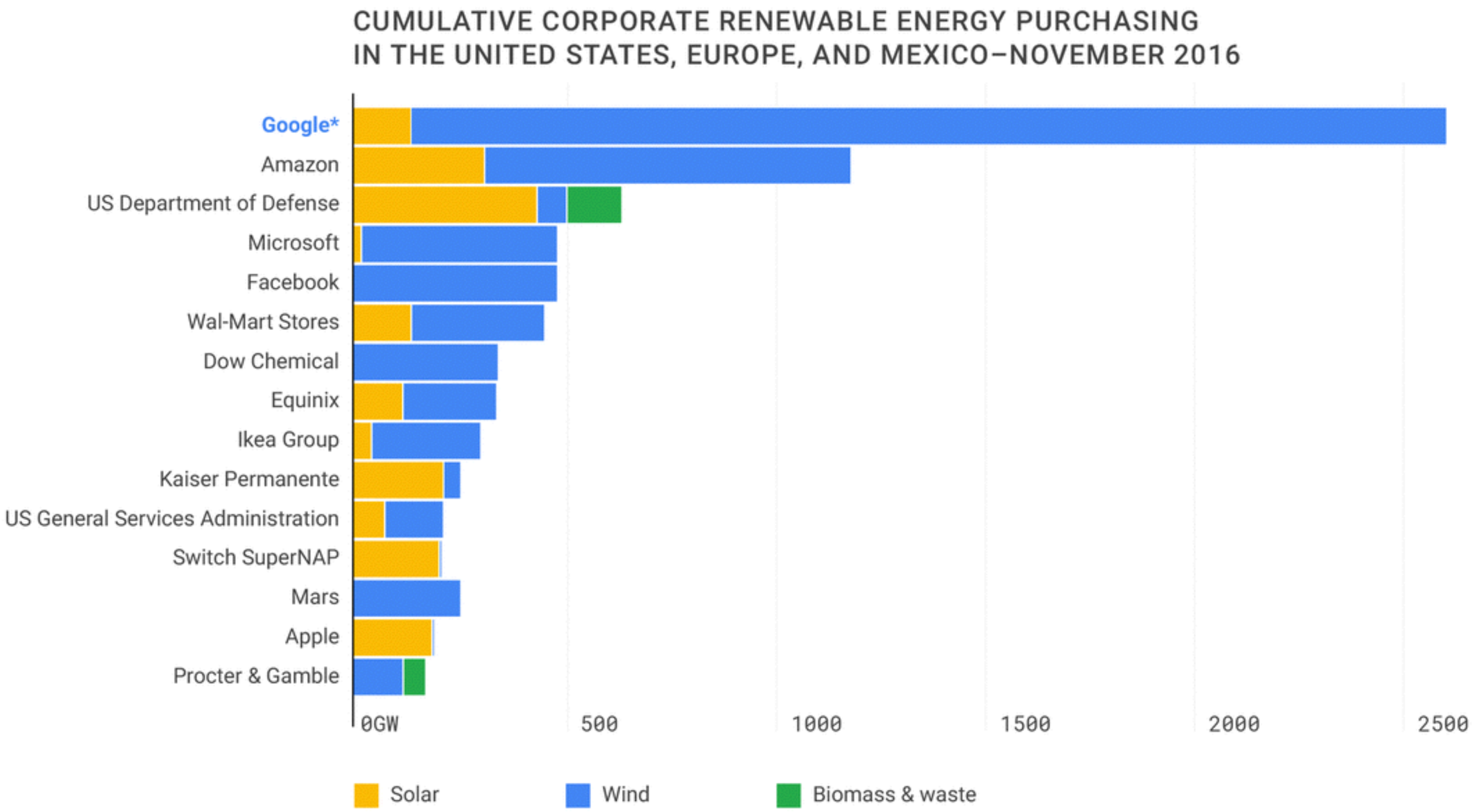
Many businesses have jumped on board

88 OF THE WORLD'S MOST INFLUENTIAL COMPANIES ARE COMMITTED TO 100% RENEWABLE POWER

RE100.org

Many businesses have jumped on board



Source: Bloomberg New Energy Finance

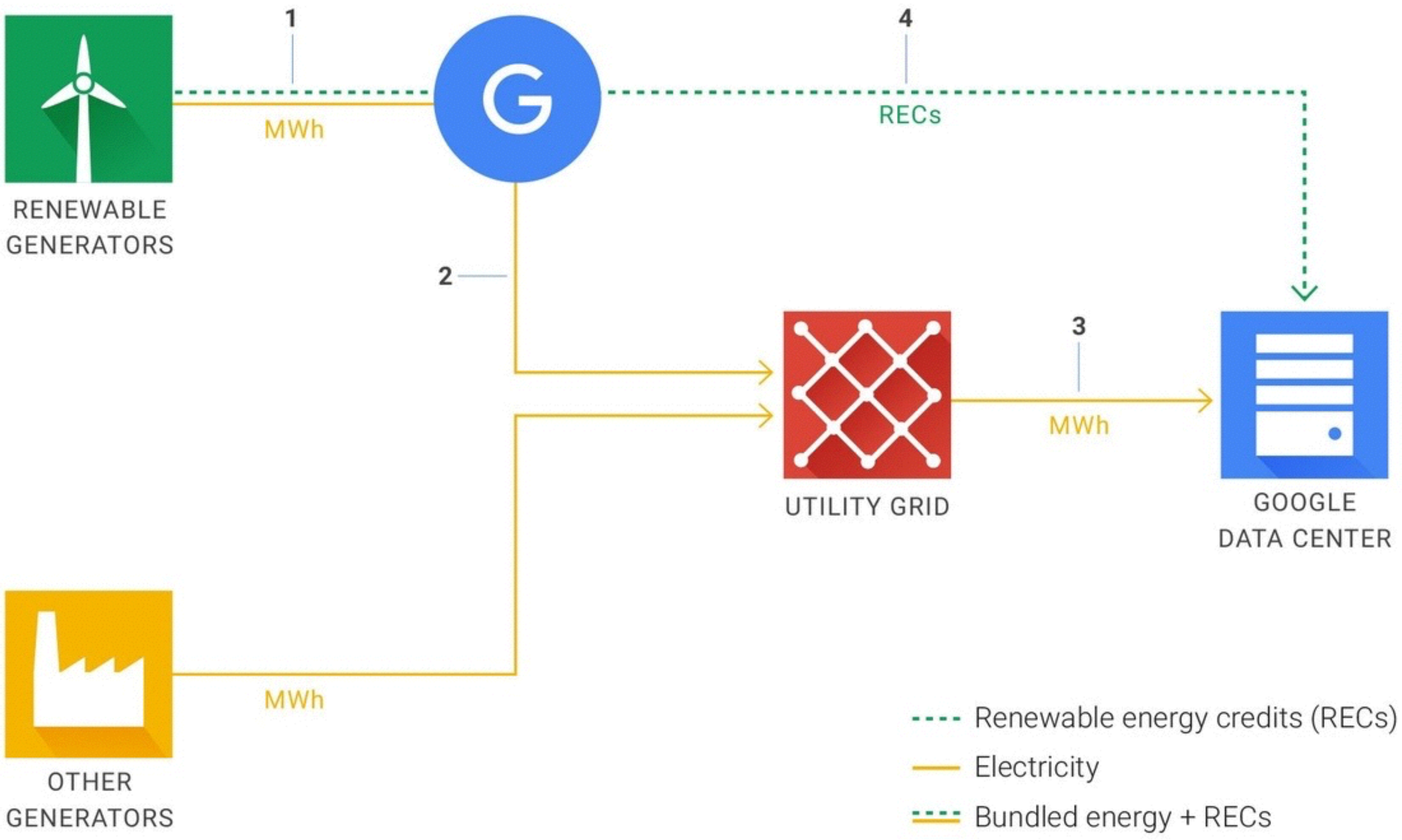
*Google total also includes one 80 MW project in Chile

Many businesses have jumped on board

GOOGLE IS SET TO REACH 100% RENEWABLE ENERGY - AND IT'S JUST THE BEGINNING

Blog Reading time: 5 minutes 6 December 2016

Many businesses have jumped on board



Many businesses have jumped on board

2.6GW

Total renewable energy we've contracted to purchase globally.

20

Number of agreements Google has made to purchase renewable energy to date.

842MW

In 2015, we entered into six new agreements totaling 842 MW—the largest aggregate purchase of renewable energy ever made by a non-utility.

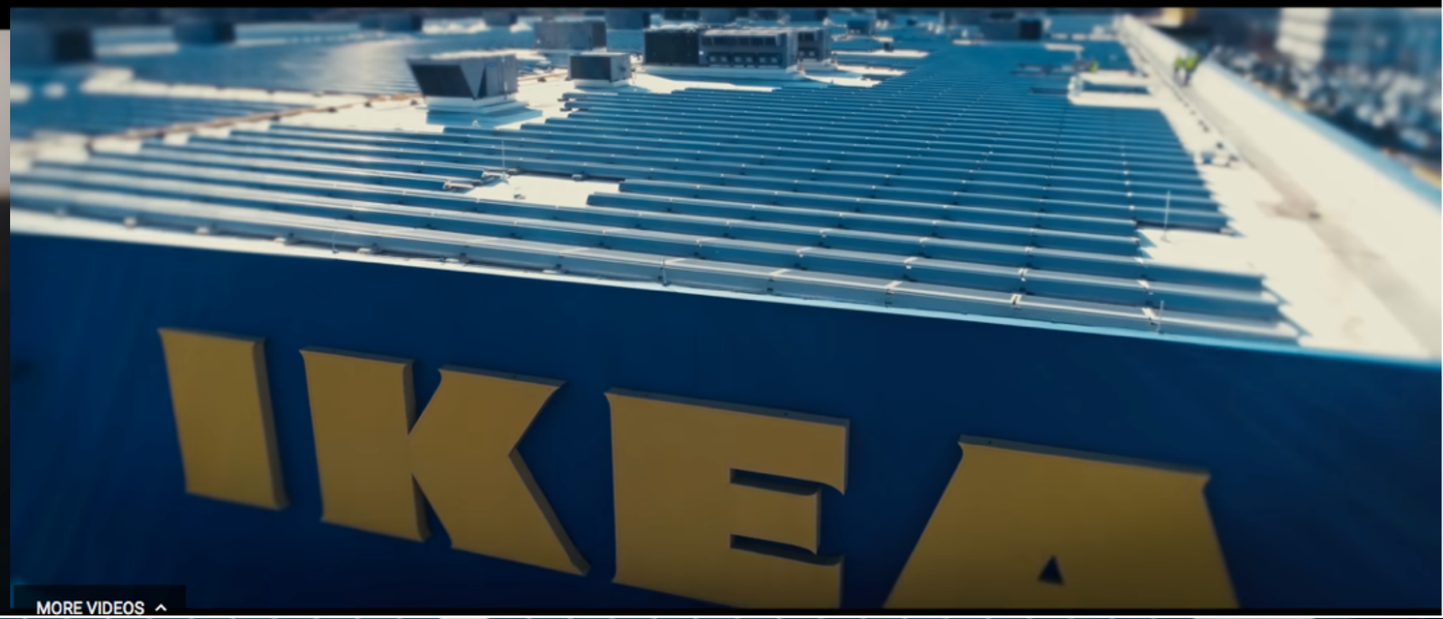
$3.5billion

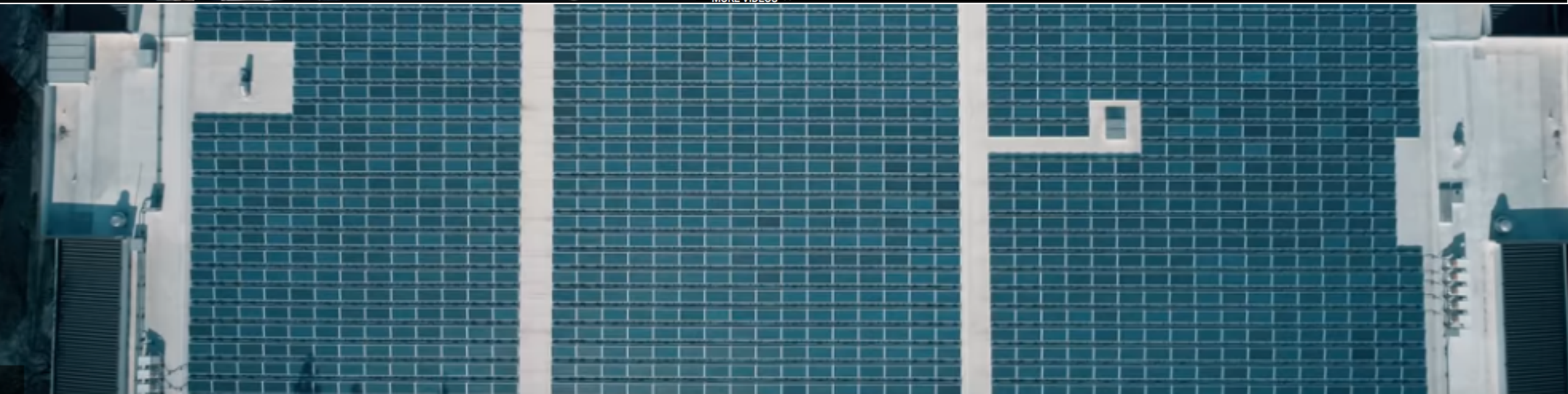
New capital investments worldwide generated by renewable energy projects from which we buy electricity.

$10s of millions

Economic impact of lease payments and local taxes from Google's commitment to renewable energy.

Many businesses have jumped on board





Many businesses have jumped on board

WORLD'S LARGEST BREWER COMMITS TO A 100% RENEWABLE ELECTRICITY FUTURE

LONDON: The world's largest brewer, Anheuser-Busch InBev, has joined RE100 with a commitment to power its global operations – representing almost six terawatt-hours of electricity annually – with 100% renewable sources.

Many businesses have jumped on board

ABInBev

Committing to a Renewable Electricity Future

100% purchased electricity from renewable sources by 2025

AB InBev to become the largest corporate direct purchaser of renewable electricity in the global consumer goods sector[1]

Mexico leads the way

Our renewable electricity transformation starts in Mexico by signing an agreement which will increase the country's wind and solar energy capacity > 5%[2]

7% → **100%**

Shift in sourcing purchased electricity from renewable sources from today to 2025

Reducing our carbon footprint by **30%**

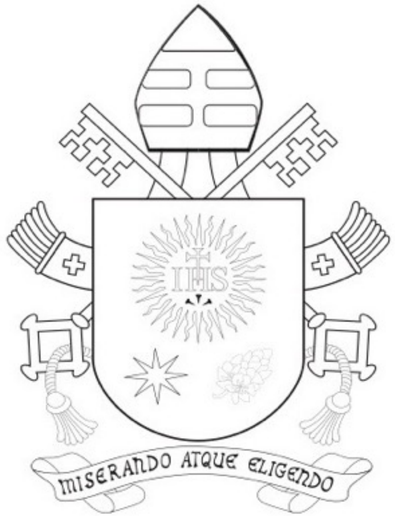
Equivalent to removing nearly 500,000 cars from the road[3]

Shifting electricity to renewable resources

Our commitment will shift 6 terawatt-hours of electricity annually to renewable sources, equivalent to solar panels covering the area of 400 soccer pitches[4]

Religion

Pope Francis is leading the way



ENCYCLICAL LETTER

LAUDATO SI'

OF THE HOLY FATHER

FRANCIS

ON CARE FOR OUR COMMON HOME

Pope Francis is leading the way

Universities

Other universities are doing it

"...Now, this is a steep mountain, and we have to figure out how to reach the top. But we are the University of California. And there is no reason that UC can't lead the world in this quest, as it has in so many others...The good news is that research universities like UC are in the business of breaking through barriers. That's why we call them breakthroughs. It is the essence of what research universities do."

*– UC President Janet Napolitano, announcing that **UC will be carbon neutral by 2025***

Other universities are doing it

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– UC President Janet Napolitano, announcing that UC will be carbon neutral by 2025

Sustainability Brochure

UC: The Living Laboratory for Sustainability

Other universities are doing it

FOSSIL FREE STANFORD

Join the movement!

Coal was just the beginning. It's time to #DivestTheRest.

Get Involved:

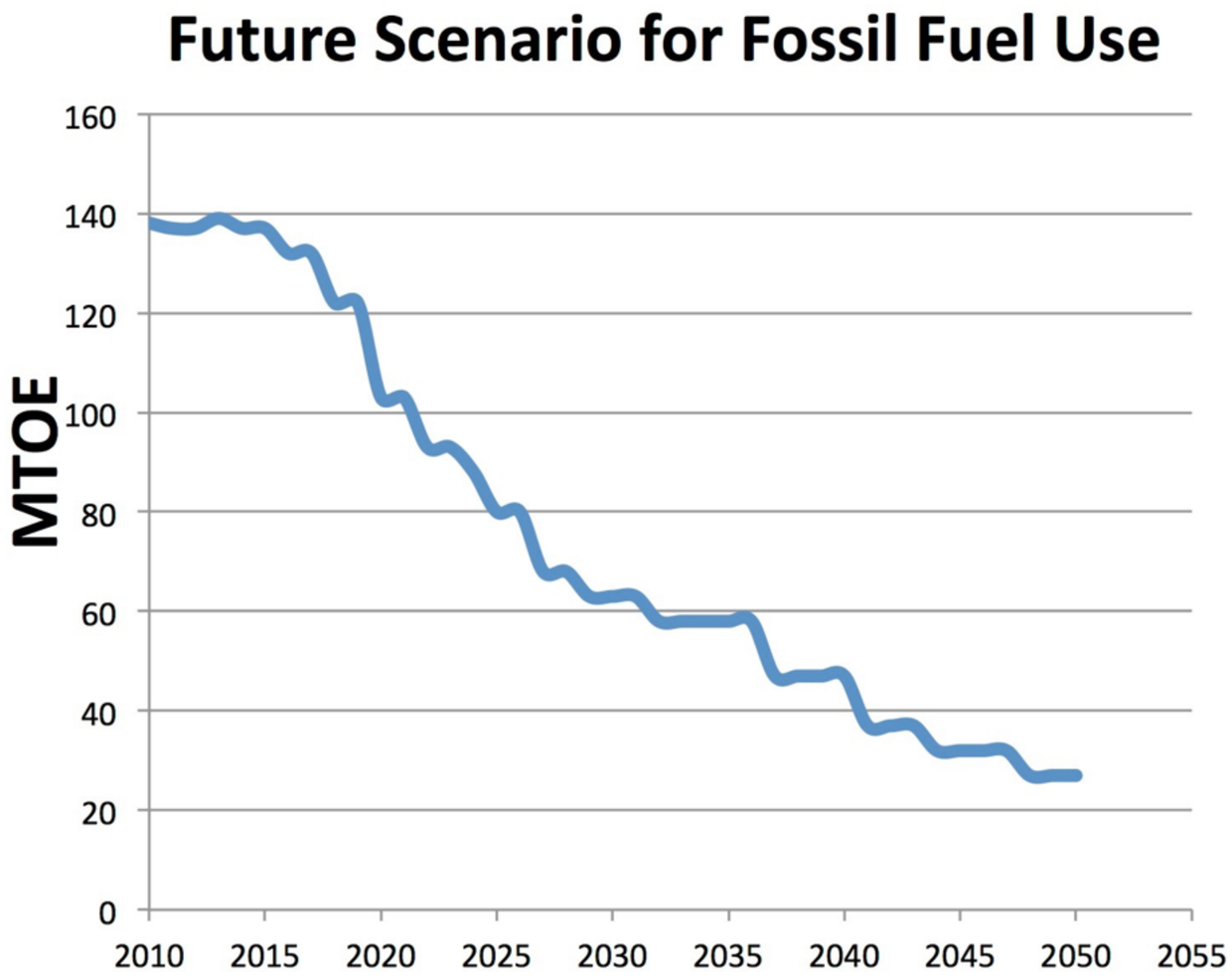
Want to get involved with Fossil Free Stanford? First...

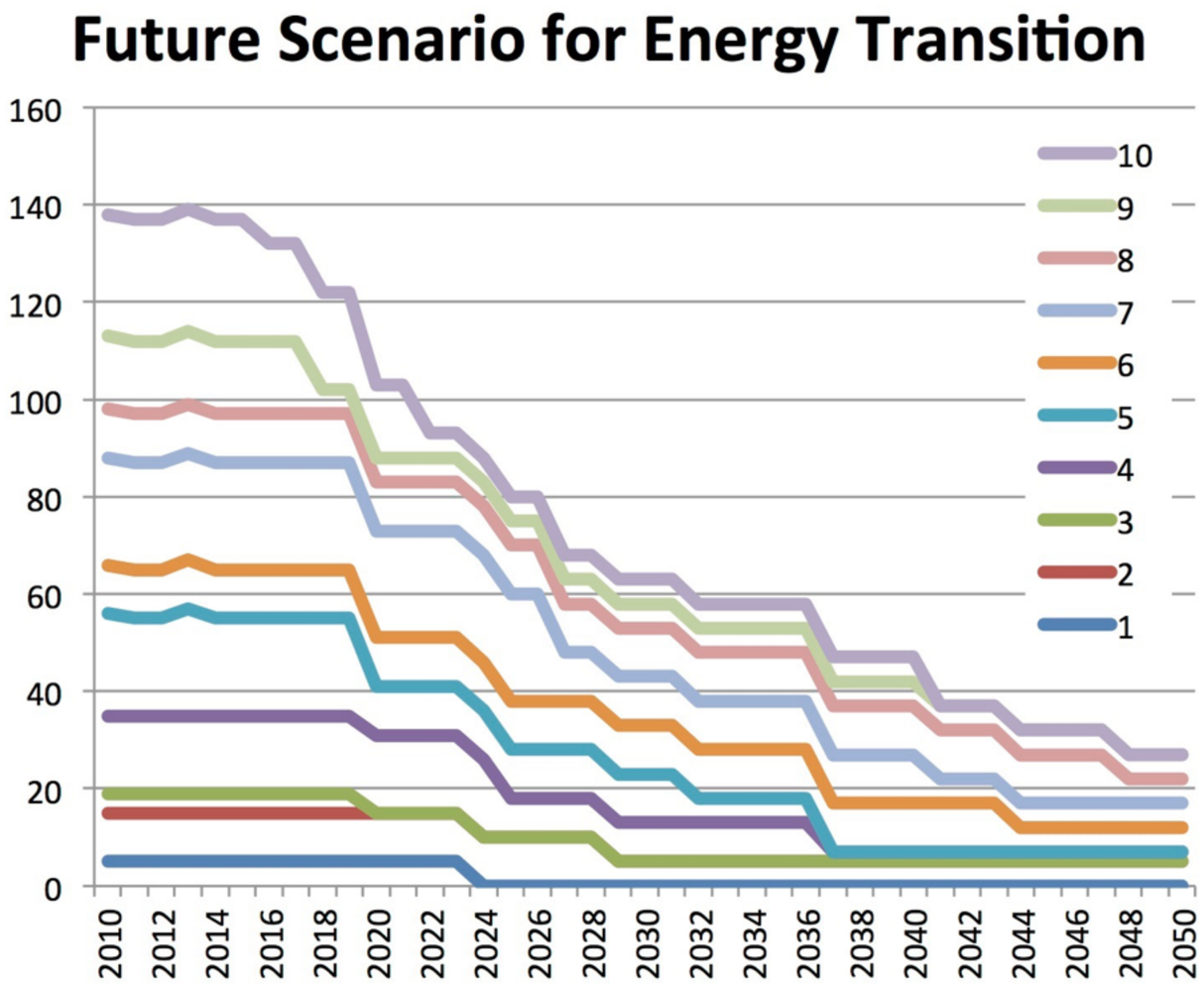
1. **Sign our petition.**
2. **Like us on Facebook.**
3. **Follow us on Twitter.**

...So we can keep you up to date on our campaign, and tell you about key opportunities to take action.

If they can do it, so can we at San José State!

The transition happens one project at a time



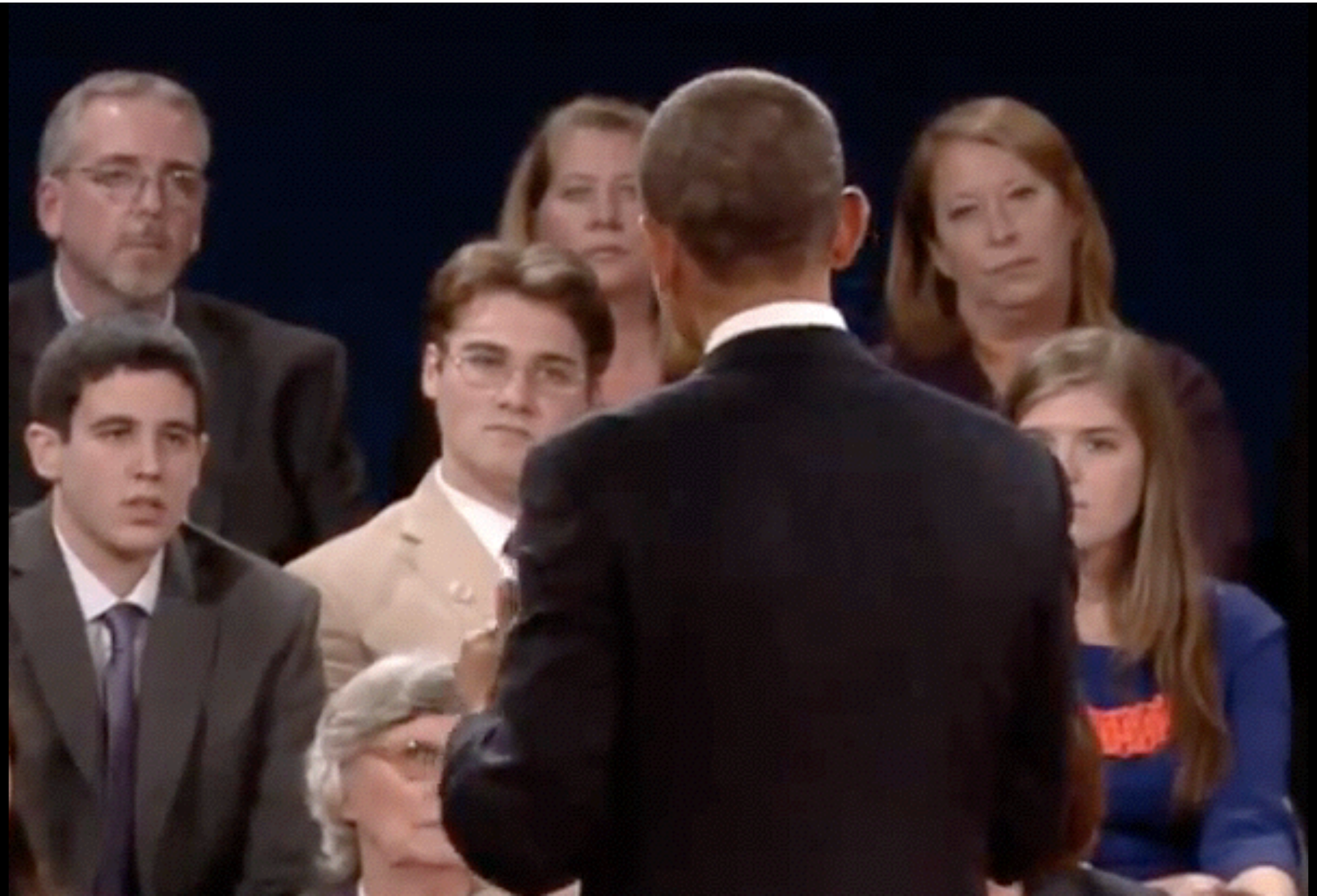


Only individuals can do it

Getting jobs was a hot topic in the 2012 debates

“When I graduate, I will have little chance to get employment … what can you say to reassure me…?

Obama: “We’ve got to make sure we’re building the energy source of the future…”



Today’s Energy Jobs Are in Solar, Not Coal

SECTIONS HOME SEARCH

The New York Times

LOG IN

Today’s Energy Jobs Are in Solar, Not Coal

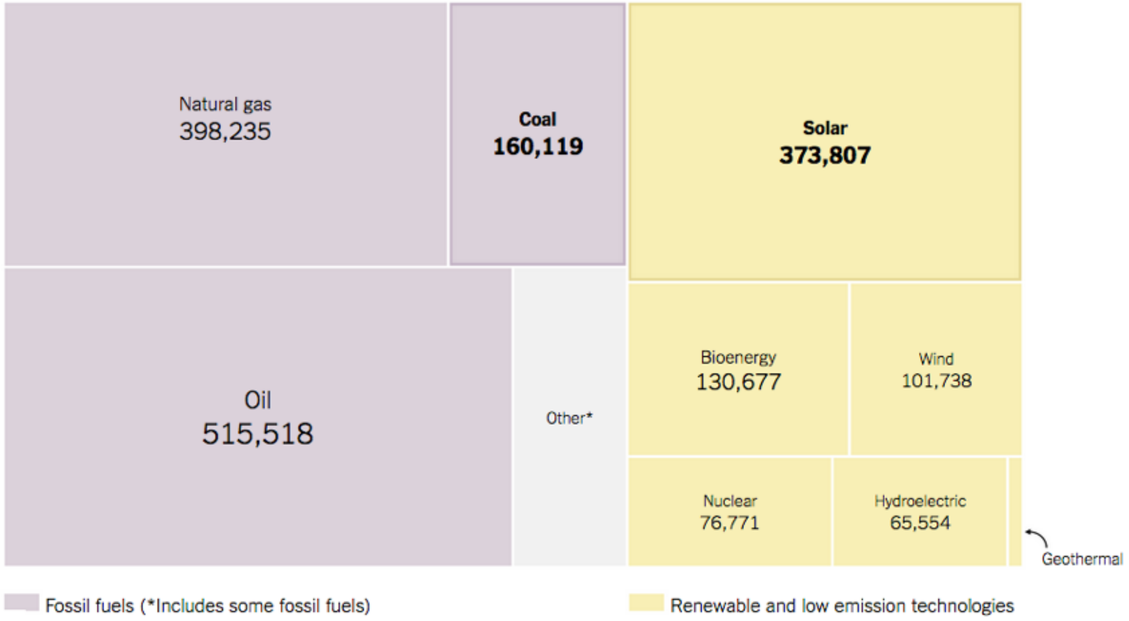
By NADJA POPOVICH APRIL 25, 2017

President Trump has promised to revive the coal industry and double down on fossil fuels, creating “so many energy jobs,” but he has not focused on the increasingly important role of renewable power in America’s energy economy.

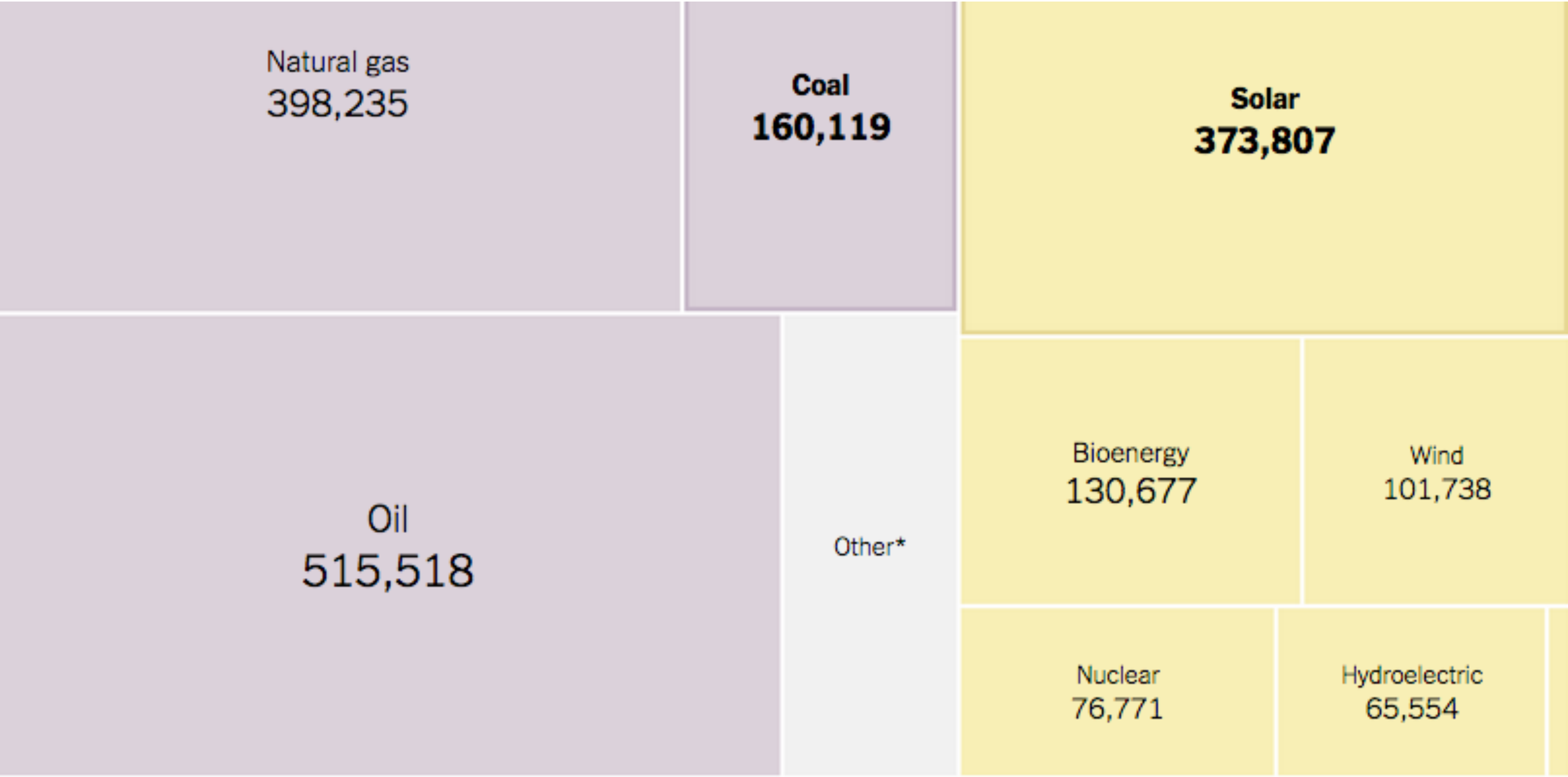
Last year, the solar industry employed many more Americans than coal, while wind power topped 100,000 jobs.

Power creation jobs in 2016

1.9 million



Today's Energy Jobs Are in Solar, Not Coal



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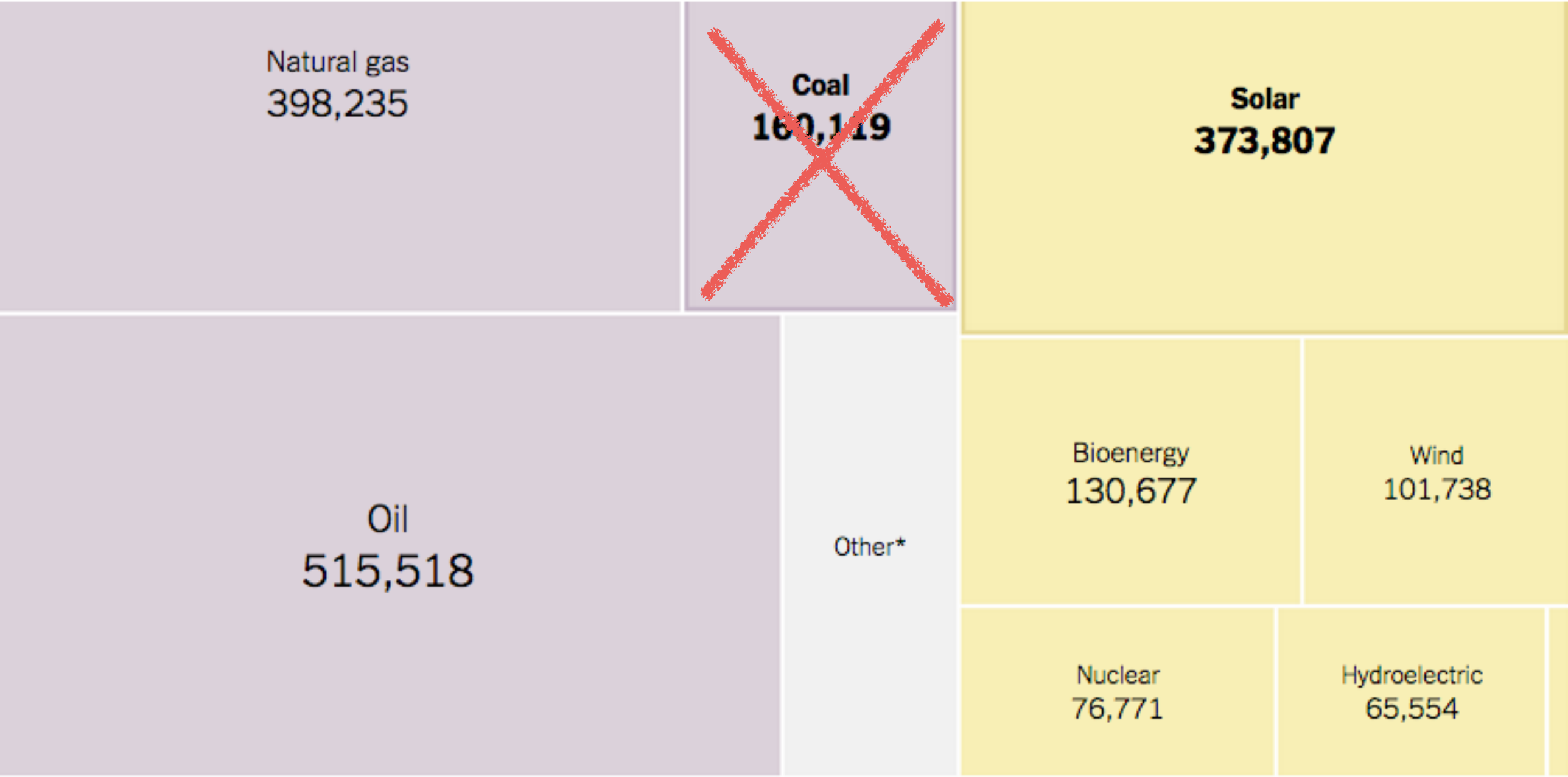
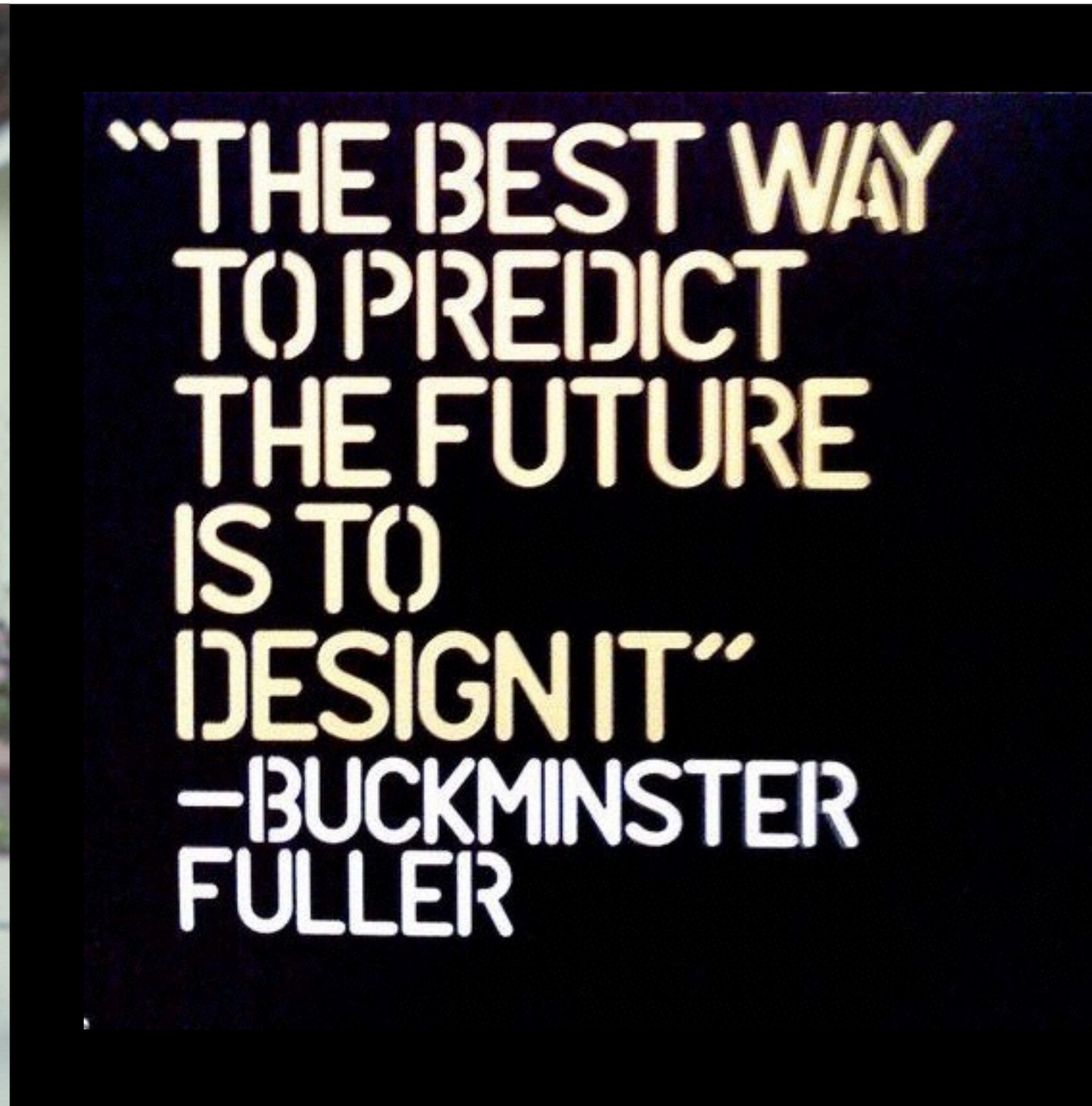


Bucky Fuller taught us how to predict the future

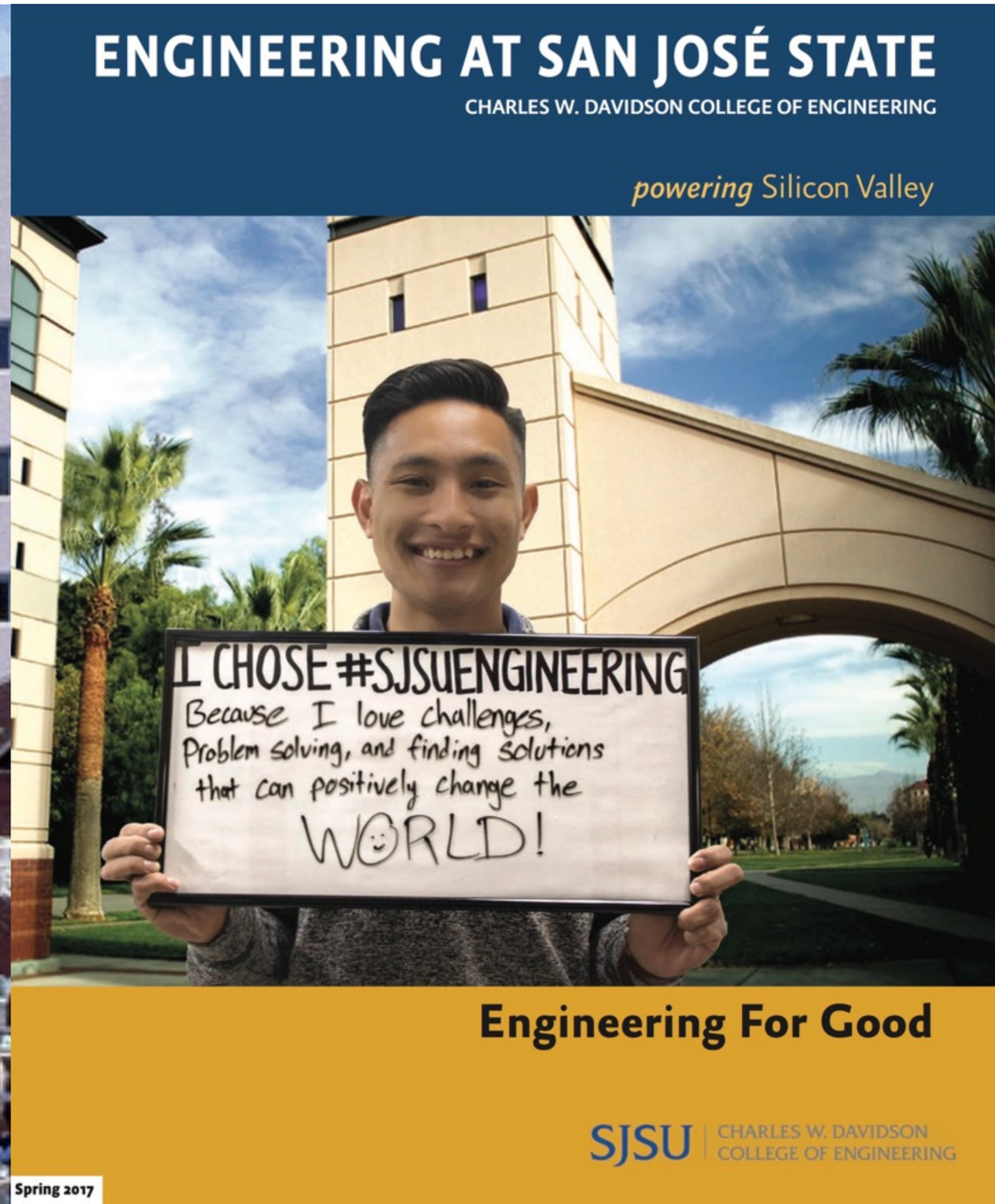


Solar

Storage

Smart Grid

The best place to start is right here at home



We need to know how much solar can be captured

There is concern: “…these are intermittent sources”

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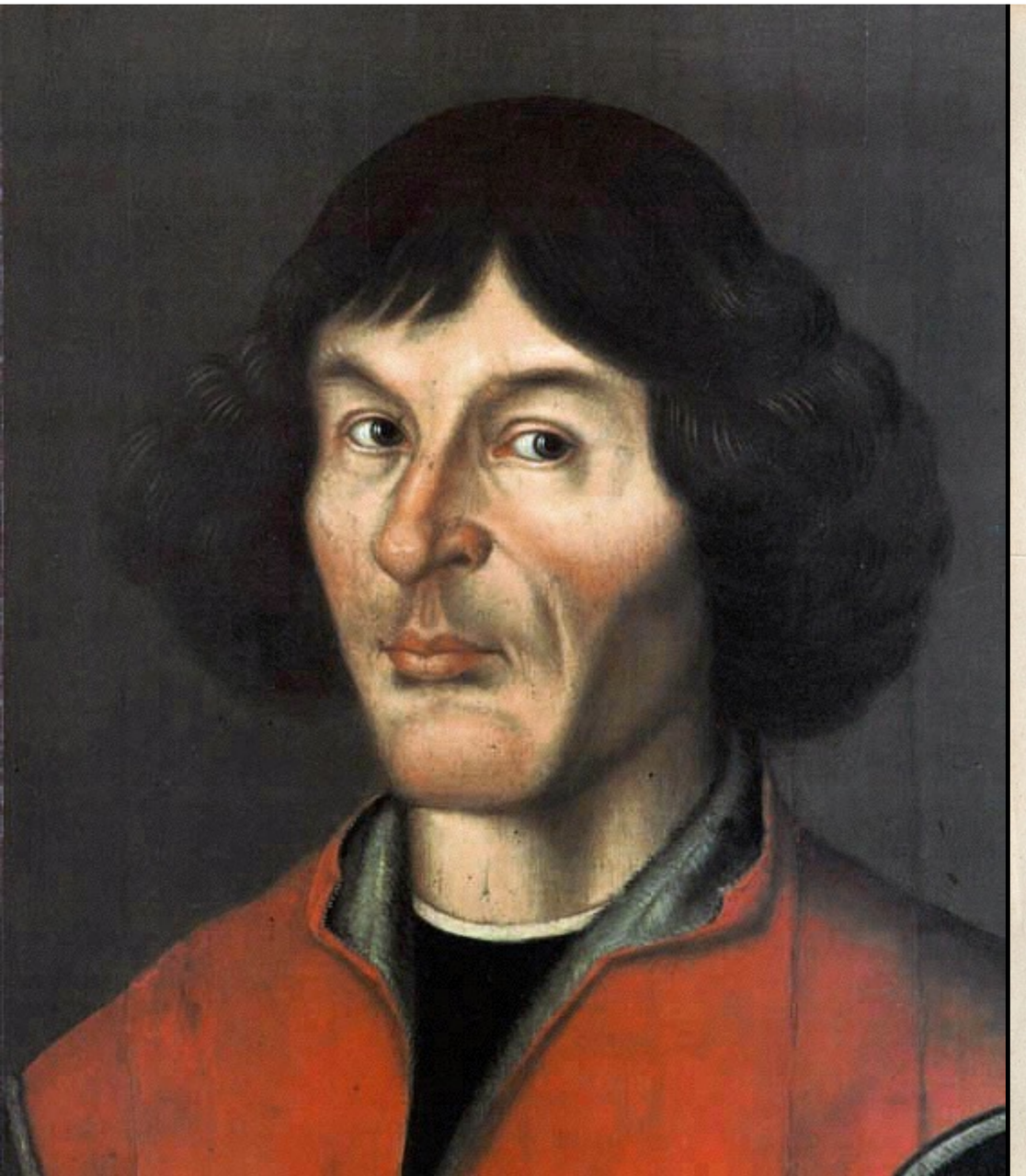

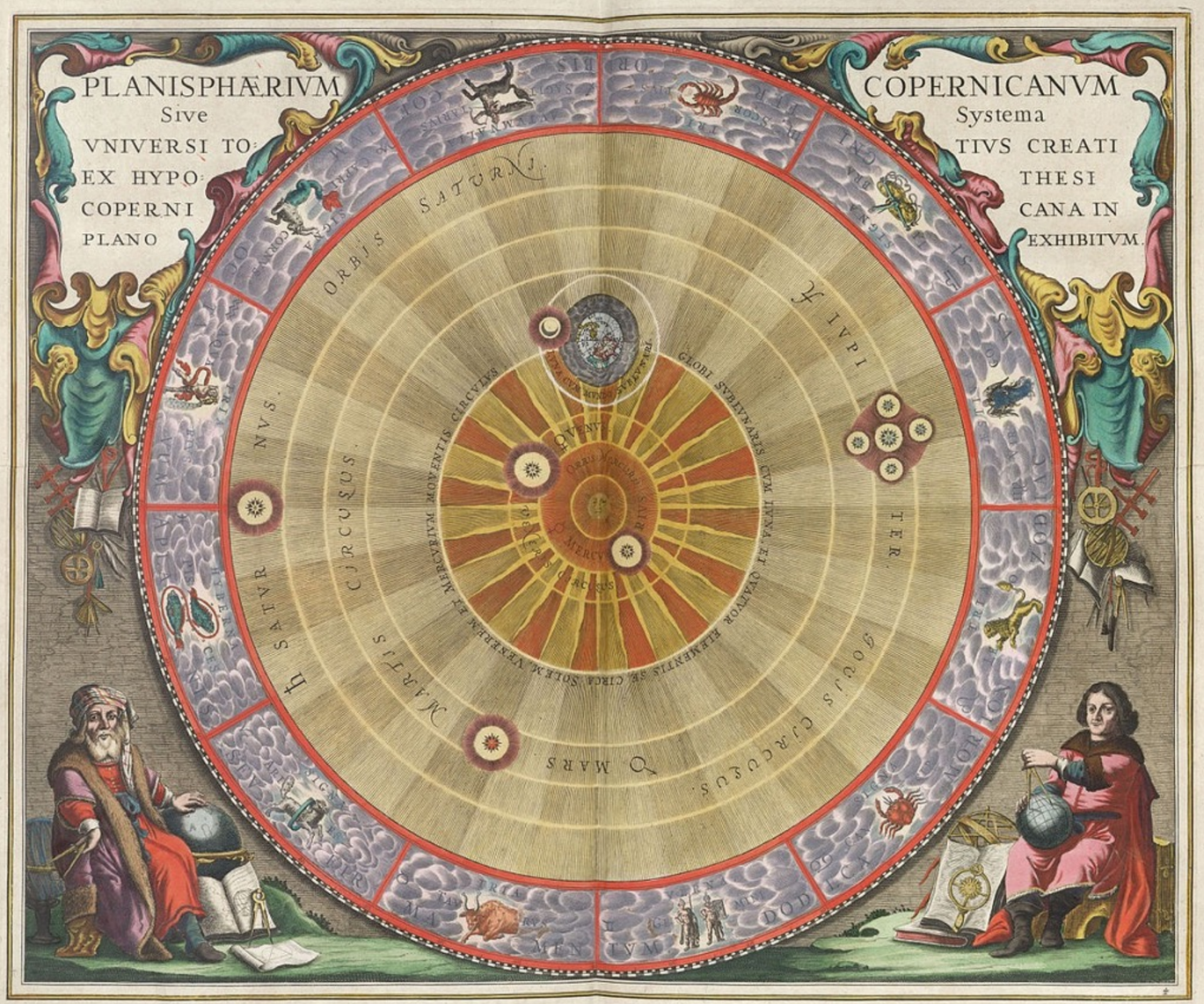

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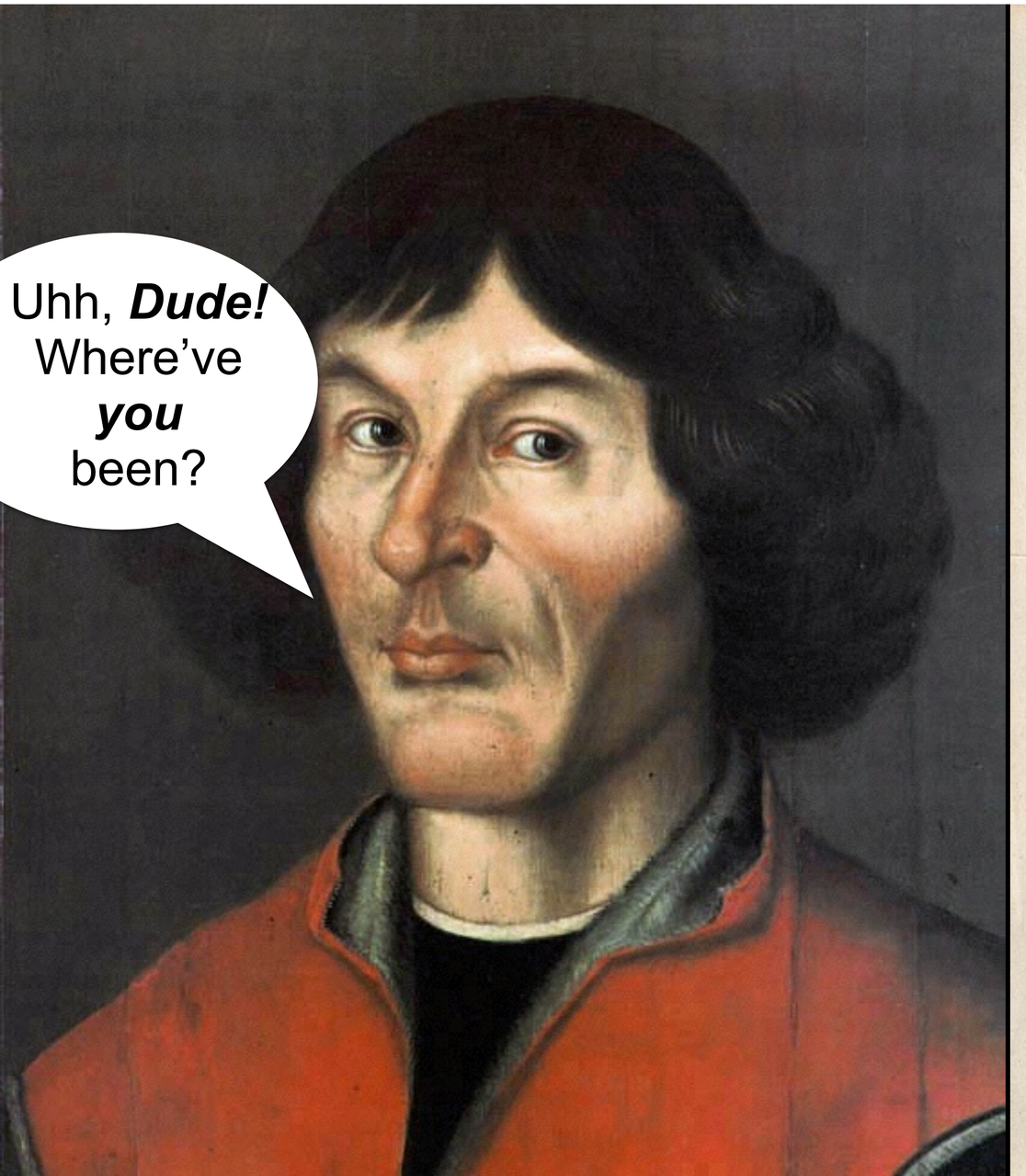

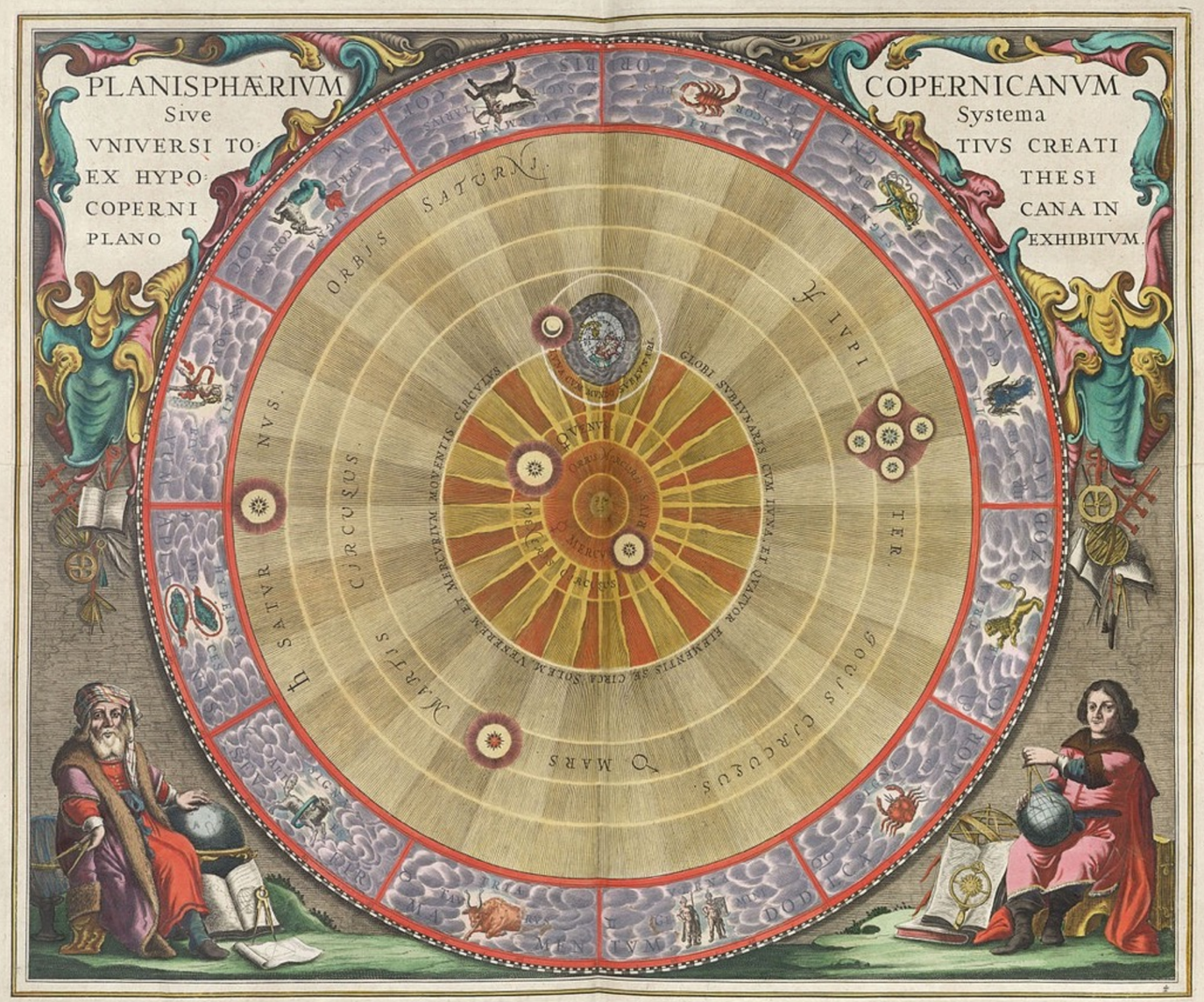

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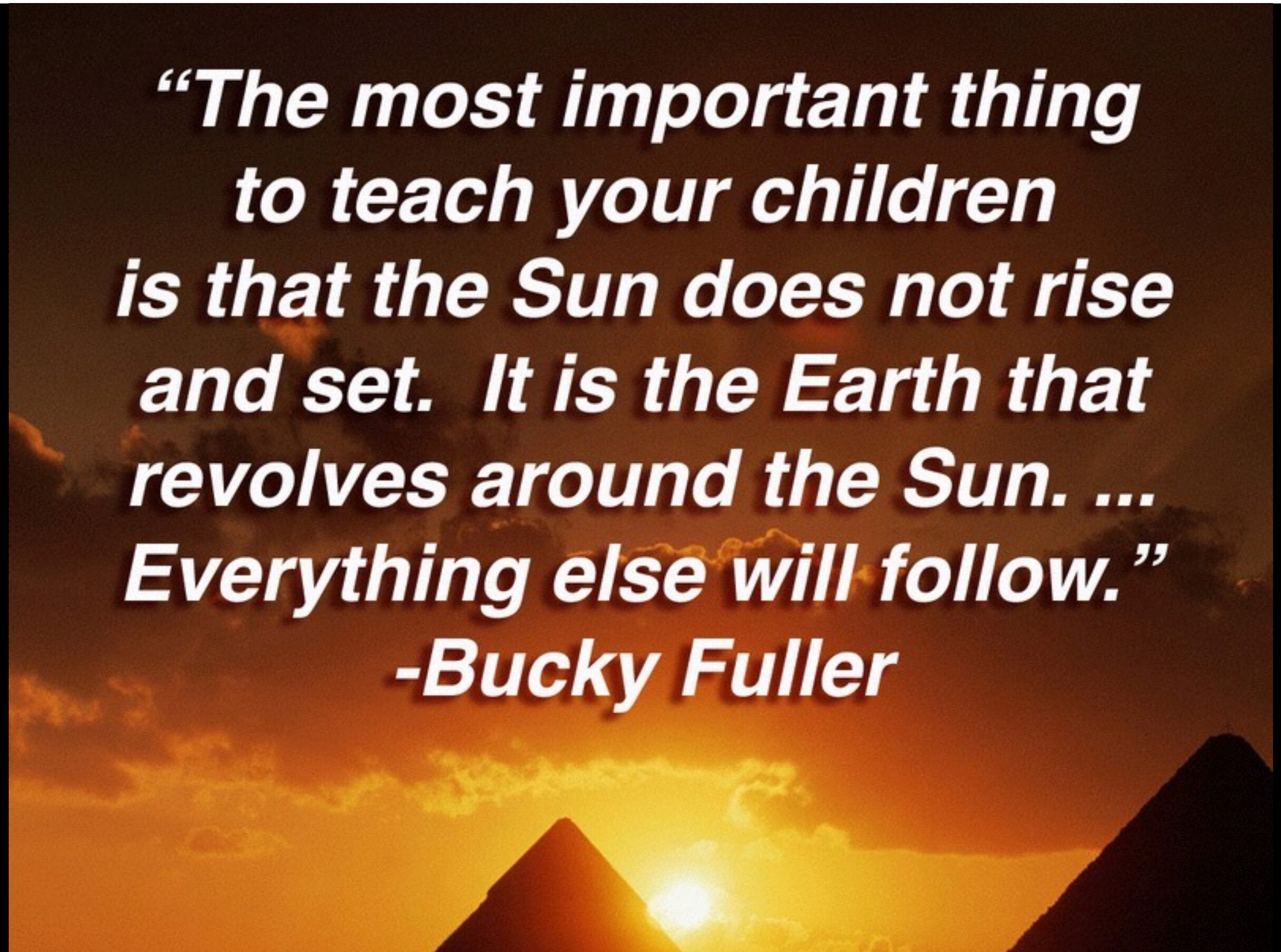
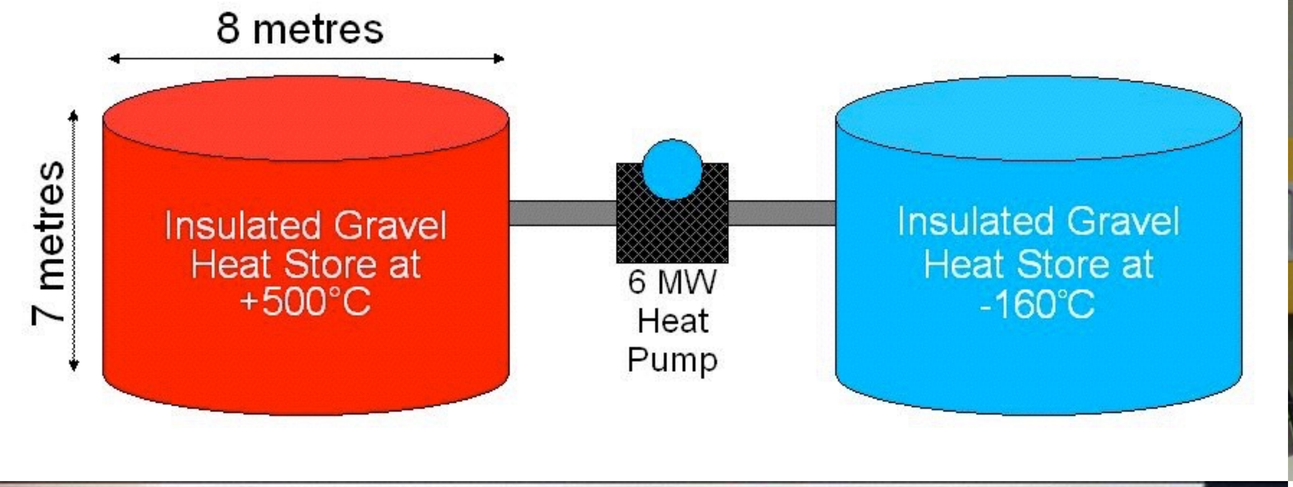


There are many storage technologies we can use



And we need to know how much energy is used

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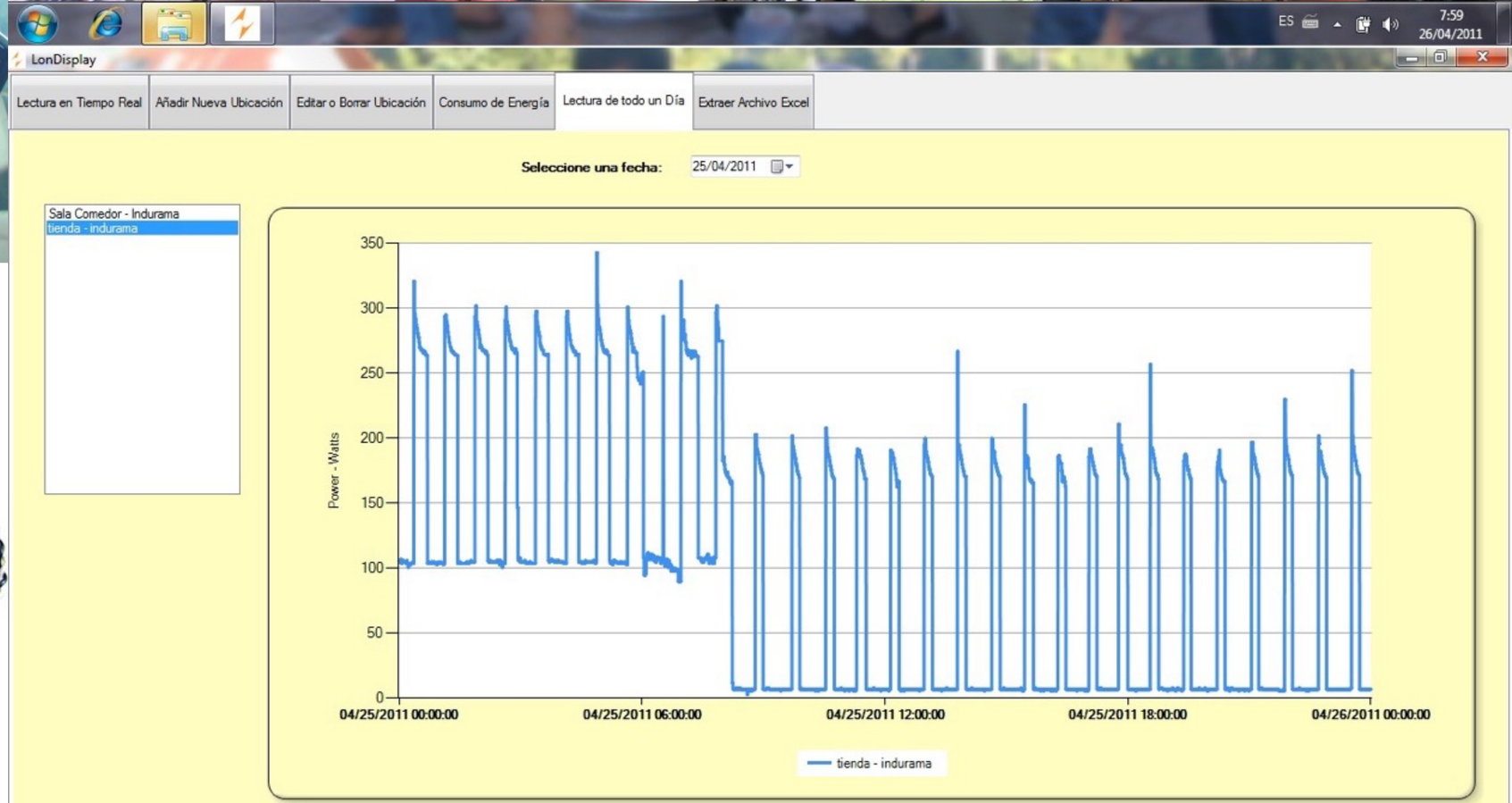
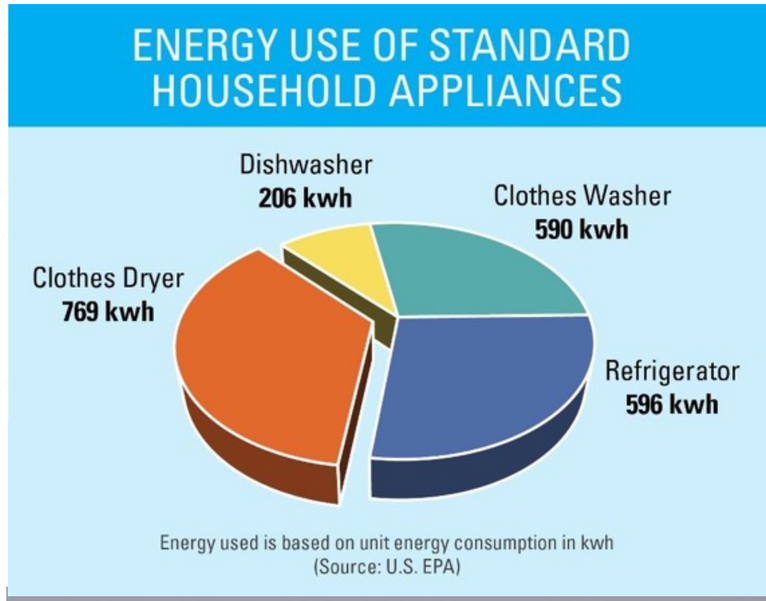
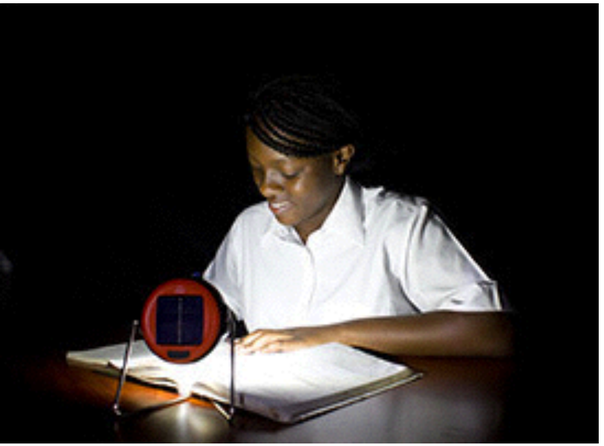
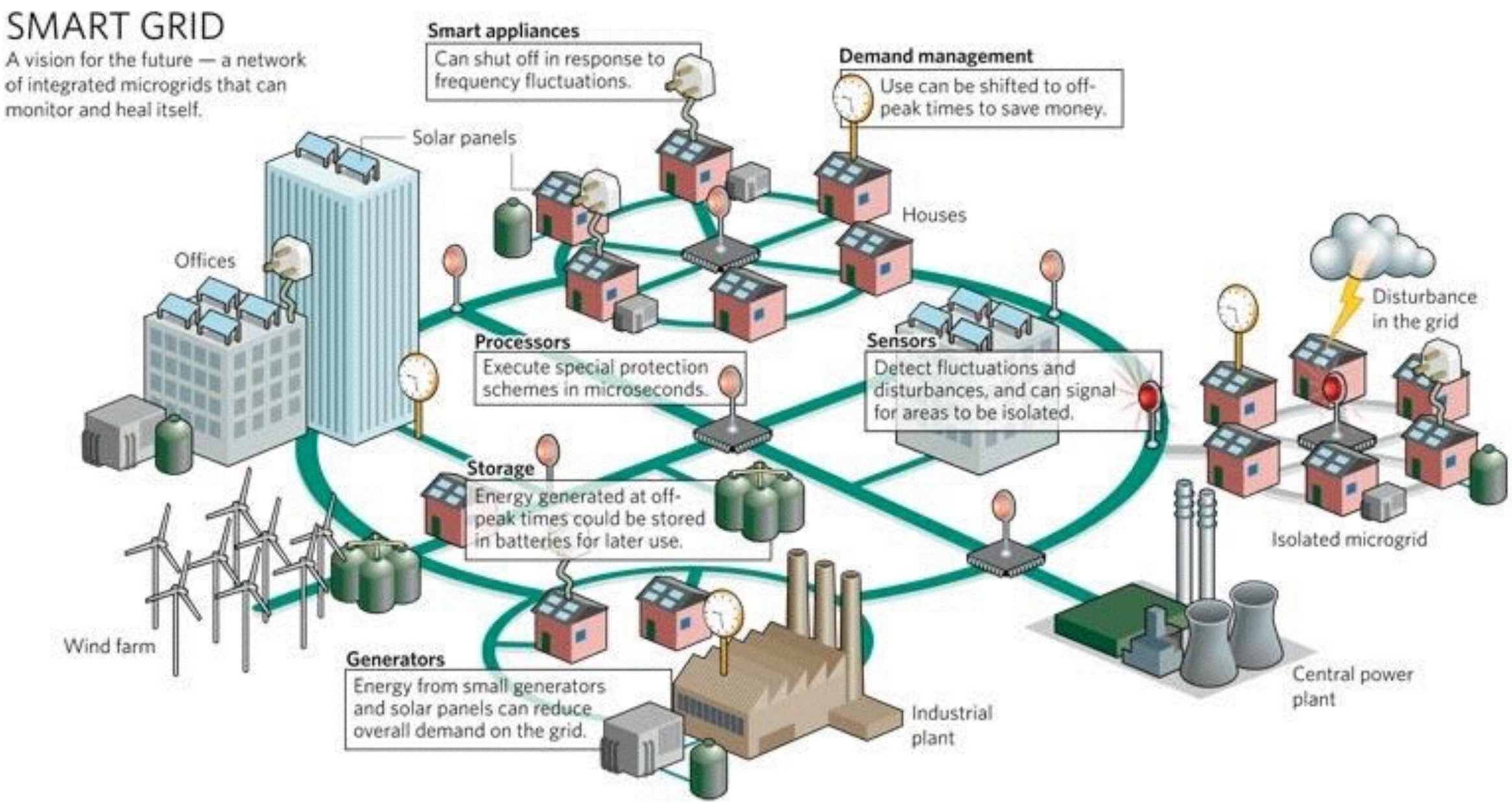


We can find many ways to reduce electricity loads





Smart Grid technology will play an important role



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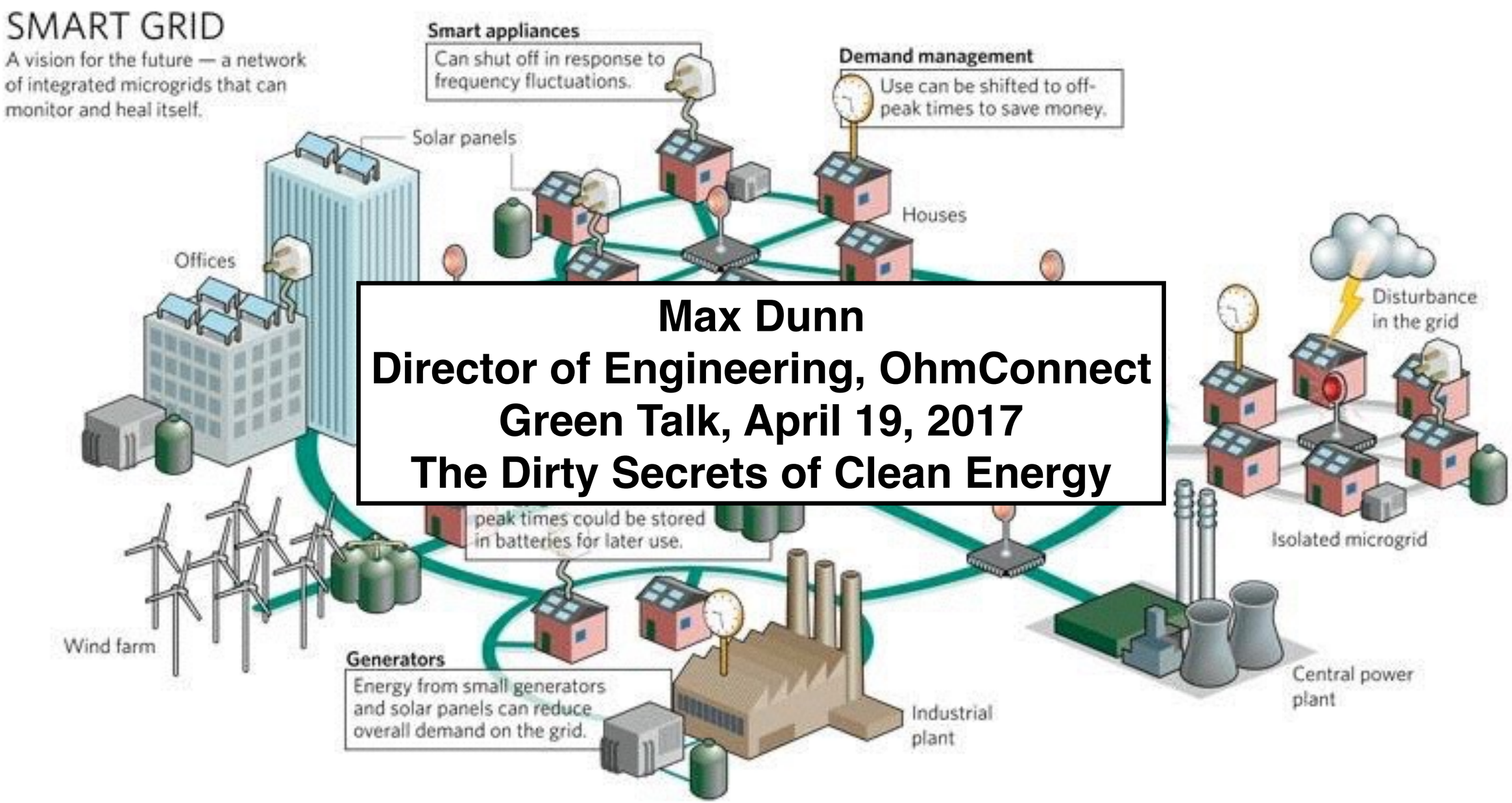


Max Dunn
Director of Engineering, OhmConnect
Green Talk, April 19, 2017
The Dirty Secrets of Clean Energy

Solar Mobility

There’s something, though, that many renewable energy advocates haven’t figured out how to fix

TAXI
TAXI

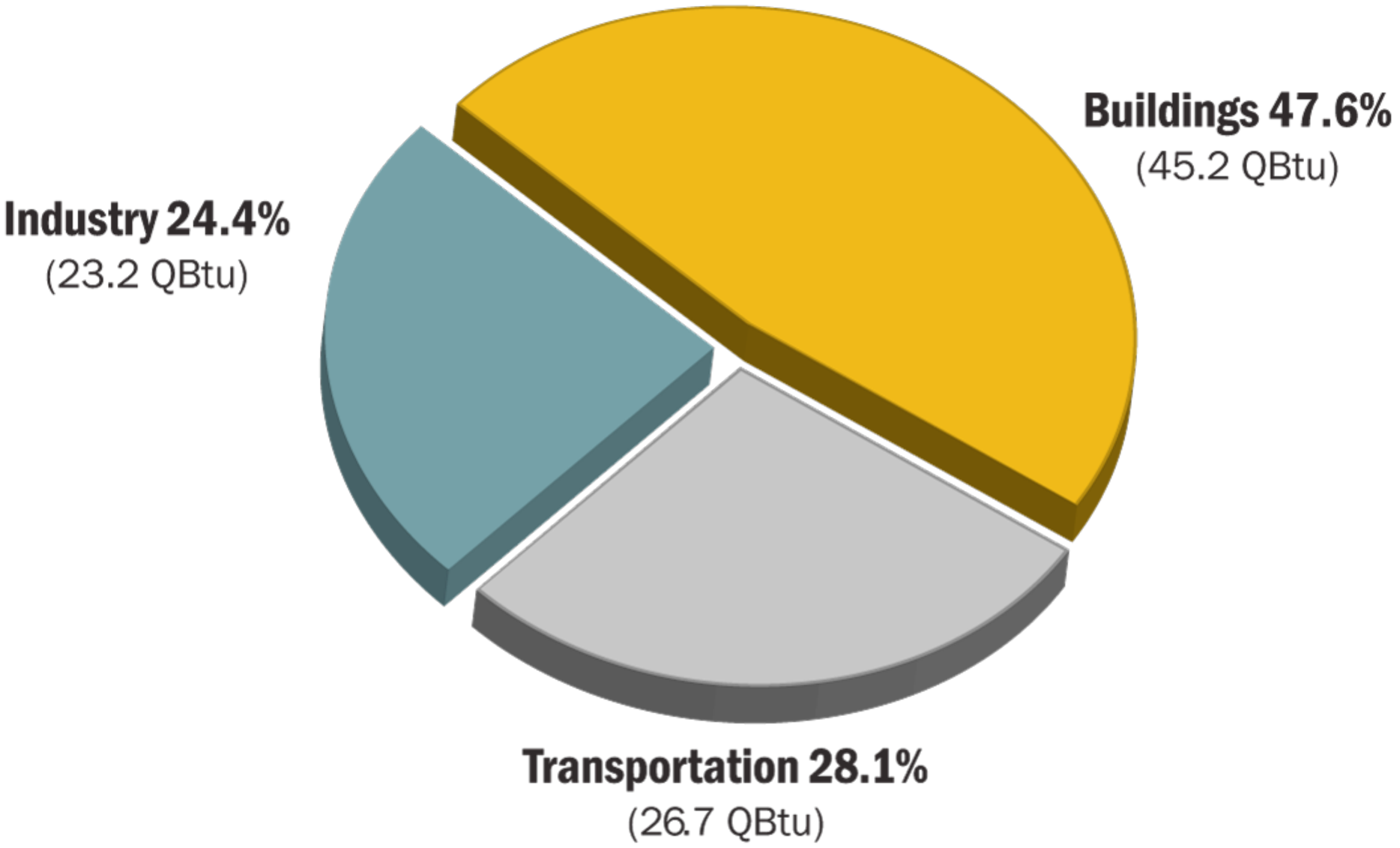
TAXI
TAXI

There’s something, though, that many renewable energy advocates haven’t figured out how to fix

VARIETY

VARIETY

Transport consumes a third of commercial energy



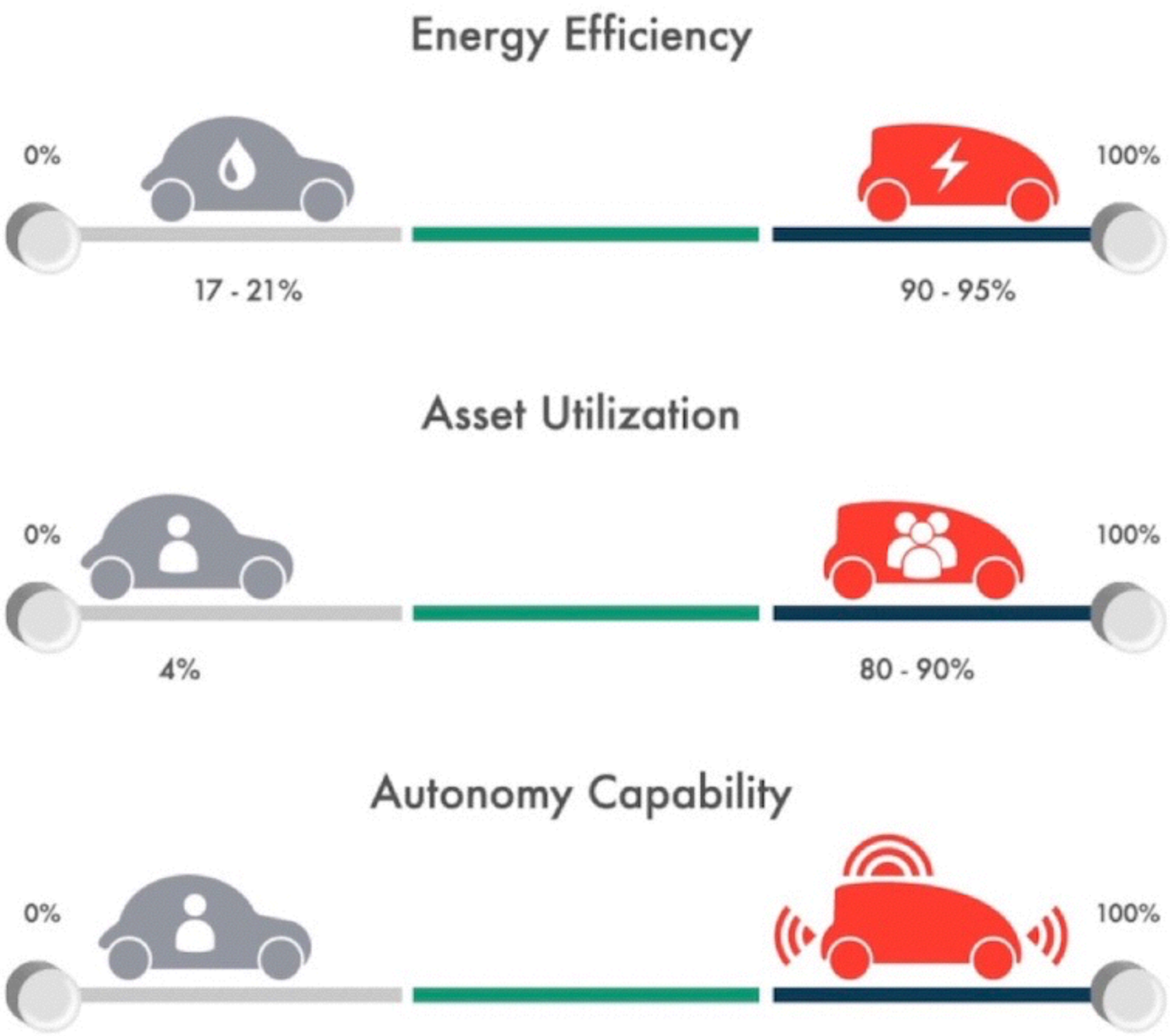
U.S. Energy Consumption by Sector

Automation fascination is taking the nation

Automation fascination is taking the nation

Automation fascination is taking the nation

Many applaud electric and autonomous vehicles



©Tony Seba

But what happens when we flip the tables on them?

But what happens when we flip the tables on them?

But what happens when we flip the tables on them?

(ooops…)

But what happens when we flip the tables on them?

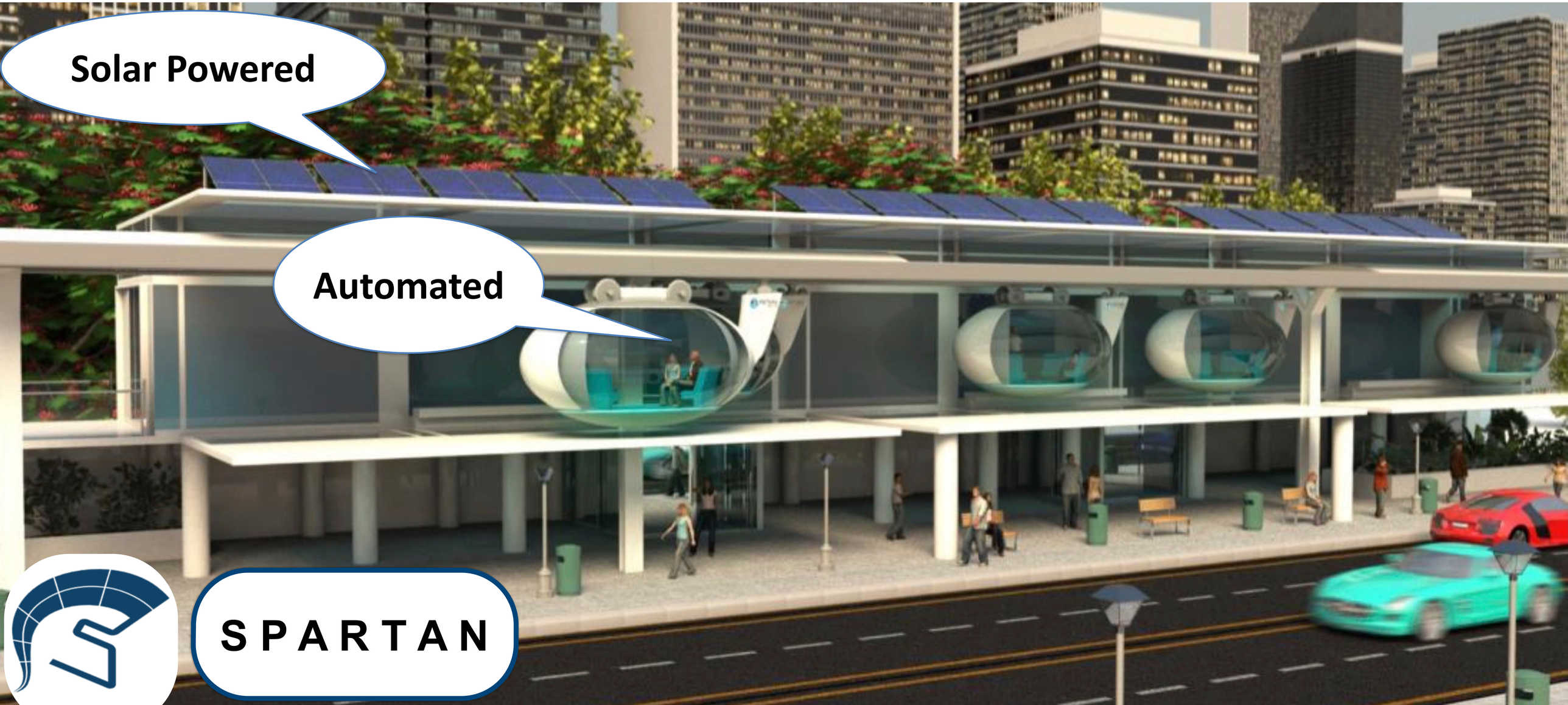
ahh, that’s better!

We make room for people, pets, pedals, and petals!

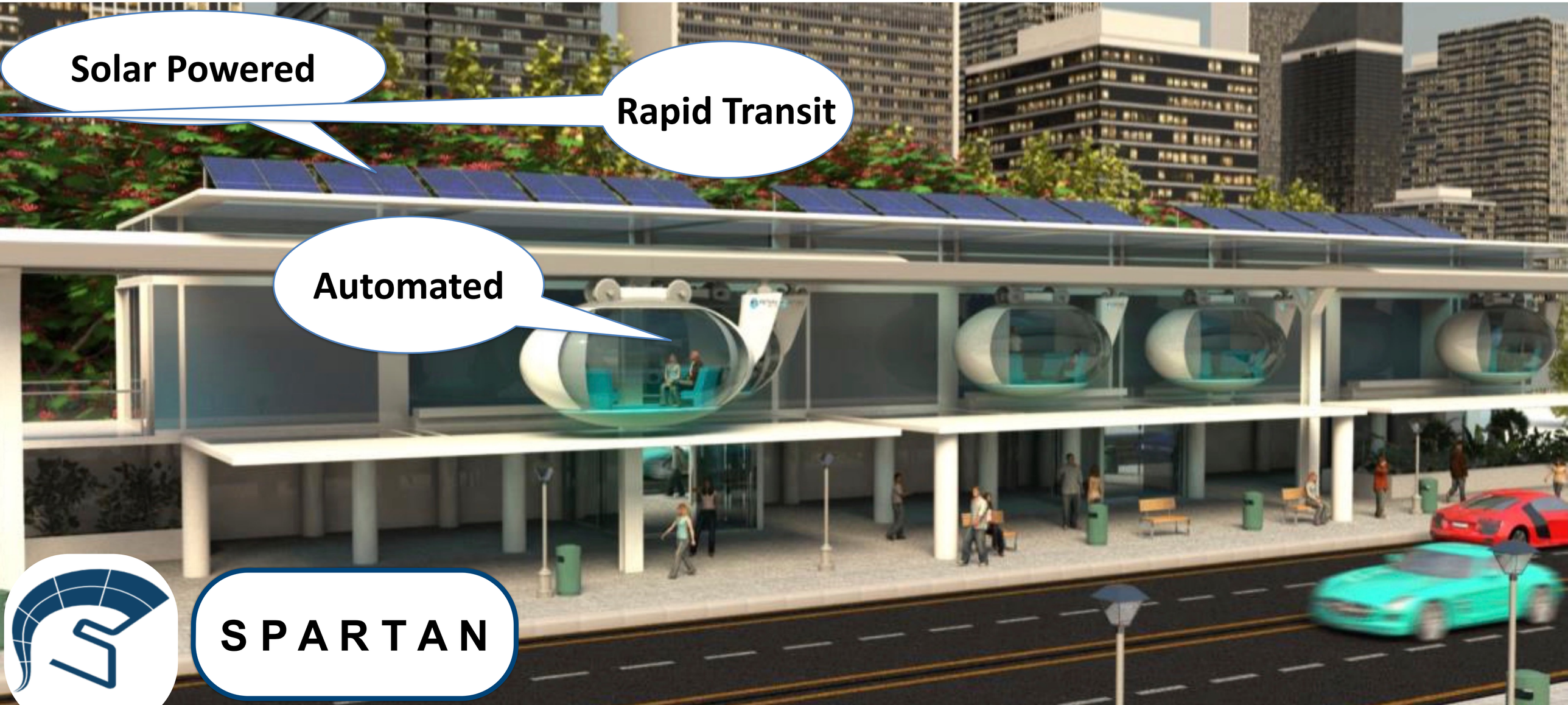
SPARTAN engineers are designing Solar Powered Automated Rapid Transit Ascendant Networks

SPARTAN engineers are designing Solar Powered Automated Rapid Transit Ascendant Networks

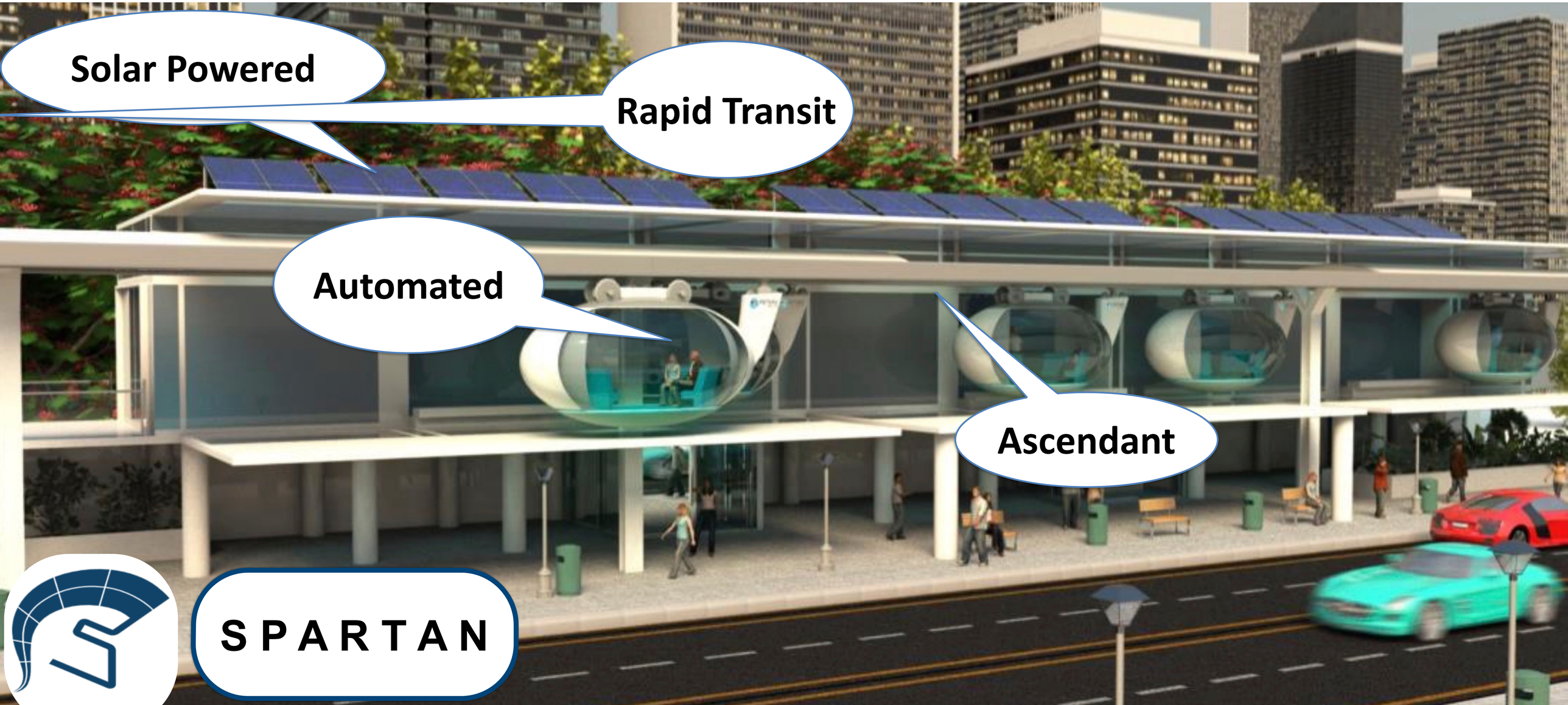
SPARTAN engineers are designing Solar Powered Automated Rapid Transit Ascendant Networks



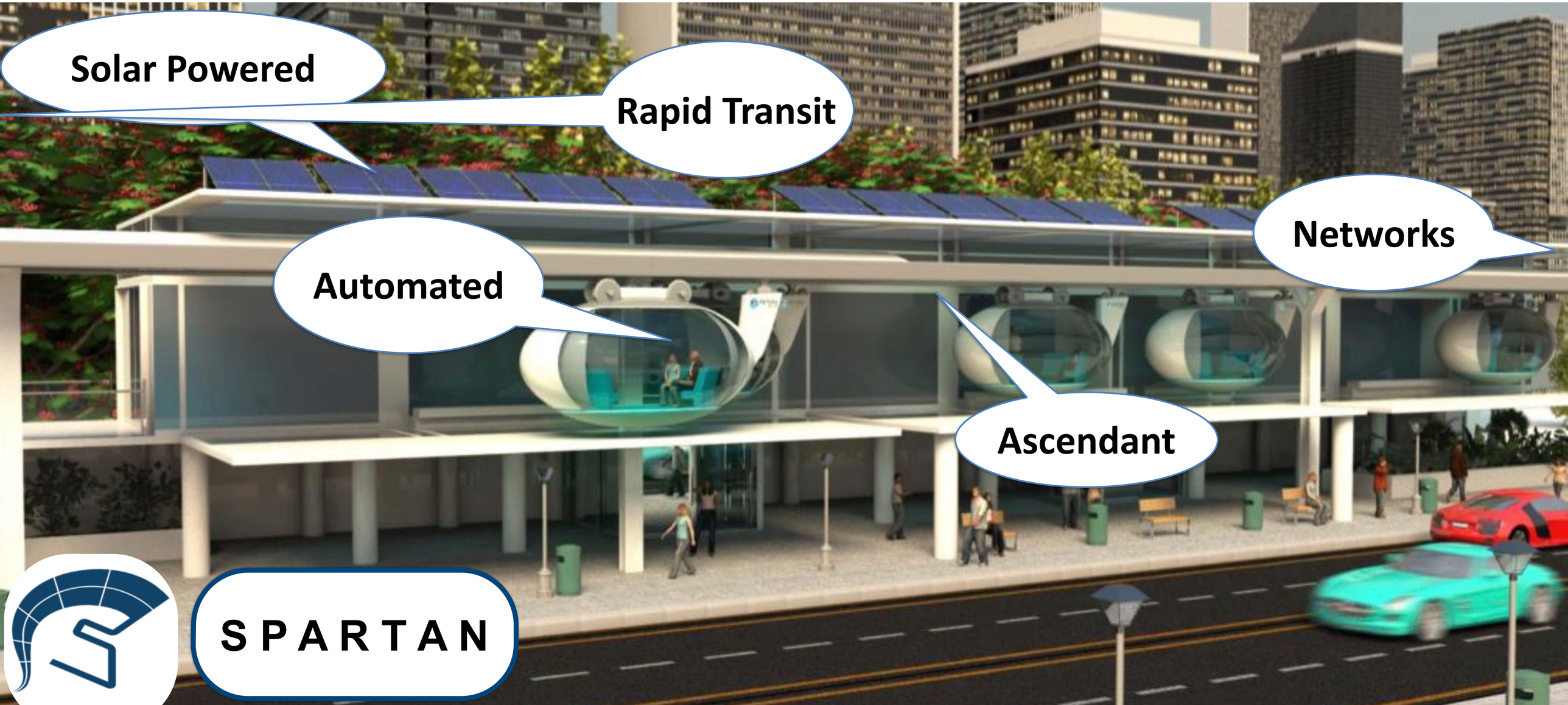
SPARTAN engineers are designing Solar Powered Automated Rapid Transit Ascendant Networks



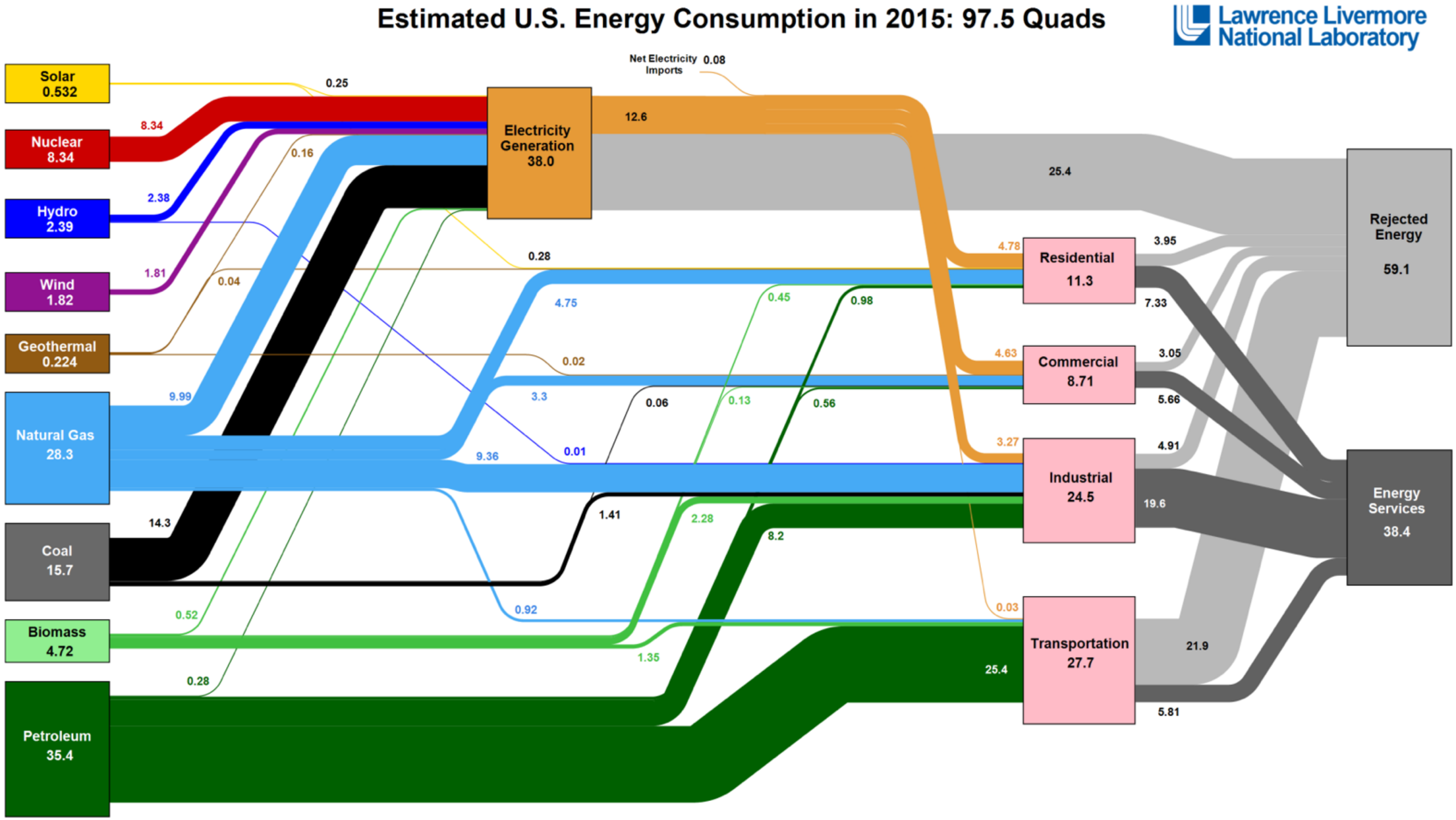
SPARTAN engineers are designing Solar Powered Automated Rapid Transit Ascendant Networks



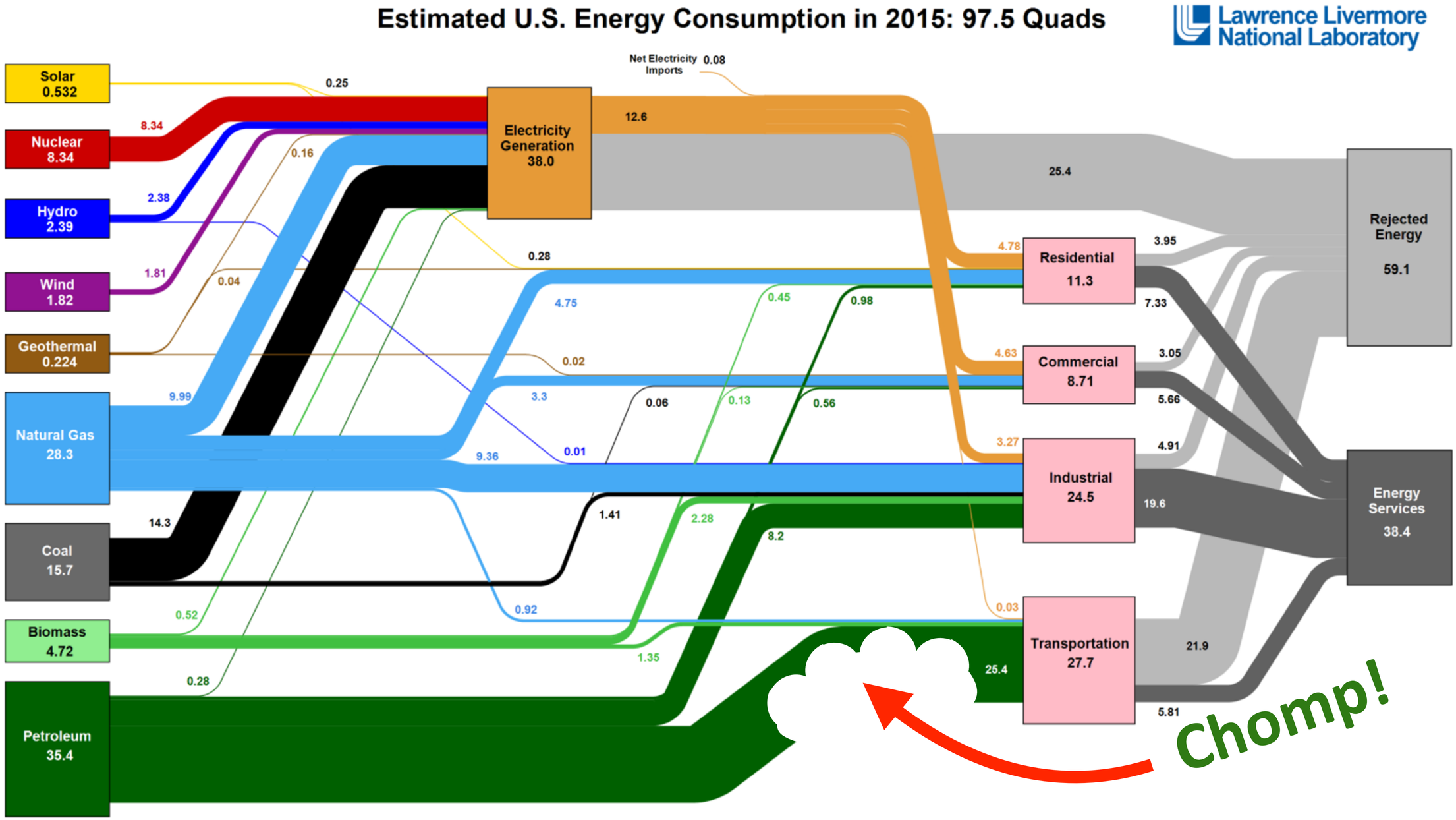
SPARTAN engineers are designing Solar Powered Automated Rapid Transit Ascendant Networks



S.P.A.R.T.A.N. will impact urban mobility globally

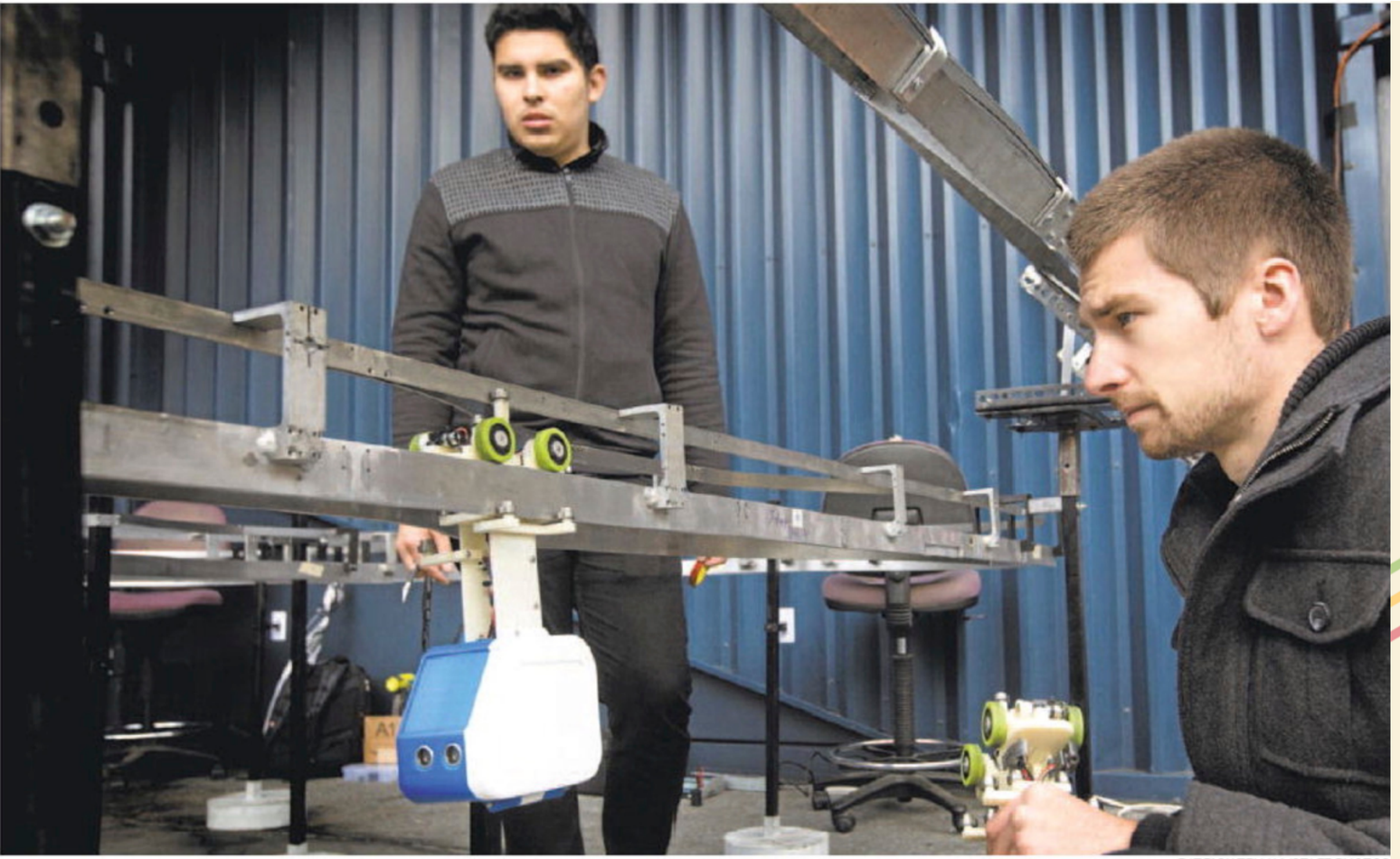


S.P.A.R.T.A.N. will impact urban mobility globally



The Spartan Superway is in the news

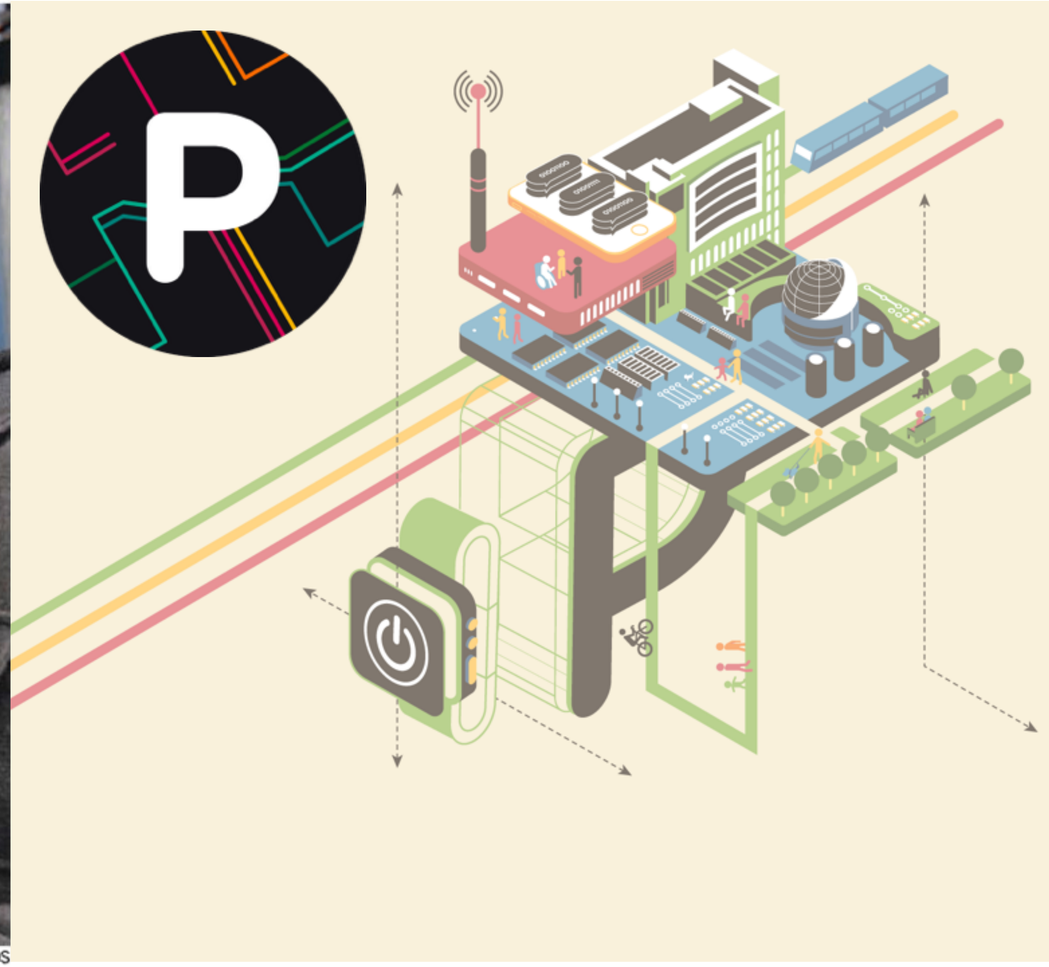
Prototyping a better tomorrow for San Jose



PATRICK TEHAN/STAFF PHOTOS

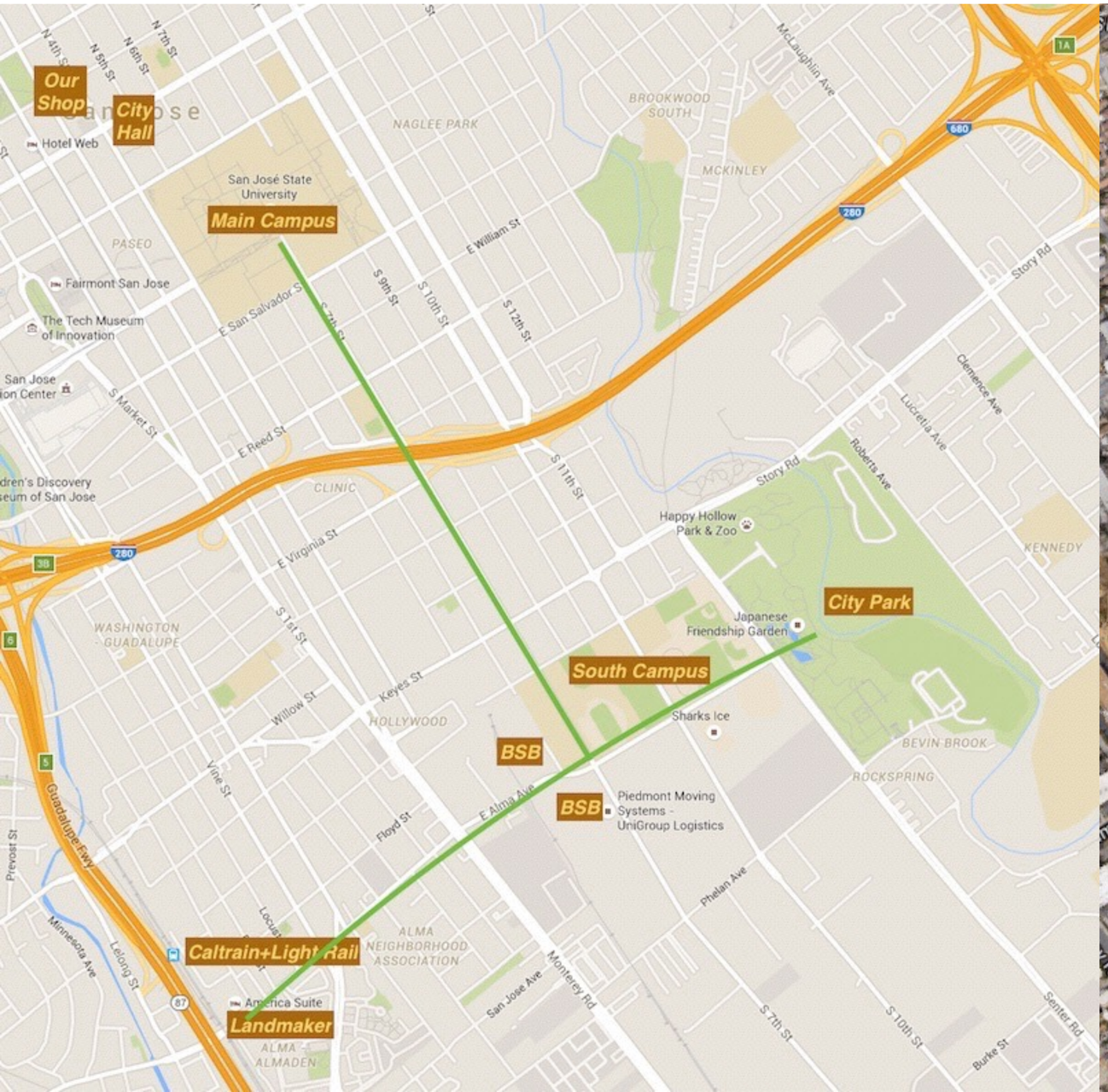
San Jose State seniors Luis Escamilla, left, and Chris Hansen, watch their project, the Spartan Superway, which would shuttle passengers between campus and Spartan Stadium. It was one of the many projects presented at the Paseo Public Prototyping Festival at the Hammer Theatre Center.

San Jose State students show off innovative designs to solve urban problems at festival



The Mercury News

For starters, let’s connect the campuses using solar



It’s a Bird!? It’s a Plane!? It’s Superway!!

It’s a Bird!? It’s a Plane!? It’s Superway!!

We've been developing SPARTAN technology since 2012

We’ve been developing SPARTAN technology since 2012

2012-13

We've been developing SPARTAN technology since 2012

We've been developing SPARTAN technology since 2012

We've been developing SPARTAN technology since 2012

We’ve been developing SPARTAN technology since 2012

2013-14

We've been developing SPARTAN technology since 2012

We've been developing SPARTAN technology since 2012

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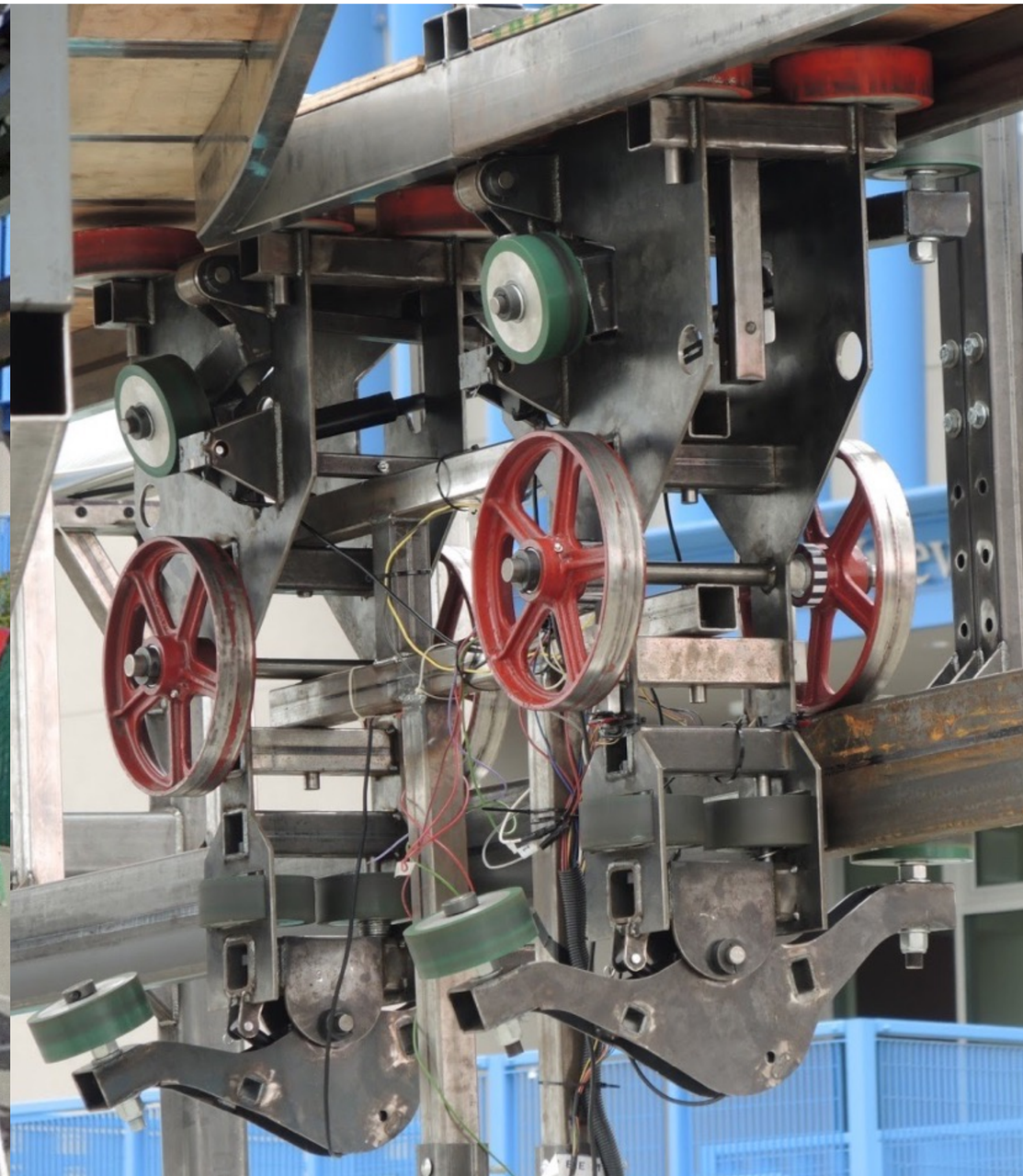

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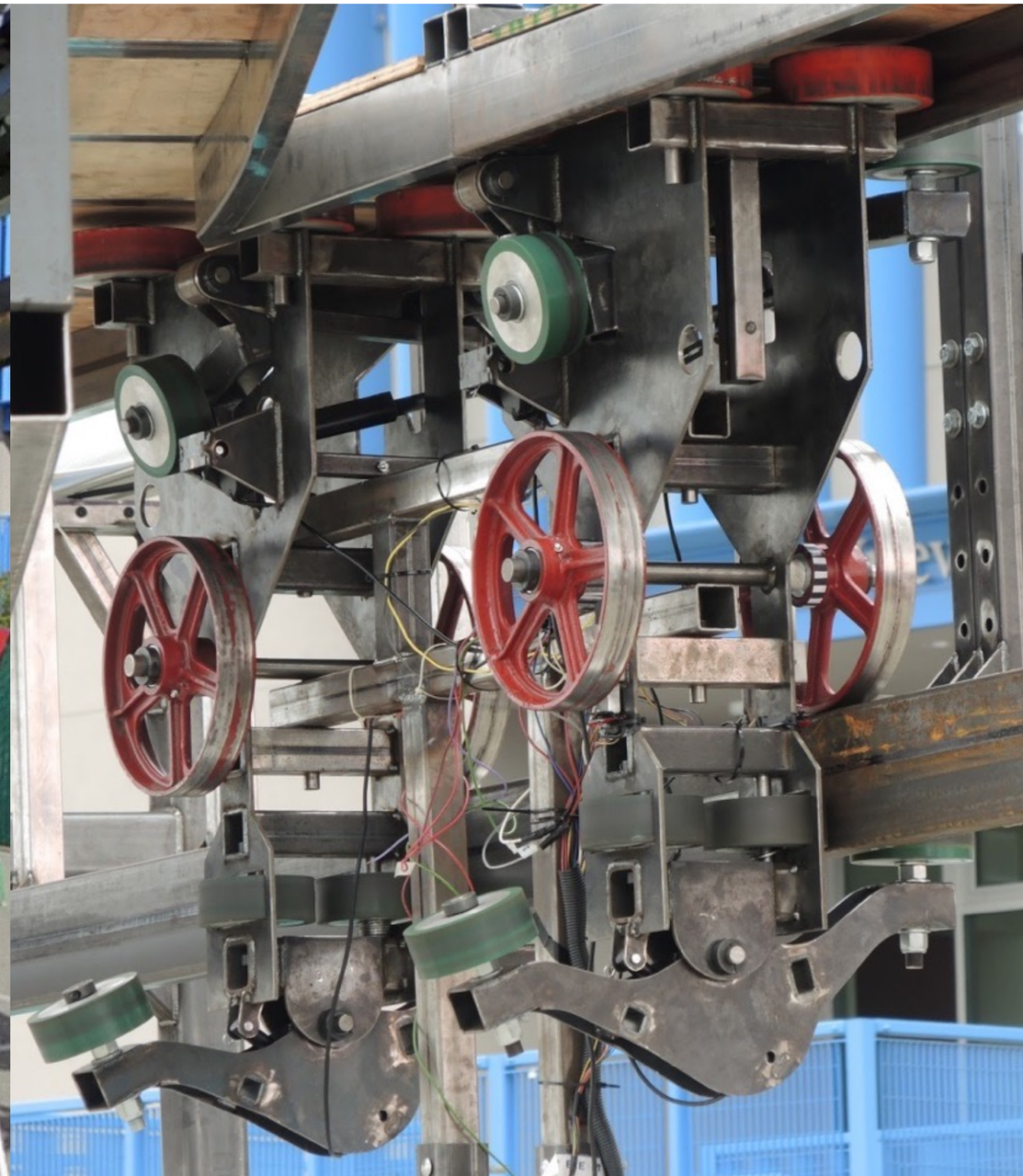

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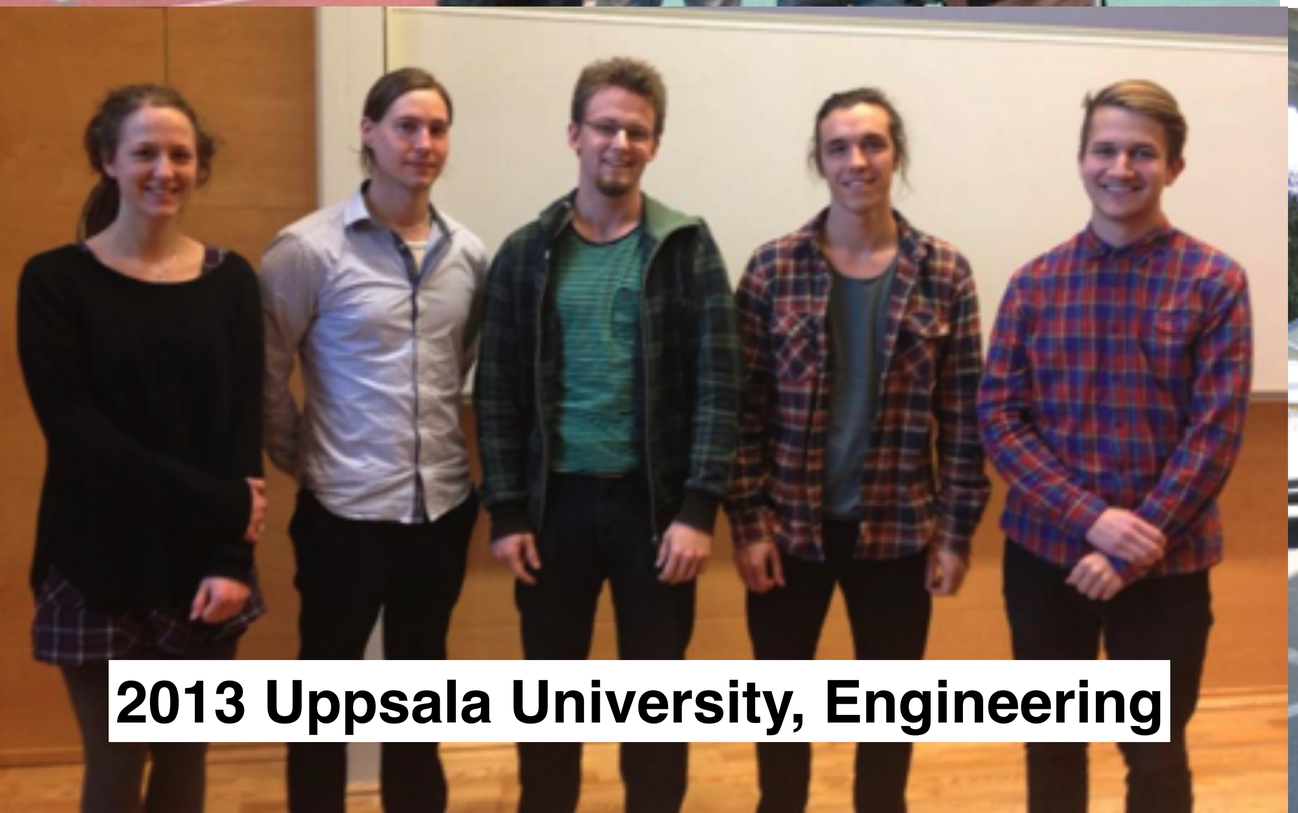
Students from other Universities have participated too

2011 Delft University, Arch & Ind Design

2014 Presidio Grad School of Business



2013 Uppsala University, Engineering

2015 Southern Illinois Univ, Architecture

3 kinds of people

There are three kinds of people in this world

There are three kinds of people in this world

Those who *make* it happen

There are three kinds of people in this world

Those who *make* it happen

Those who *watch* it happen

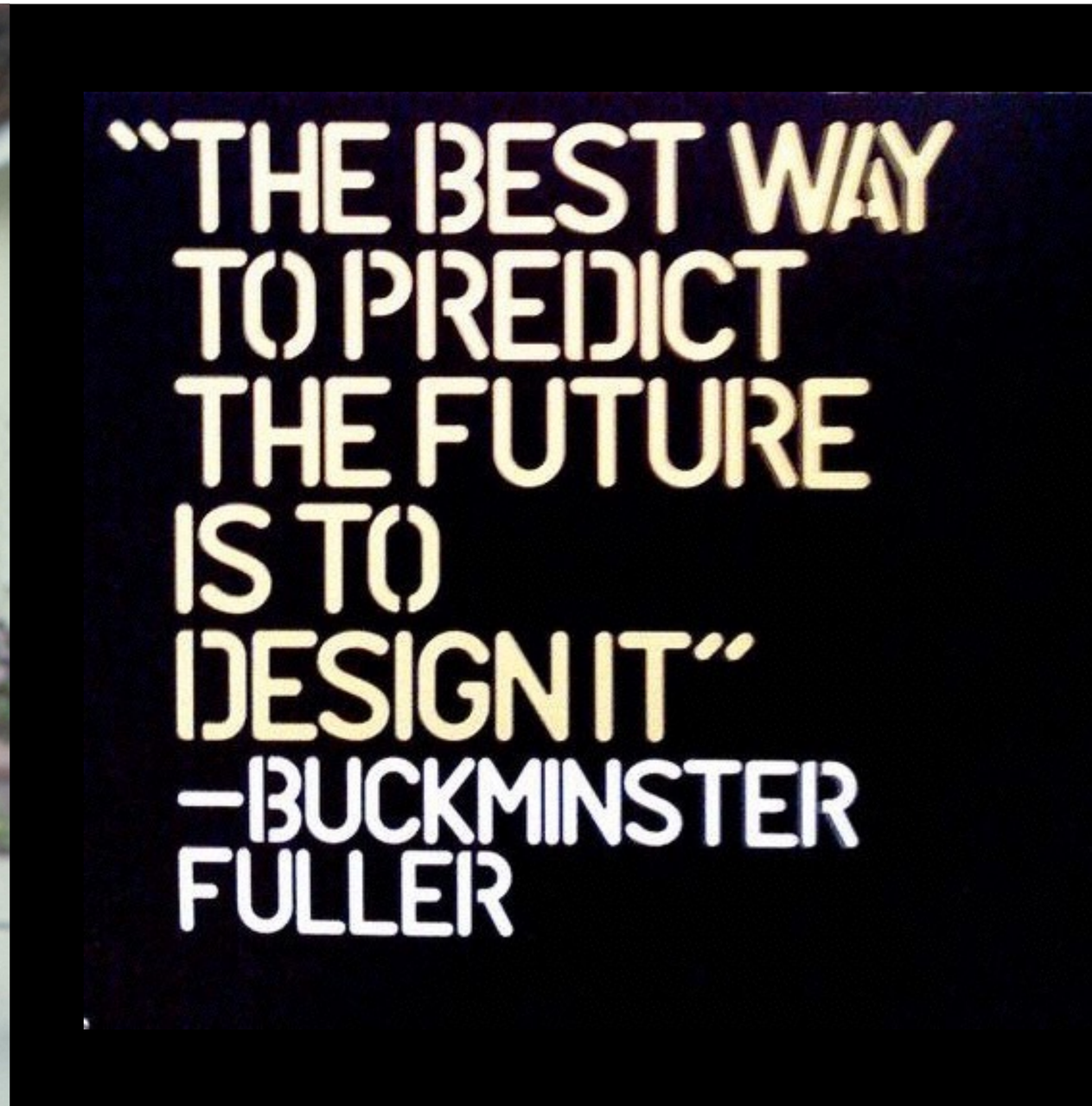
There are three kinds of people in this world

Those who *make* it happen

Those who *watch* it happen

Those who *wonder* what happened

Remember what Bucky said



I’d like you to pair up with the person next to you

I’d like you to pair up with the person next to you

First person:
What obstacles do you see?

I’d like you to pair up with the person next to you

First person:
What obstacles do you see?

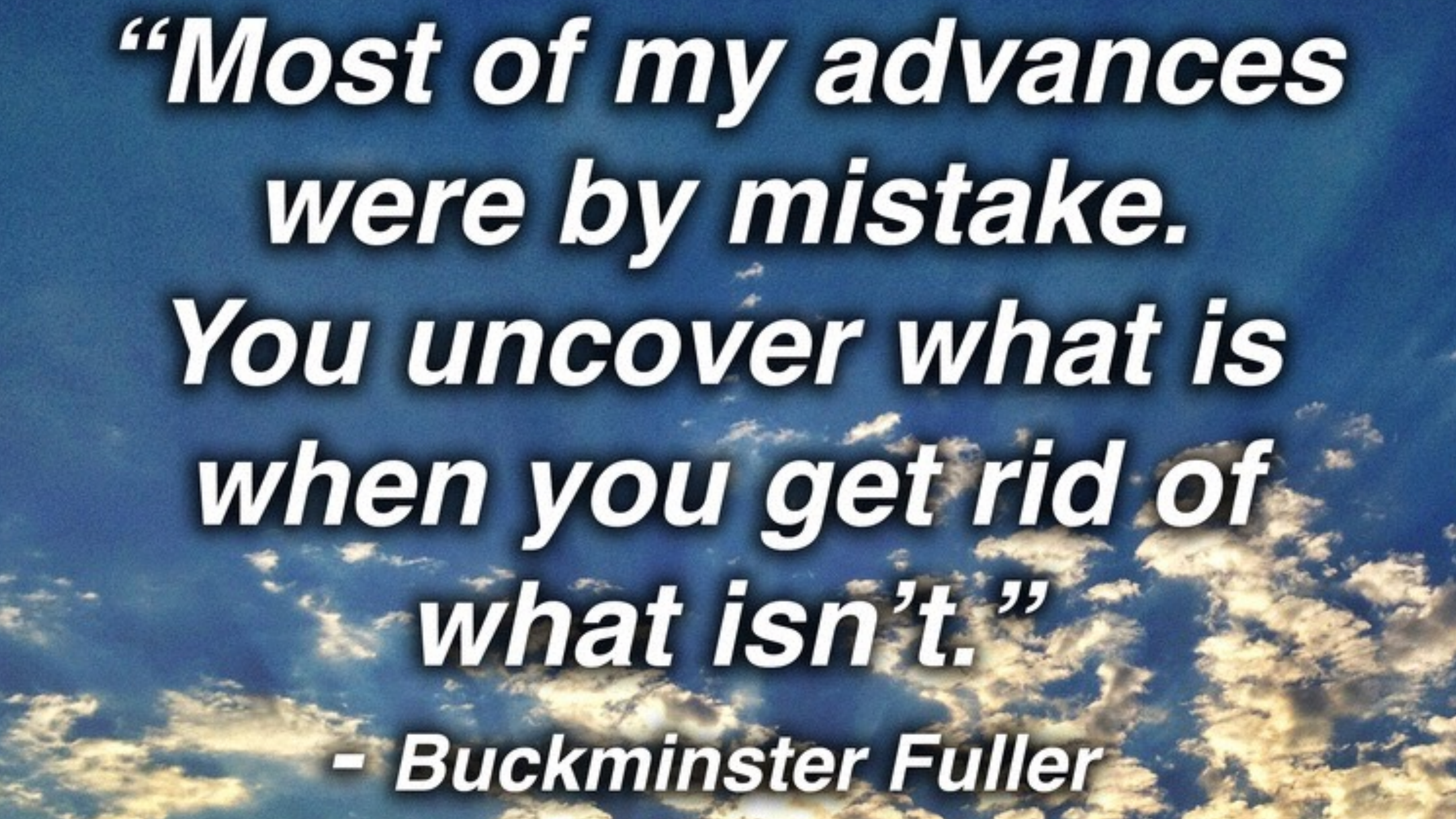
Second person:
Come up with *designs* to overcome those obstacles

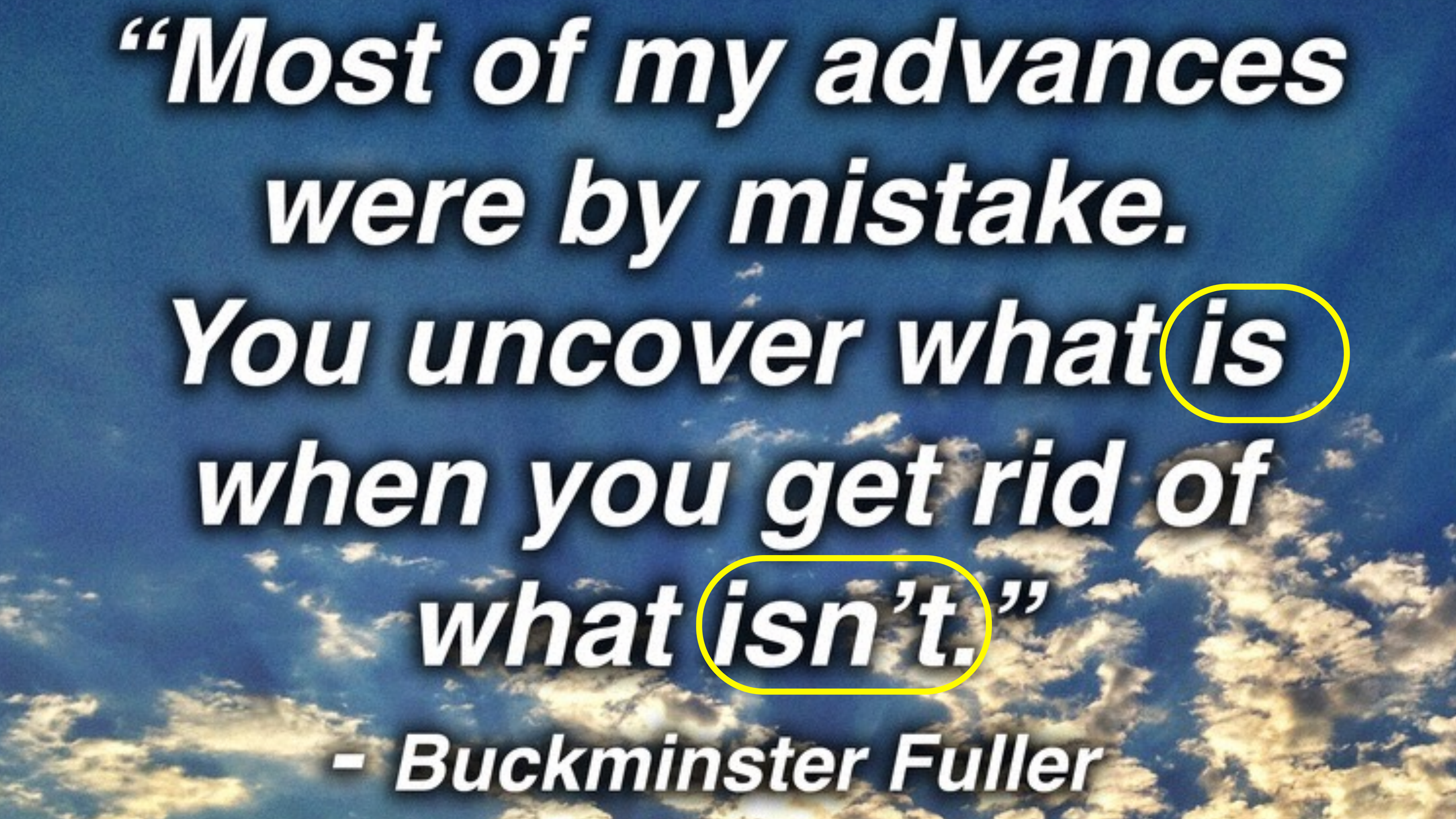
I'd like you to pair up with the person next to you

First person:
What obstacles do you see?

Second person:
Come up with *designs* to overcome those obstacles

Then switch places


"Most of my advances
were by mistake.
You uncover what is
when you get rid of
what isn't."
- Buckminster Fuller


"Most of my advances
were by mistake.
You uncover what is
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- Buckminster Fuller

I’d like several of you to take seats onstage

I’d like several of you to take seats onstage

Tell us how you approached the challenge

I’d like several of you to take seats onstage

Tell us how you approached the challenge

Who might help you the most to get results?

I’d like several of you to take seats onstage

Tell us how you approached the challenge

Who might help you the most to get results?

What kind of organization would work the best?

There are many ways for you to design your future

There are many ways for you to design your future

2017 Urban International Design Contest

There are many ways for you to design your future

2017 Urban International Design Contest

Spartan Superway Summer Internships

There are many ways for you to design your future

2017 Urban International Design Contest

Spartan Superway Summer Internships

Spartan Solar Development Internships

Let’s look at the first of these

2017 Urban International Design Contest

URBAN INTERNATIONAL DESIGN CONTEST

Best practices for Automated Public Transit

The rapid development of autonomous vehicles for private and public transportation creates a completely new playground for urban development.

The UIDC series of workshops will combine the know-how and creativity of academics and students, city planners, transportation specialists, and developers to create and propose new urban designs, incorporating the new possibilities that can be achieved with elevated and road-based autonomous vehicles.

The Urban International Design Contest will culminate at Podcar City 11 in Las Vegas / November

Winter & Spring 2017	*Build your local team*
Summer 2017	*Design internships in Silicon Valley*
September & October 2017	*Local design workshops (charrettes)*
November 2017	*Compete at Podcar City 11*

Join the Spartan Superway Summer Internship Program, June–July 2017 in Silicon Valley

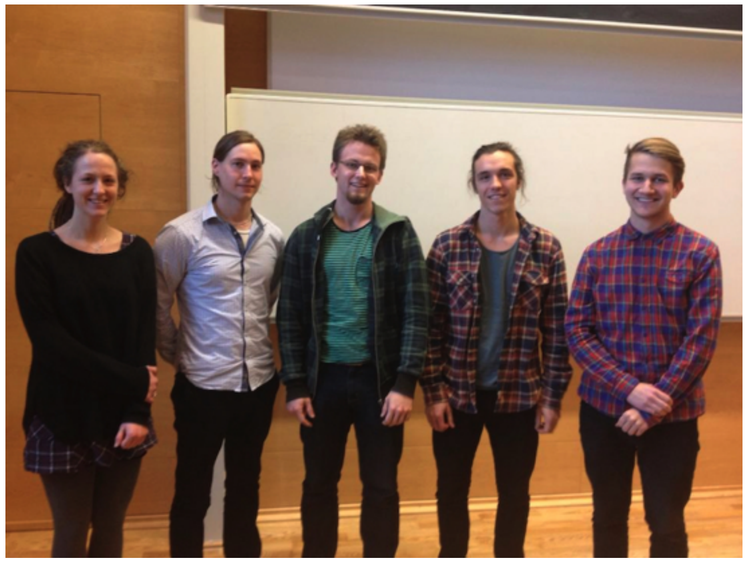
Join the Spartan Superway Summer Internship Program, June–July 2017 in Silicon Valley

Spartan Superway Summer Internships

Join the Spartan Superway Summer Internship Program, June–July 2017 in Silicon Valley

Interns from Sweden have participated

UPPSALA UNIVERSITET



LINKÖPING UNIVERSITY

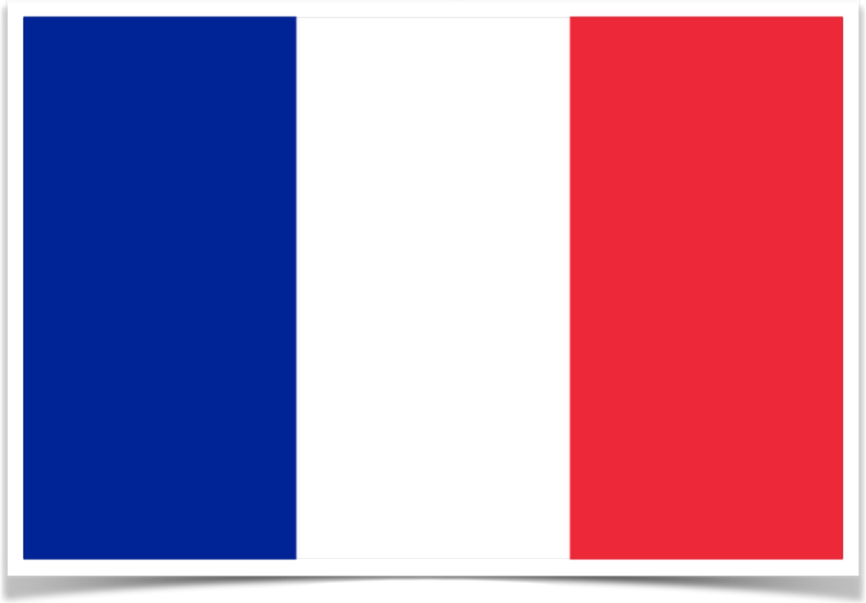
Interns from South Korea have participated

PUSAN NATIONAL UNIVERSITY SINCE 1946

부산대학교

PUSAN NATIONAL UNIVERSITY

Interns from France have participated



EML
EXECUTIVE DEVELOPMENT

l'X
ÉCOLE
POLYTECHNIQUE
UNIVERSITÉ PARIS-SACLAY

INSA
LYON

inGHenia
CAMPUS ALTERNANCE
MINES Douai

Interns from Brazil have participated

UFMS

SAPIENTIA ÆDIFICAT

UFG UNIVERSIDADE FEDERAL DE GOIÁS

UDESC UNIVERSIDADE DO ESTADO DE SANTA CATARINA

CEFET/RJ

UNISC UNIVERSIDADE DE SANTA CRUZ DO SUL

unesp

UNICAMP

UFMG

FLUENDO CRESCIT

Universidade Federal de Sergipe

SCIENTIA AD SAPIENTIAM

UNIVERSIDADE FEDERAL DE ALAGOAS

UNIVERSIDADE FEDERAL DO AMAZONAS

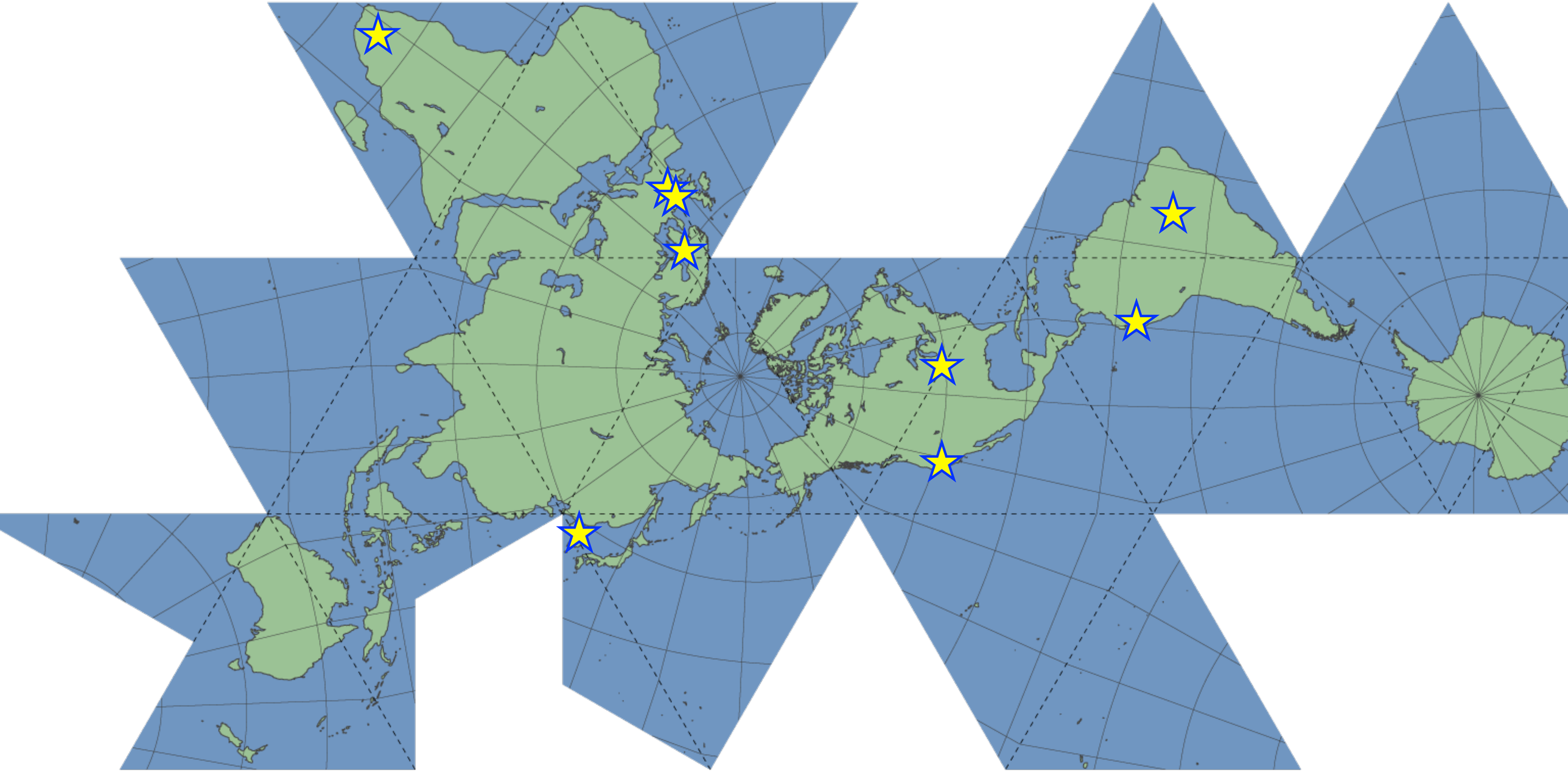
IN UNIVERSA SCIENTIA VERITAS

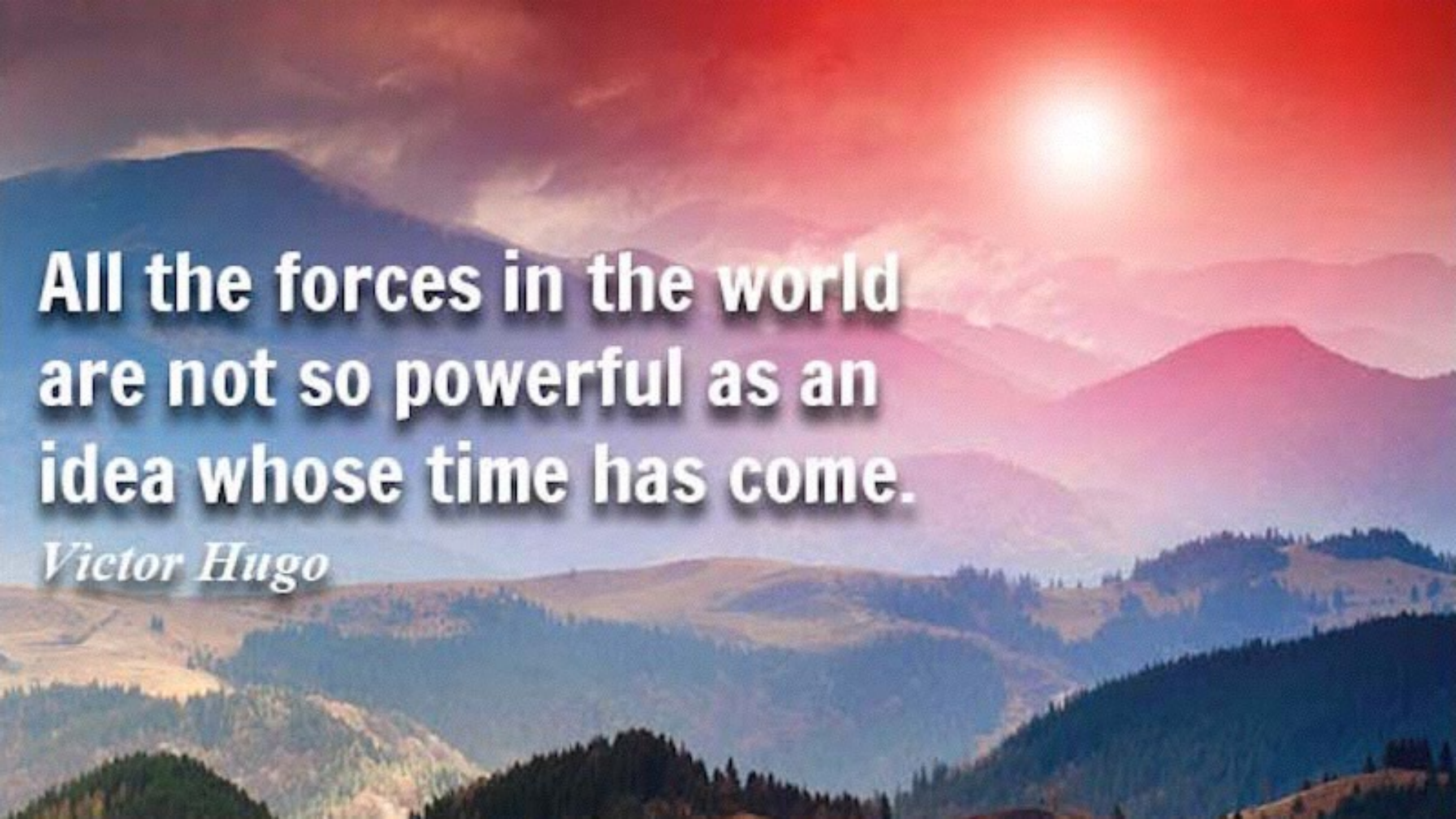
UEFS UNIVERSIDADE ESTADUAL DE FEIRA DE SANTANA

UDESC Universidade do Estado de Santa Catarina

ITA

The Solar Skyways Network is growing



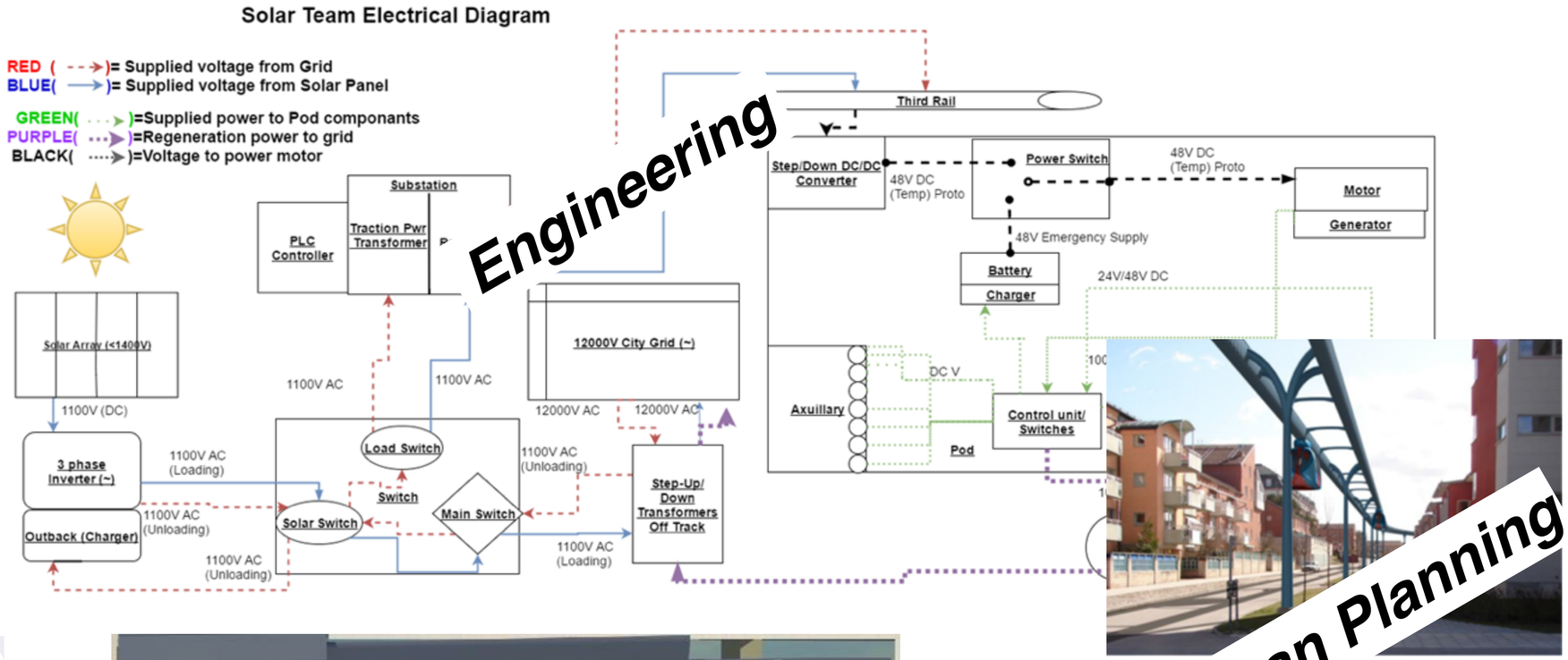

All the forces in the world
are not so powerful as an
idea whose time has come.
Victor Hugo

Spartan Solar is an idea whose time has come

Spartan Solar Development Internships

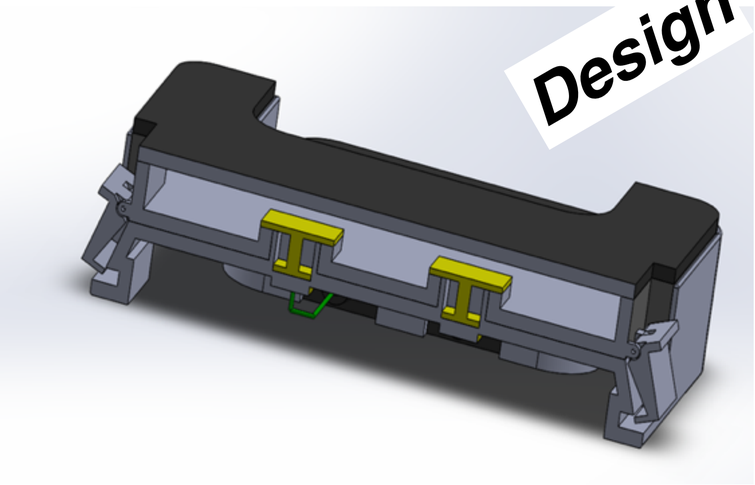
Spartan Solar is an idea whose time has come

Spartan Solar Development Internships



Engineering

Urban Planning



Design

Architecture

This will be a multidisciplinary initiative

Let’s get started!

Do what needs to be done …

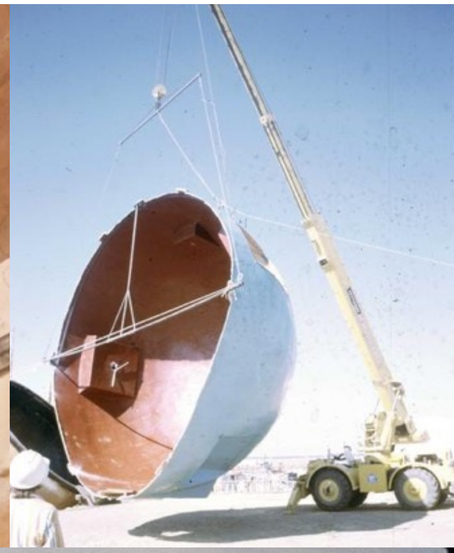
Do what needs to be done …

… and check to see if it was impossible only after you are done.

Paul Hawken

This is not my first rodeo

1972 Students at UC Davis built their own homes

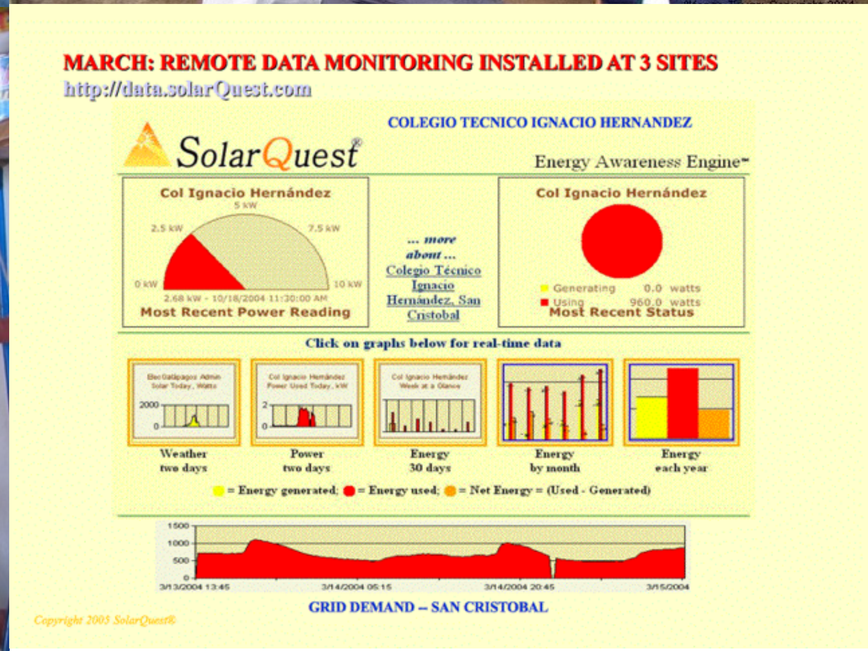


1972 Students at UC Davis built their own homes

1992 Students at UNAM built a solar race car

2000 Villagers in Bolivia installed solar and internet

2003-2011 Galapagos students did energy projects



More…

For more information, go to www.solarskyways.net

Solar Skyways Network

Bringing makers together from around the world to create solar transportation networks

Home | Podcar City | Universities | Spartan Superway | Podcar | INIST | Library

Friday, November 4, 2016

Announcing 2017 Spartan Superway Summer Workshop

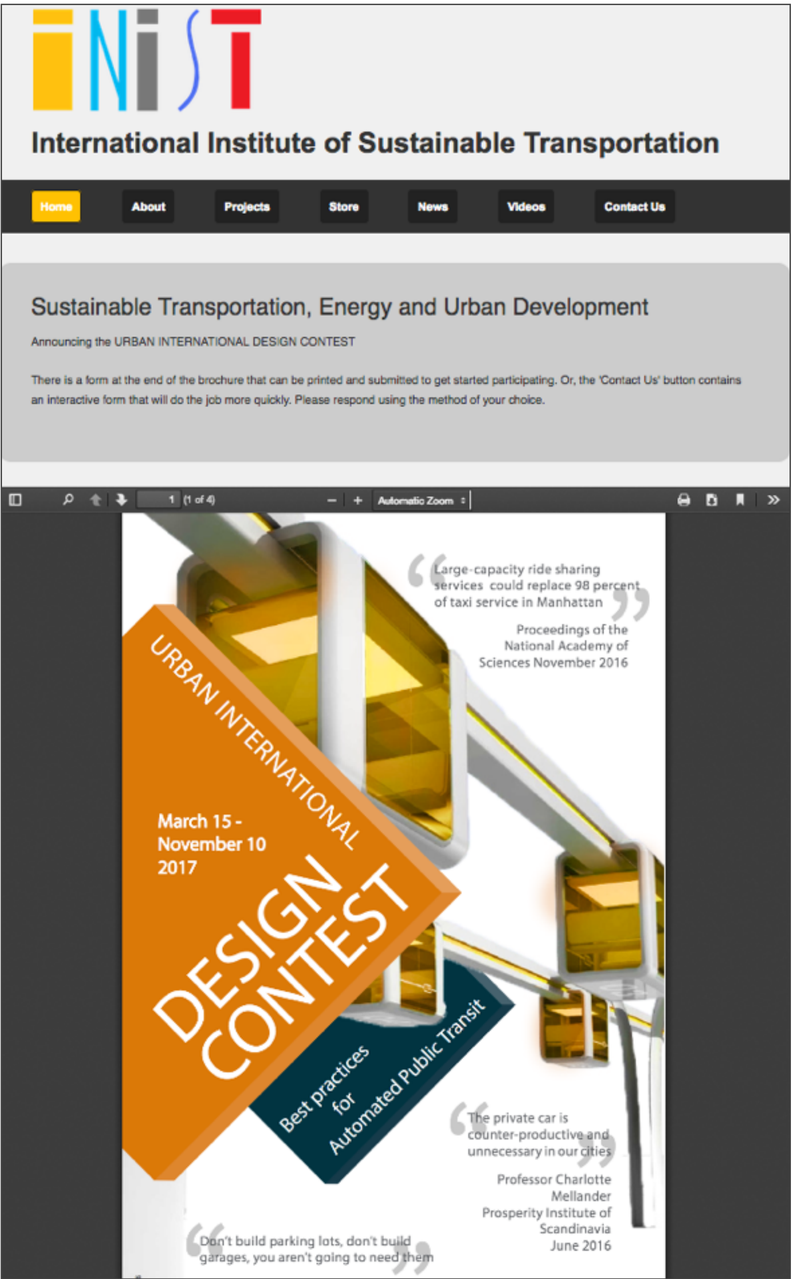
The Solar Skyways Network is now reaching out to students from universities around the world to join us for the summer months of June and July (2017) as interns at the Spartan Superway Design Center in Silicon Valley. There you will collaborate with your peers from several countries to continue the multidisciplinary development of elevated solar powered public transit under the guidance of professors, mentors from industry, and guest experts. You will work in a well-equipped shop and will have support to obtain software and materials from a wide range of well-stocked suppliers and proficient specialty fabricators in Silicon Valley.

Upcoming Events

- 2016-11-17 USDOT T3e Webinar featuring Spartan Superway
- 2017-04-08 Paseo Public Prototyping Challenge and Festival
- 2017-05-18 Maker Faire

Solar Skyways

For more information, go to www.inist.org



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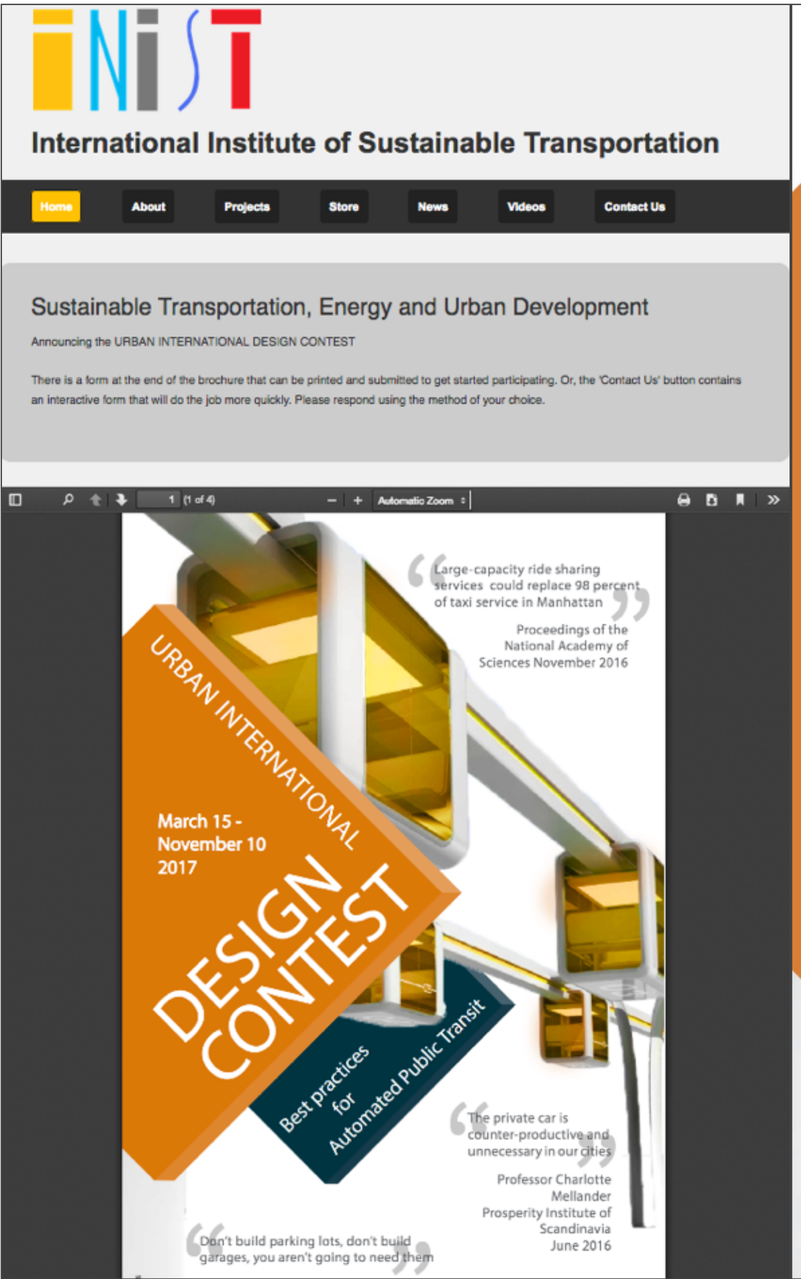

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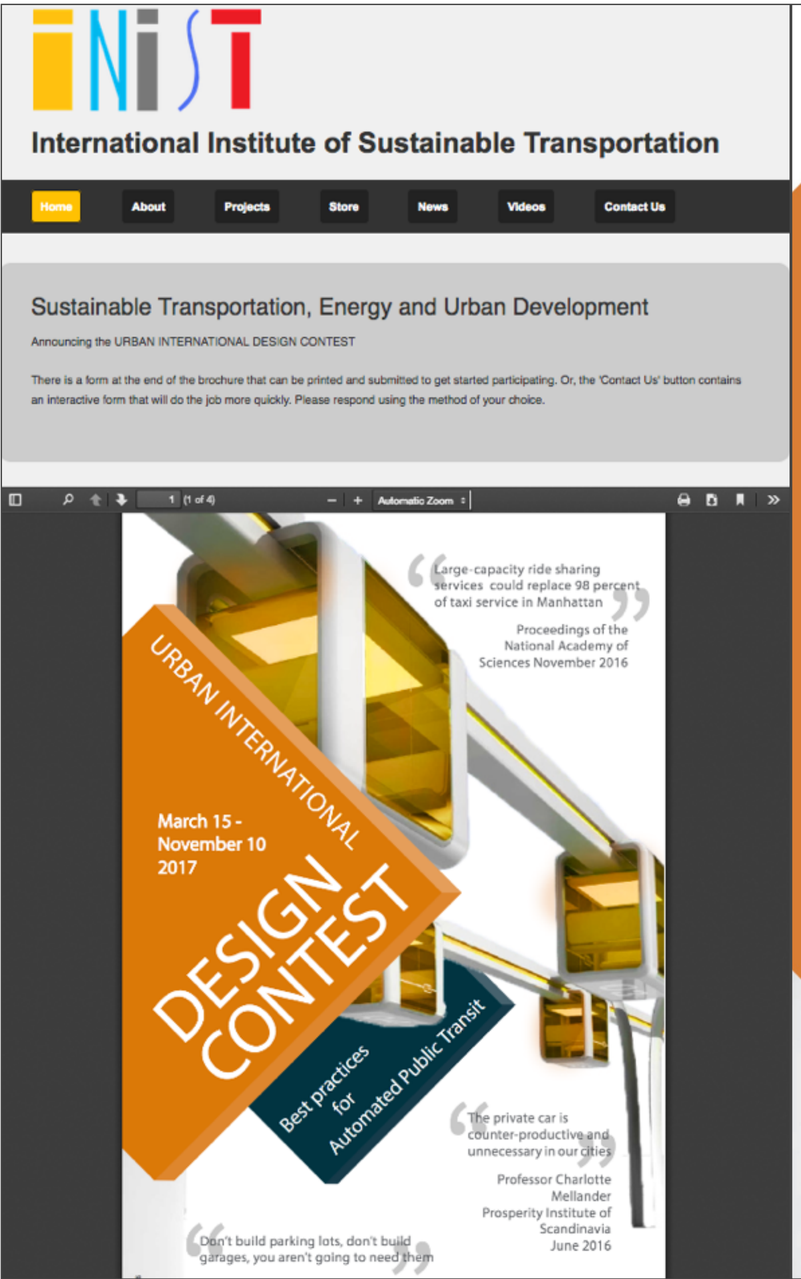

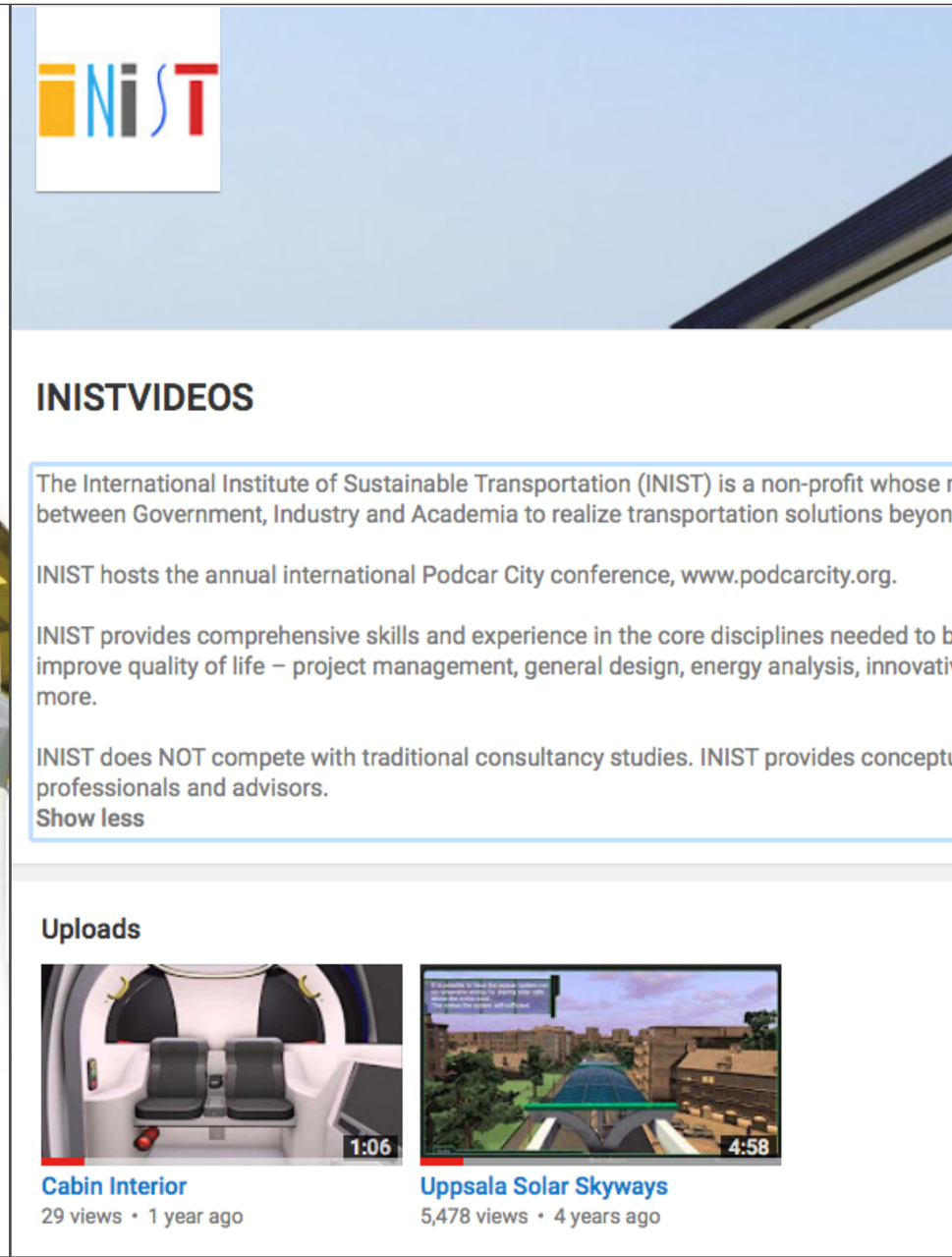

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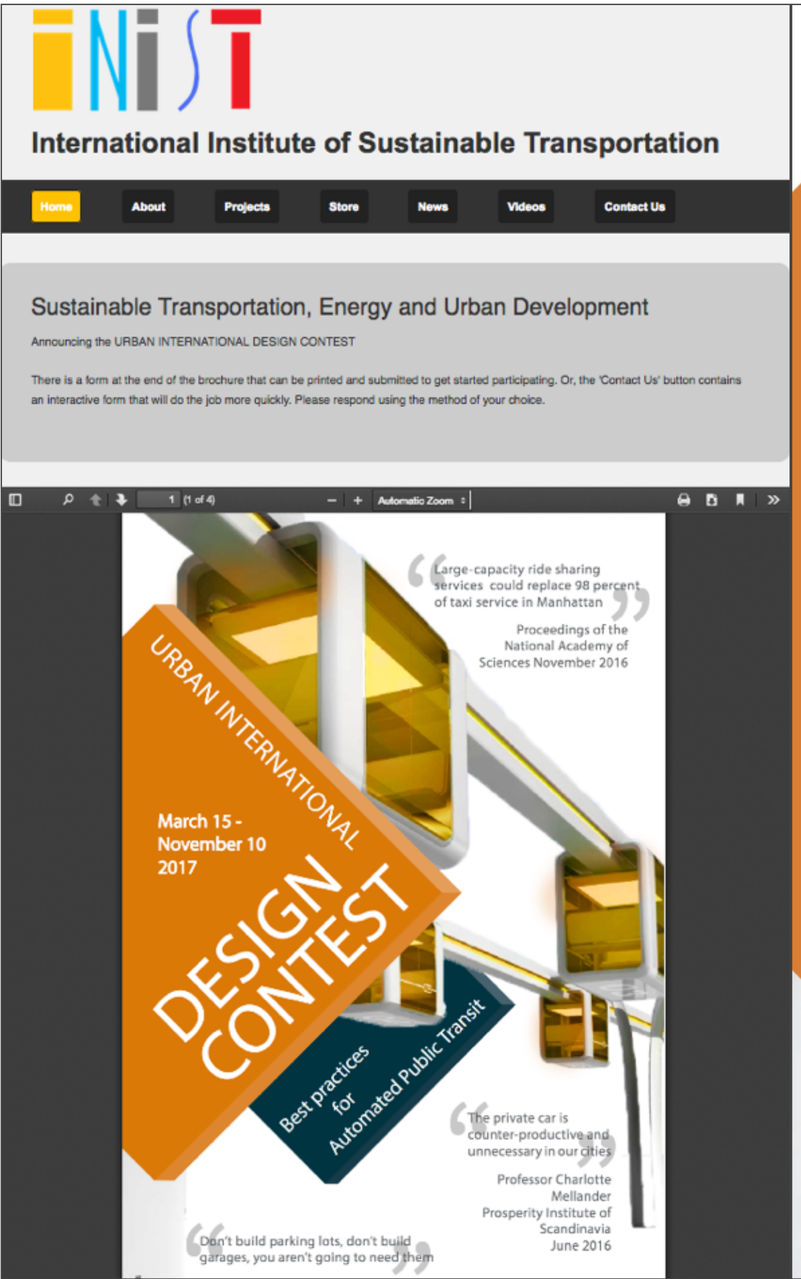

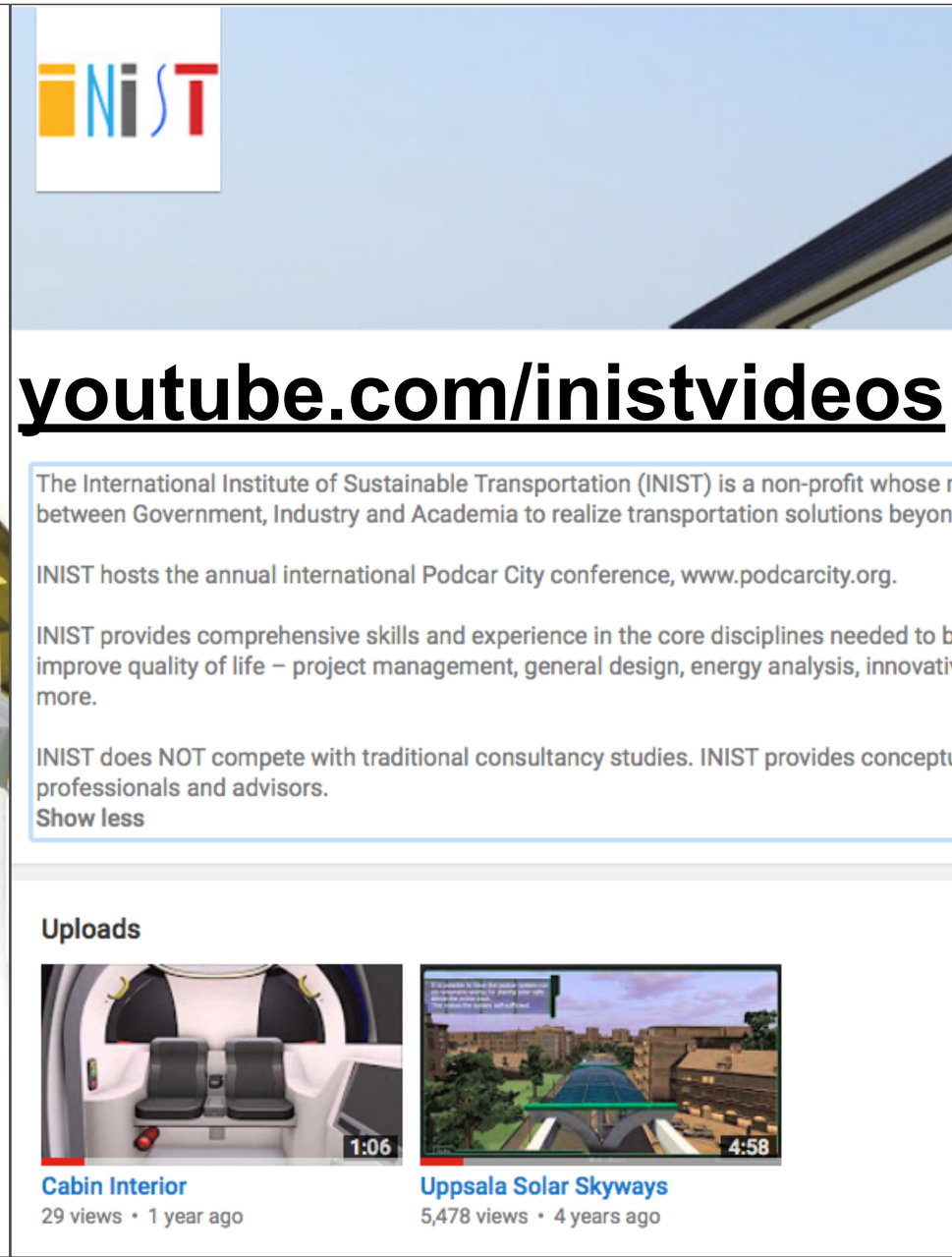

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2016-05-04.Swenson.Reflections on the Solarevolution.doc	27 KB	06.05.16 16:06:35
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2016-05-25.Alvarez (ed).Spartan Superway Spring 2016 Report.SJSU ME 195B.pdf	18.16 MB	23.06.16 22:41:39
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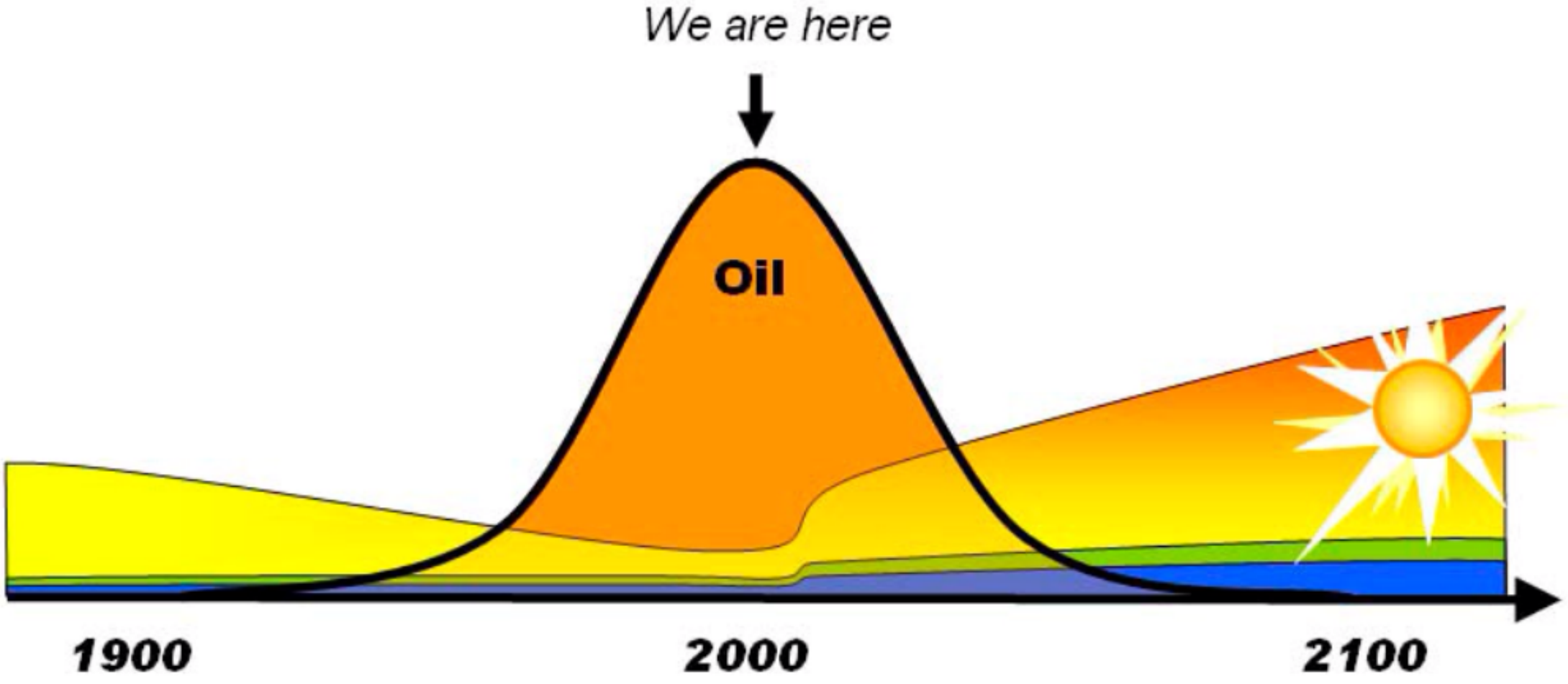
You only fail if you stop.

Wake up!!!



...to the power of Solar

Solar + Storage

DeGrussa Mine offers an important lesson

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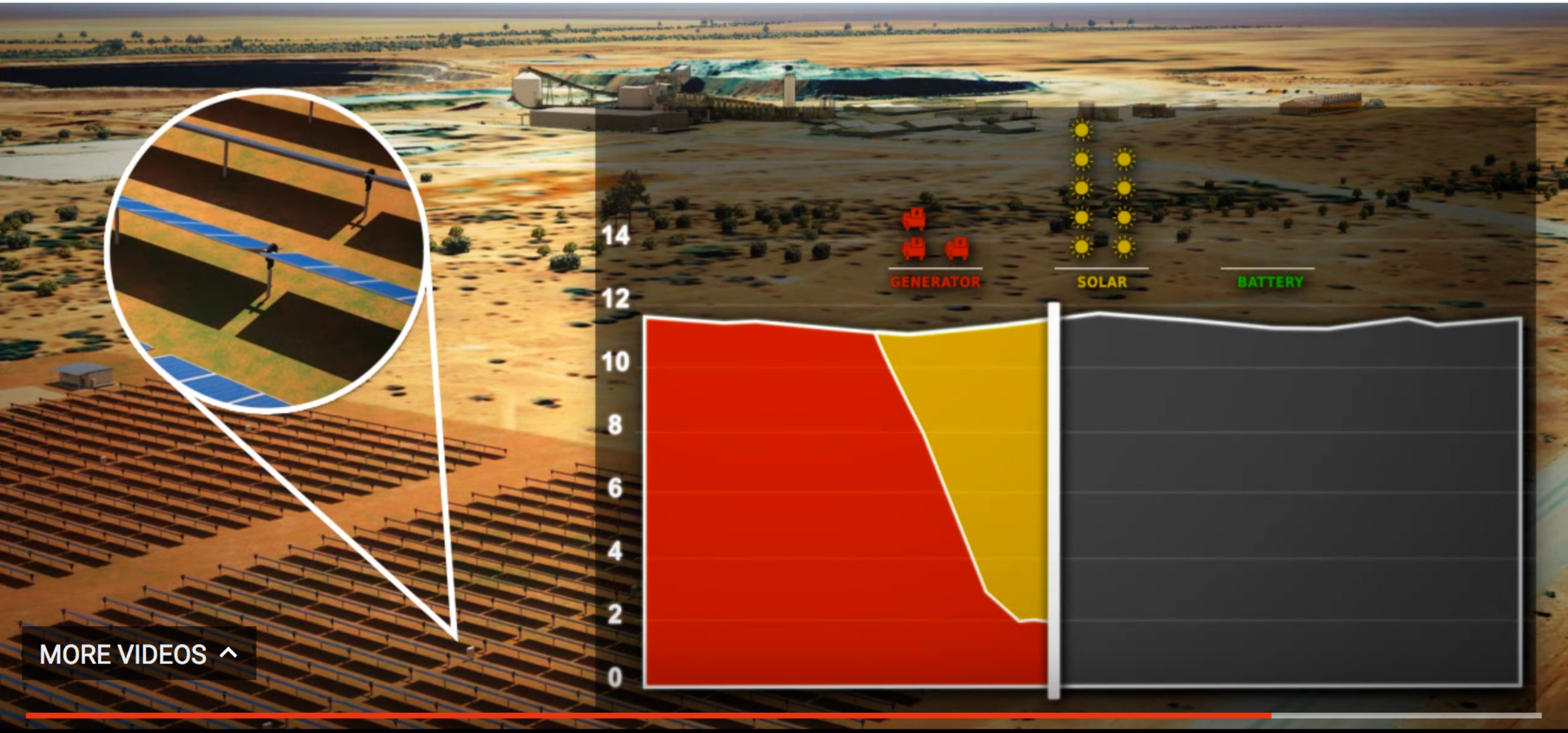

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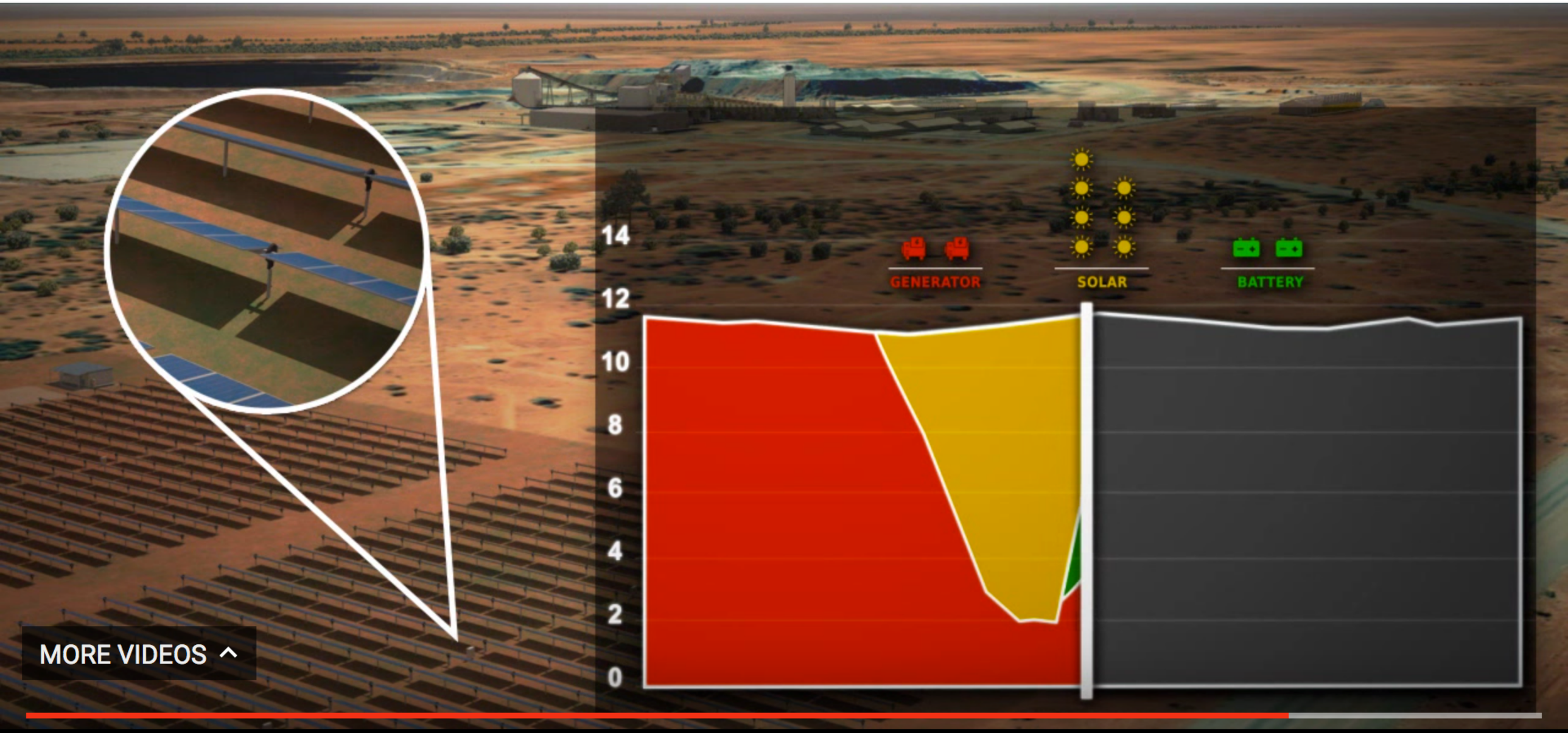

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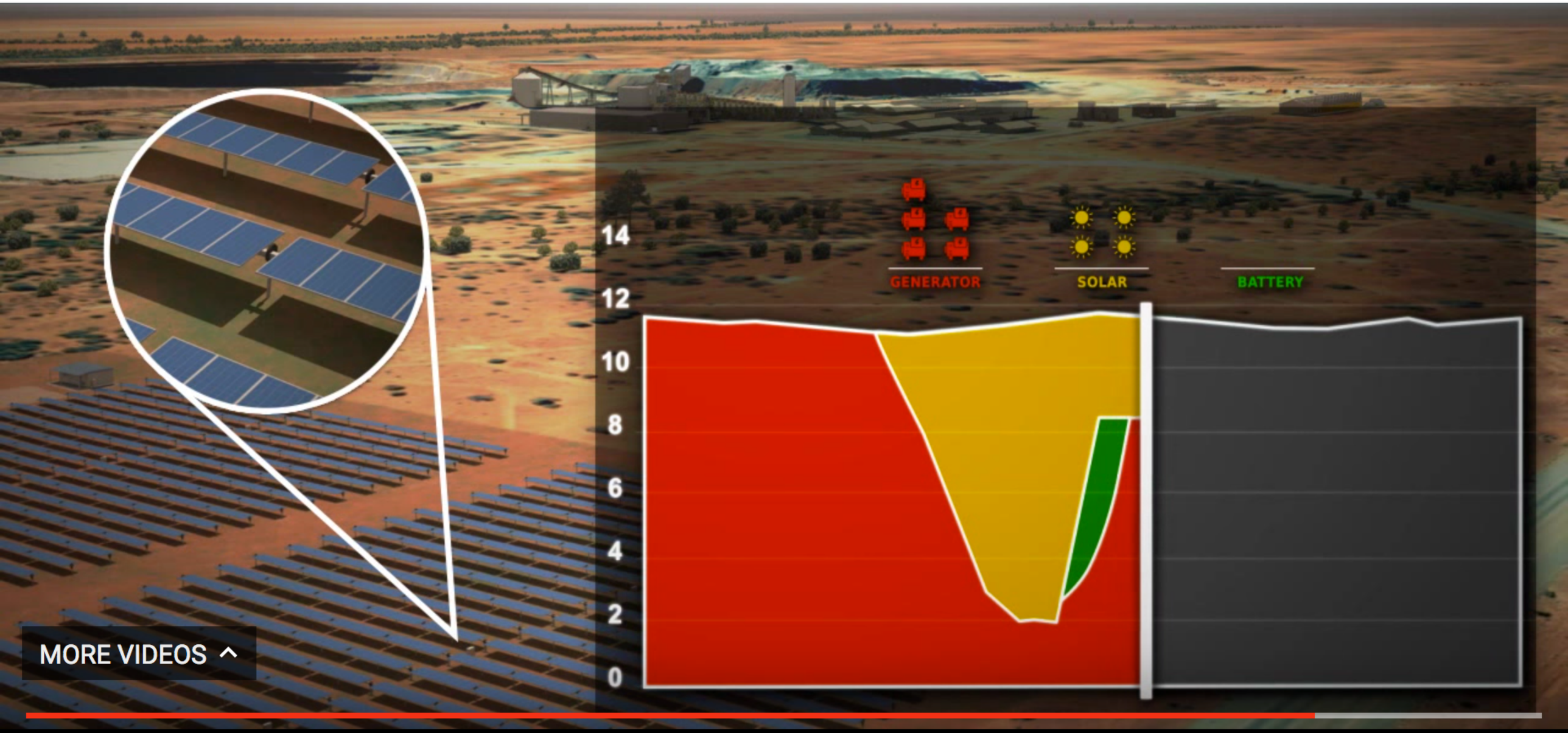

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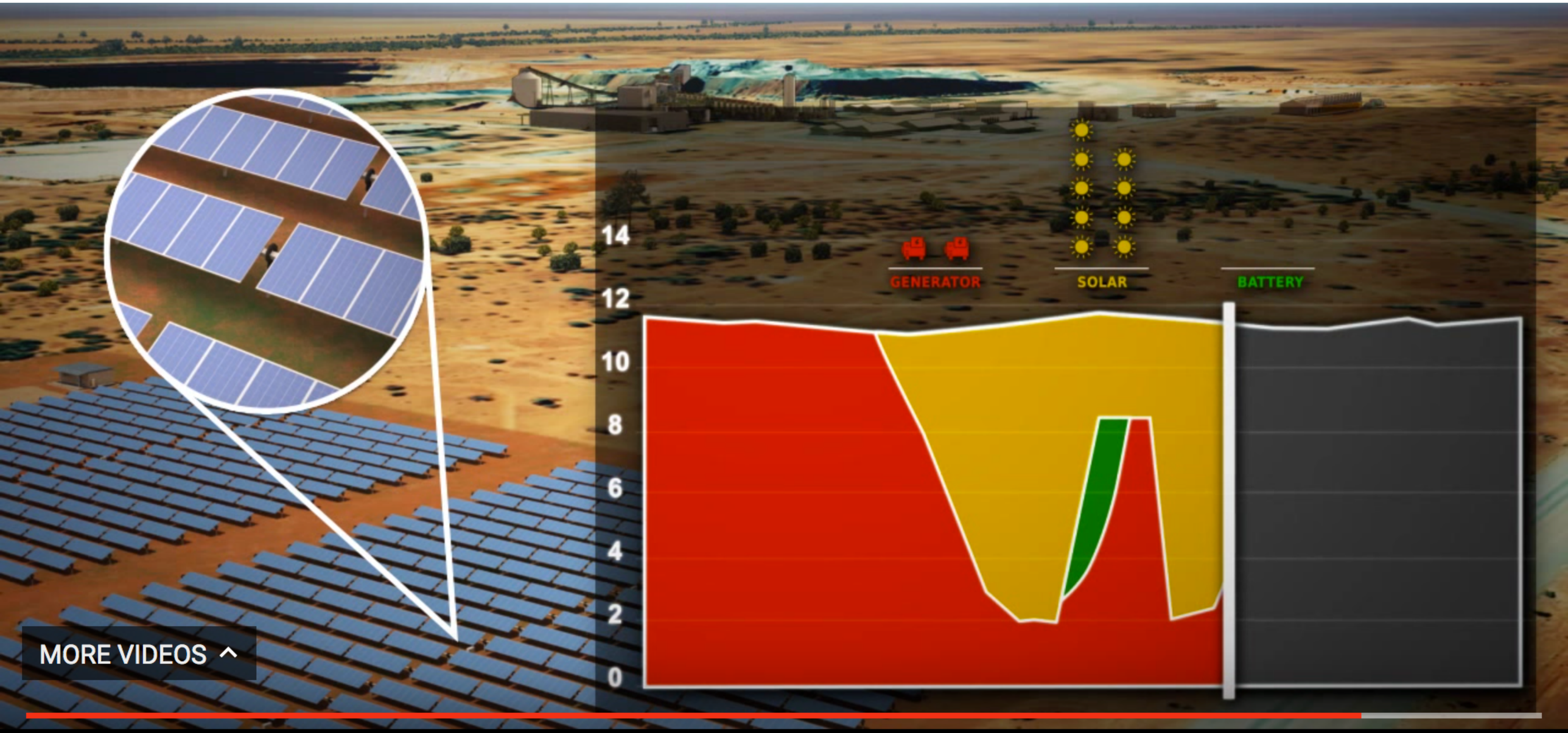

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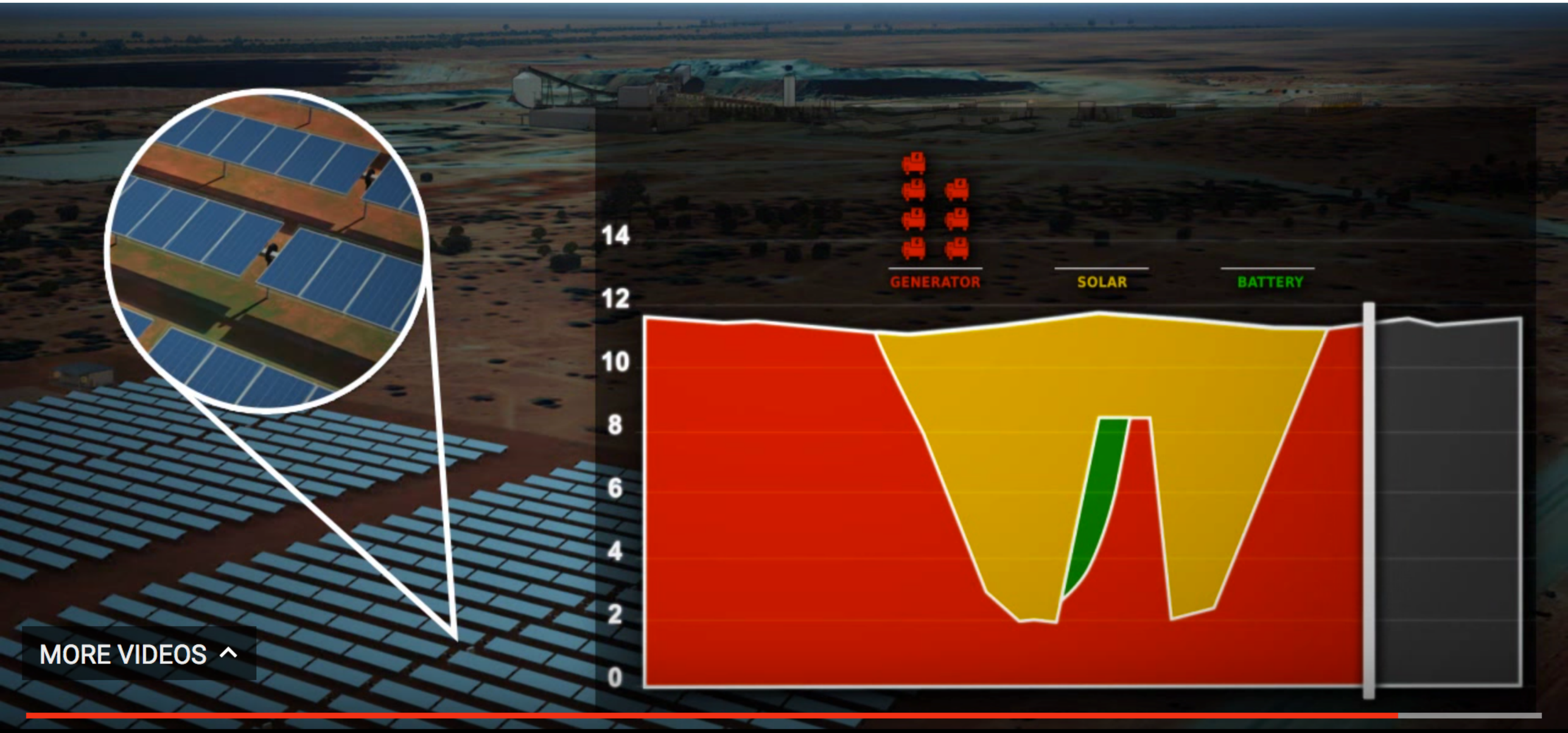
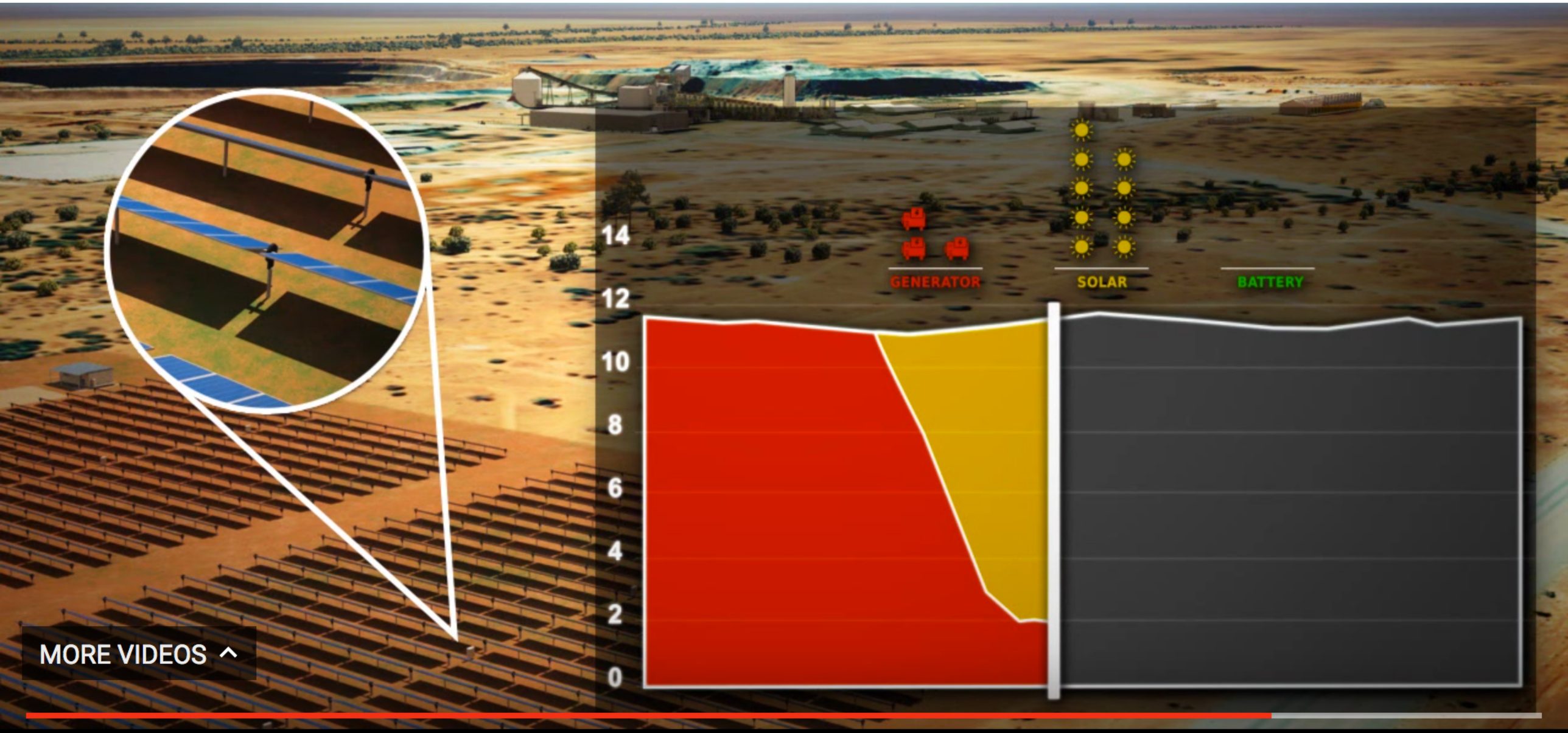


Notice that the diesel never shuts down completely



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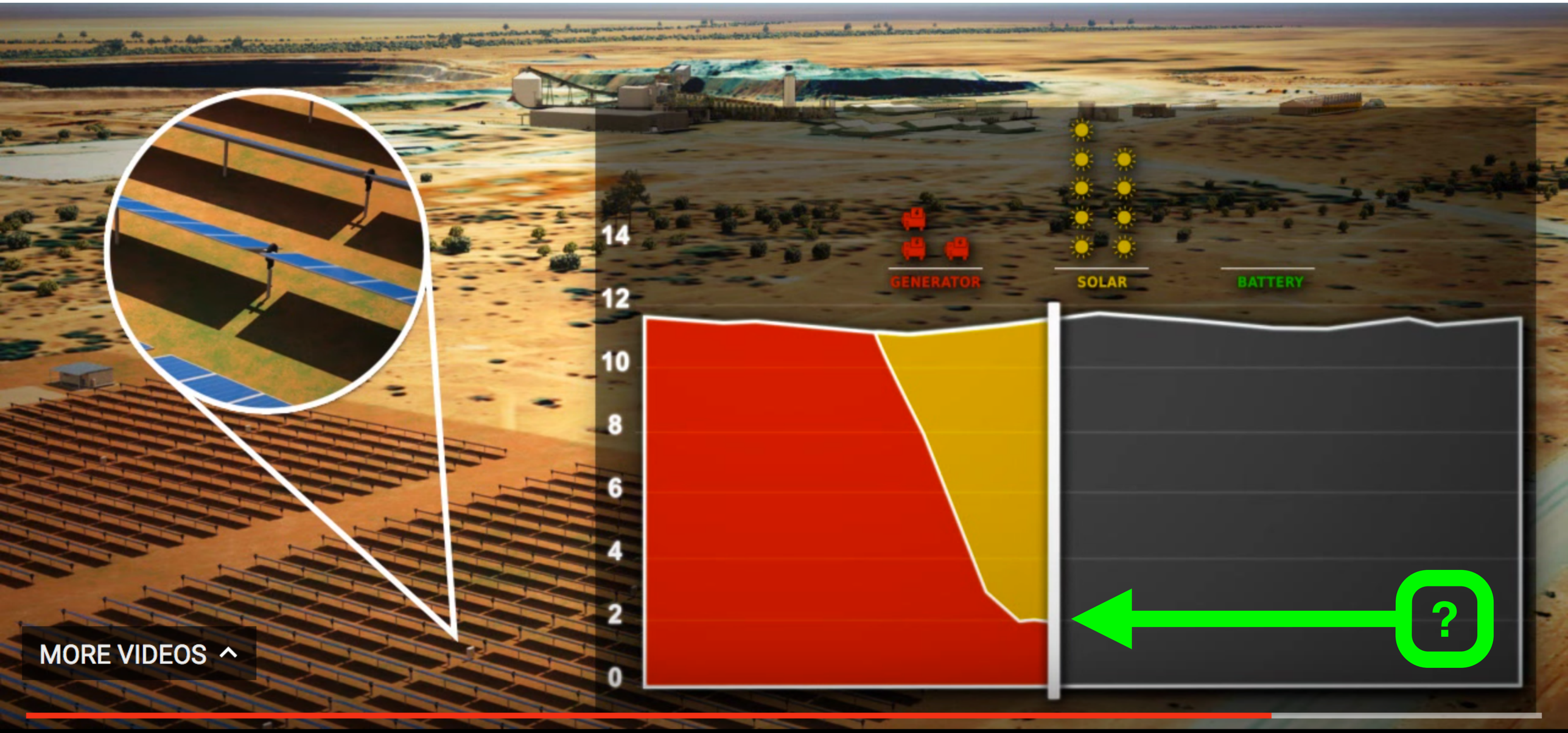

That’s what’s different about the Lakeland Mine

Baseload Renewables: The Significance of Lakeland Solar & Storage for Miners

CASE STUDIES

March 10 16:19 2017

Energy reliability is a major concern for grid-connected mines in Australia with supply constraints and power disruptions hampering production and expansion plans. In this context, the Lakeland Solar & Storage Project, currently under construction in northern Queensland, is particularly relevant for miners as it will demonstrate the power reliability benefits of large-scale solar PV and storage.

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ENERGYANDMINES

Connecting renewables with mining

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CASE STUDIES

March 10 16:19 2017

No Diesel!
Zero Carbon

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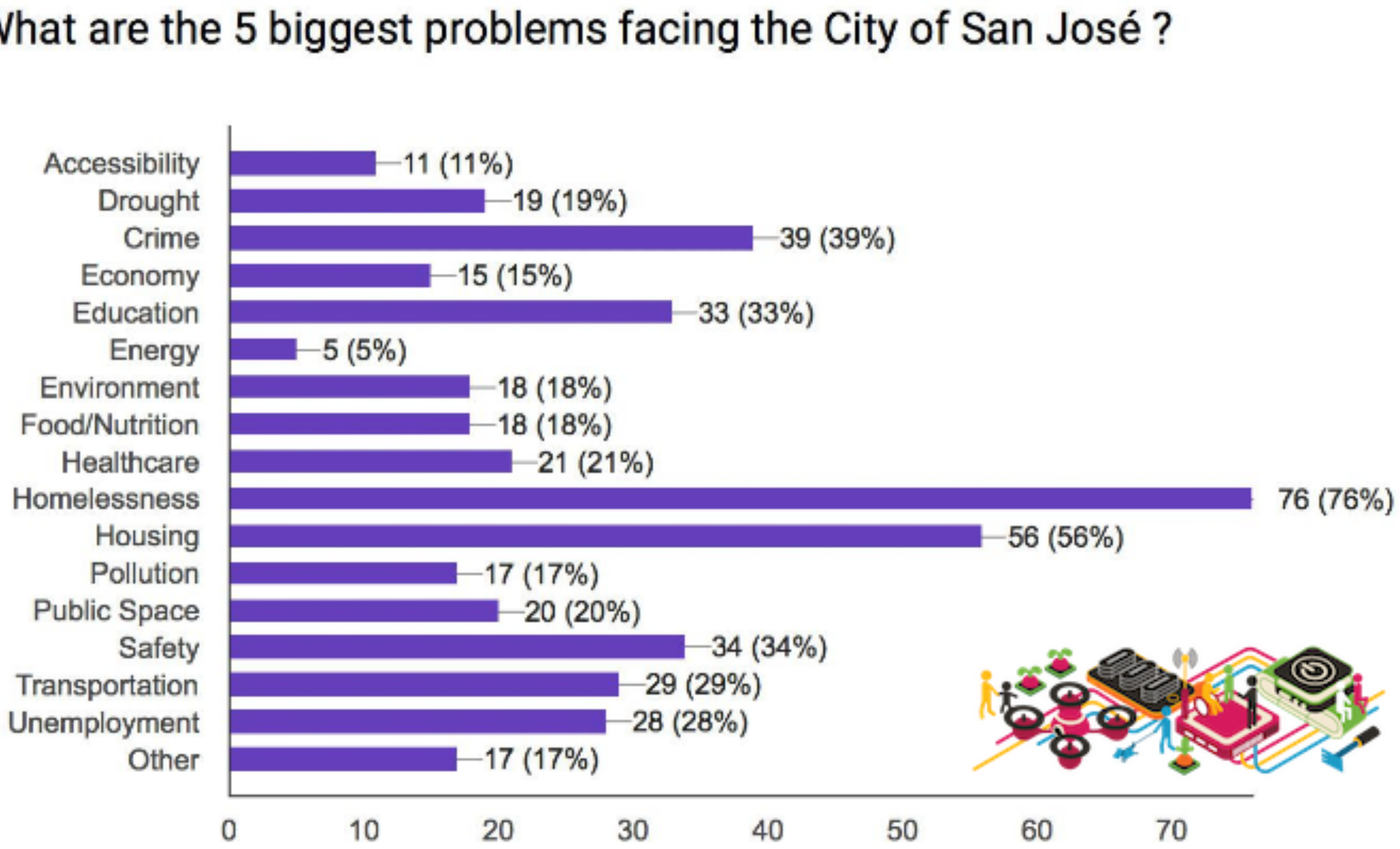
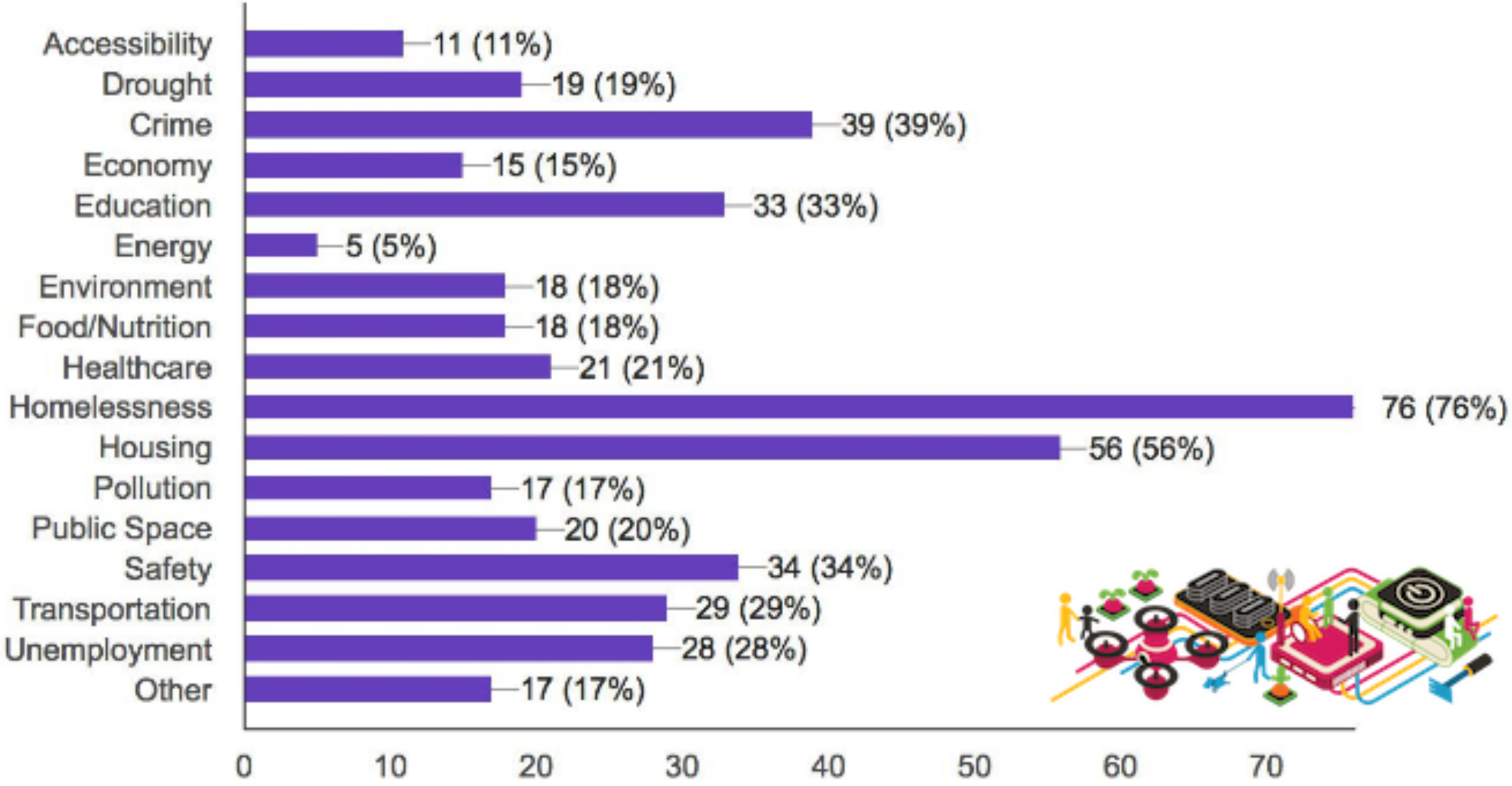
San José’s Problems

San José's problems according to Paseo survey

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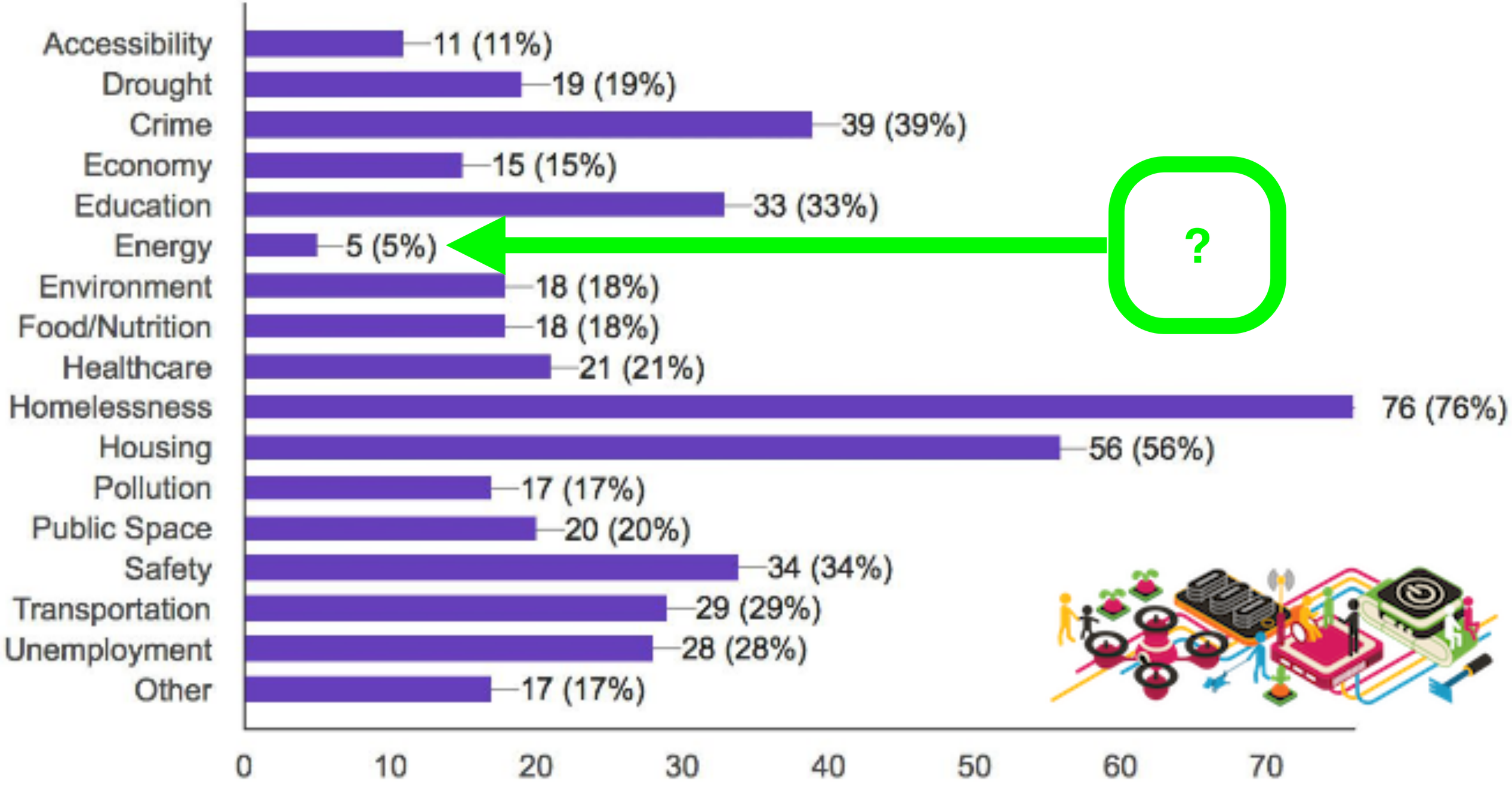
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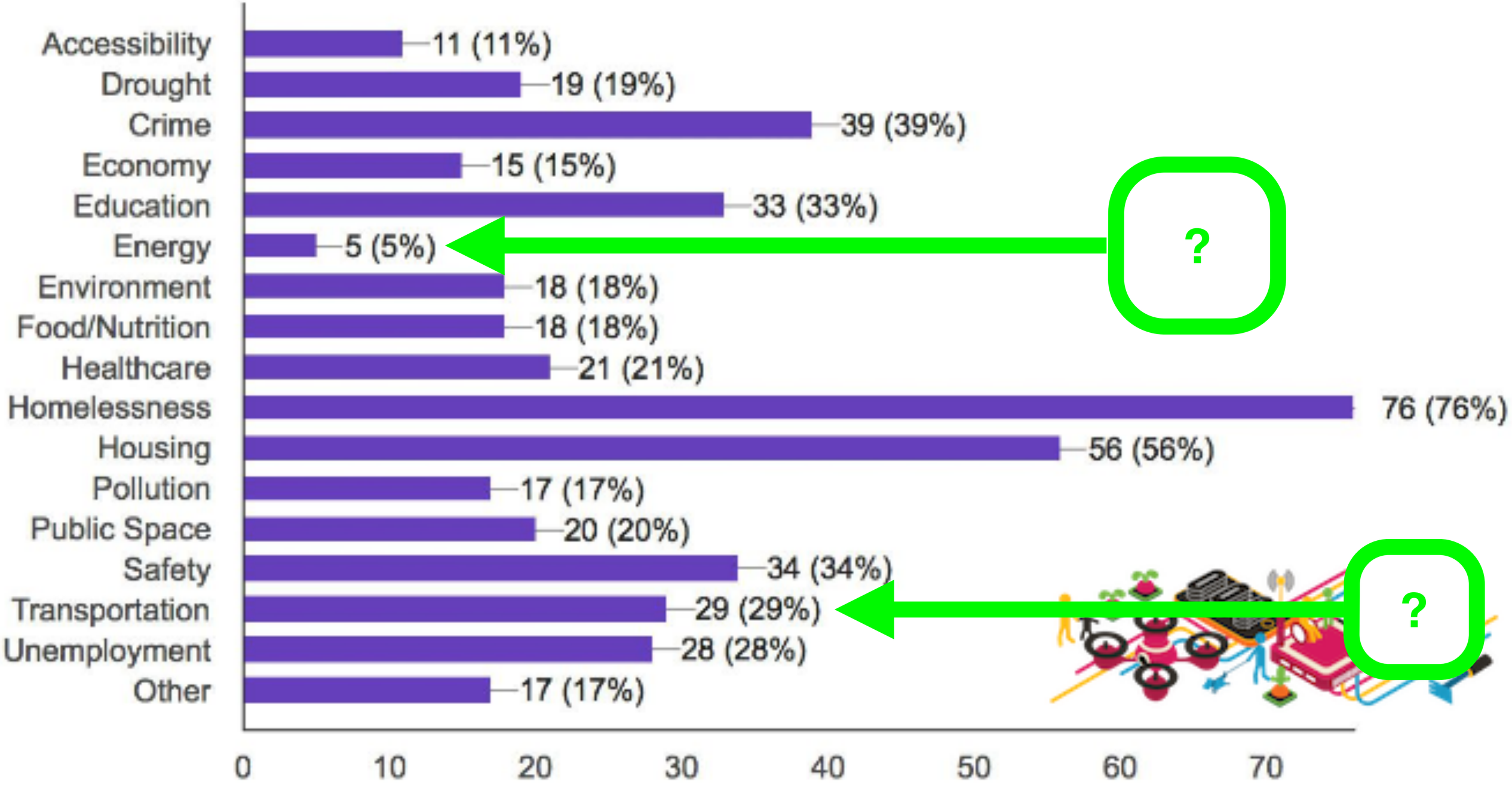
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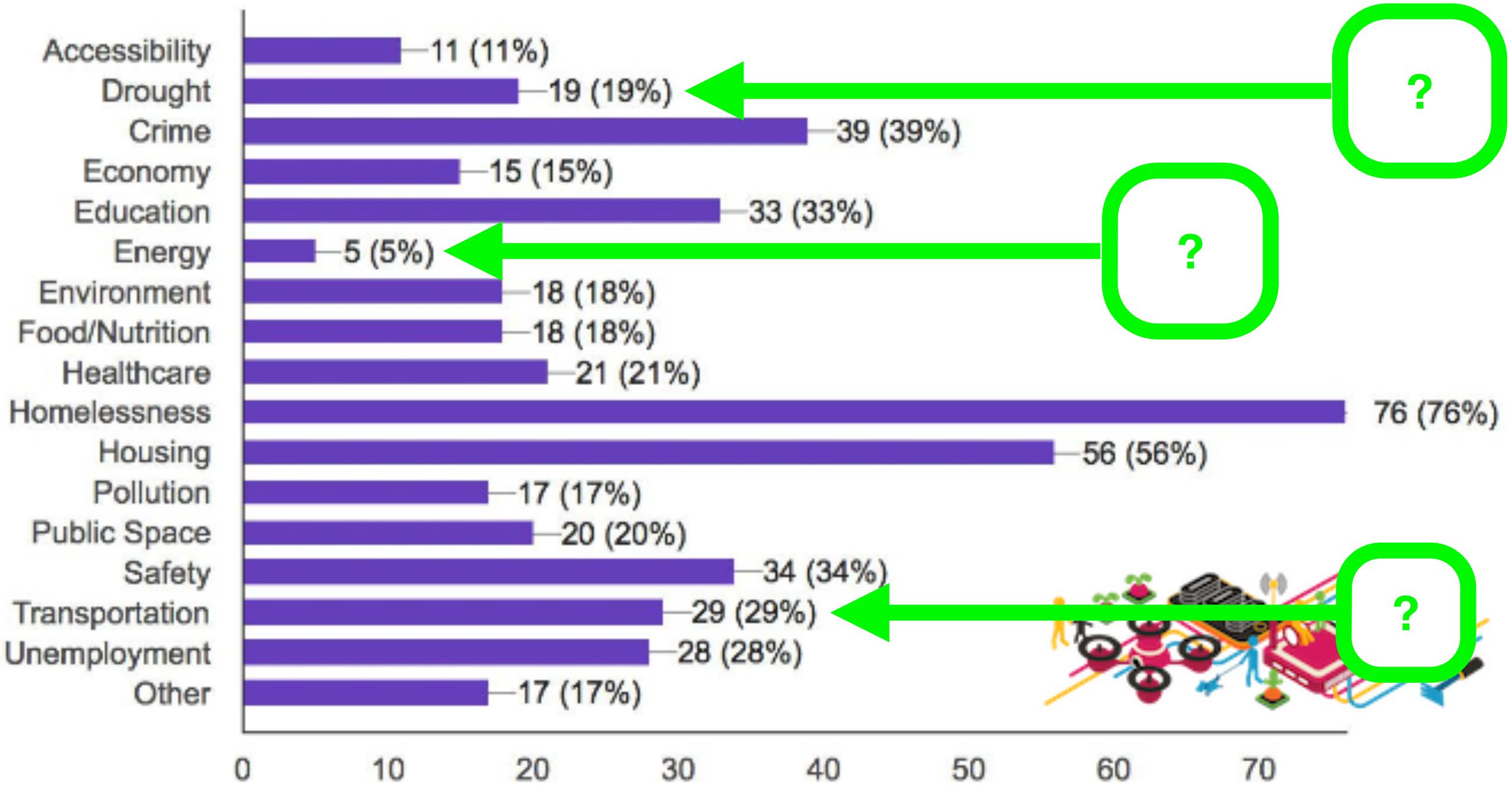
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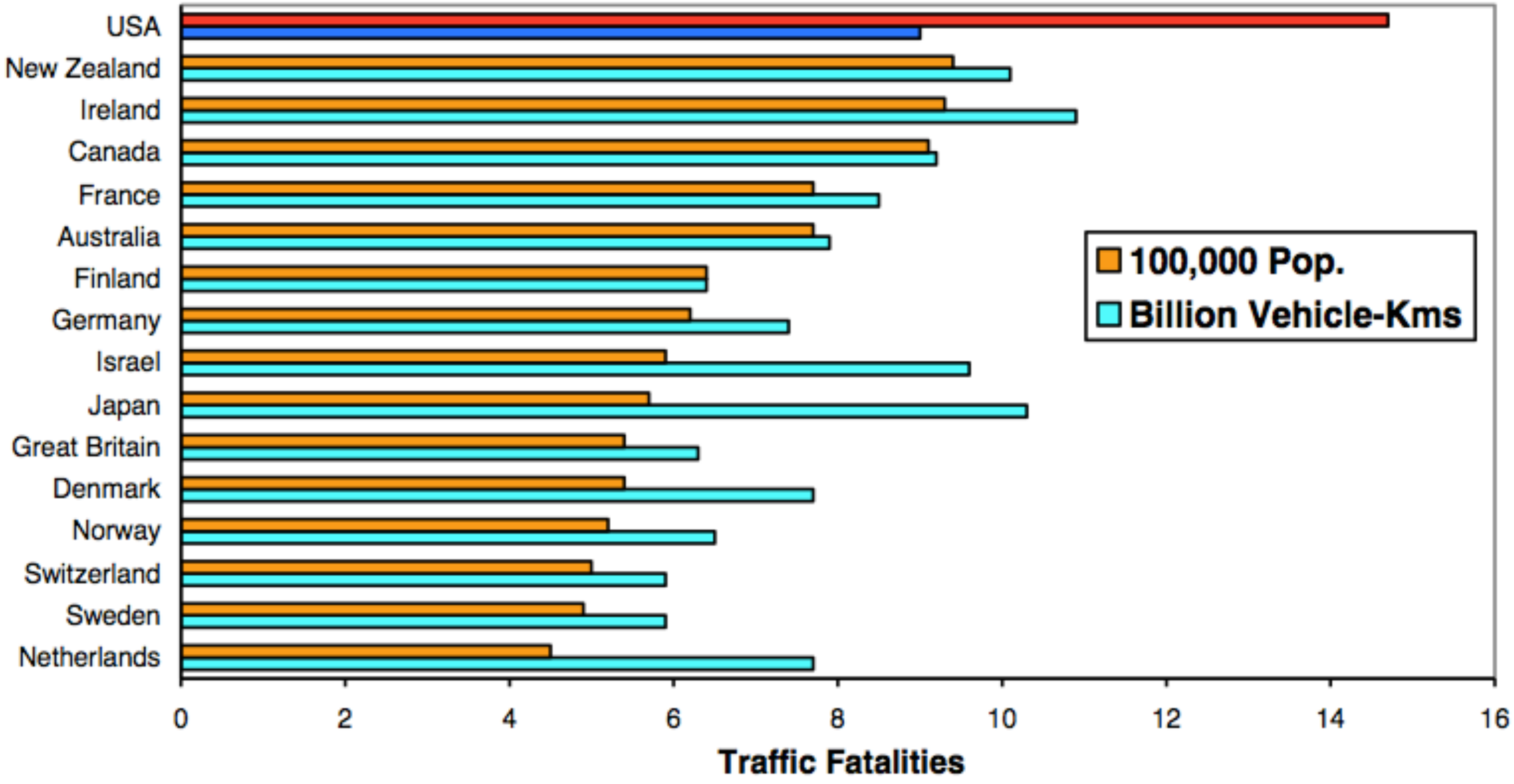
Podcars
vs
Rail & Bus Transit

SPARTAN is the cheapest transit solution, bar none

40 story skyscraper	*$200+ Million*
Metro (underground)	*$500+ M / km (BART to SJ est.)*
Light rail (LRT/tramway)	*$110+ M / km (VTA Hwy 85 est.)*
BRT	*$35+ M / km (VTA hwy 85 est.)*
One lane of new urban highway	*$20+ M / km (various sources)*
SPARTAN	*$10 M / km*

Safety

The USA has the highest per capita traffic fatality rate among peer countries



And it’s gotten worse

The Mercury News

Crash deaths hit 10-year highs

Bad driving habits are taking lives on the nation’s highways, with traffic fatalities on the rise in 39 states

By Jim Gorzelany
CTW FEATURES

Despite ongoing advancements in auto safety — including greater crashworthiness and the prevalence of accident avoidance systems like stability control and forward auto-braking systems — along with stricter state DUI and teen licensing provisions, the National Safety Council reports the nation’s highways are at their deadliest levels in a decade.

Preliminary figures indicate traffic fatalities shot up by 6 percent during 2016 and reached a grim total of 40,200 employer costs and property damage. That’s a 12 percent increase over 2015.

Why the sudden spike in traffic deaths? Part of it has to do with more cars and trucks on the road over the last few years concurrent with the nation’s economic recovery. But a great deal of the responsibility lies firmly on the shoulders of U.S. drivers. A recent NSC survey showed that while 83 percent of motorists say that safe driving is of paramount concern, 63 percent are nevertheless comfortable with speeding and 47 percent send and/or receive text messages behind the wheel

There are two approaches to safety

Rhetoric

There are two approaches to safety

Rhetoric

Physics

There are two approaches to safety

Rhetoric

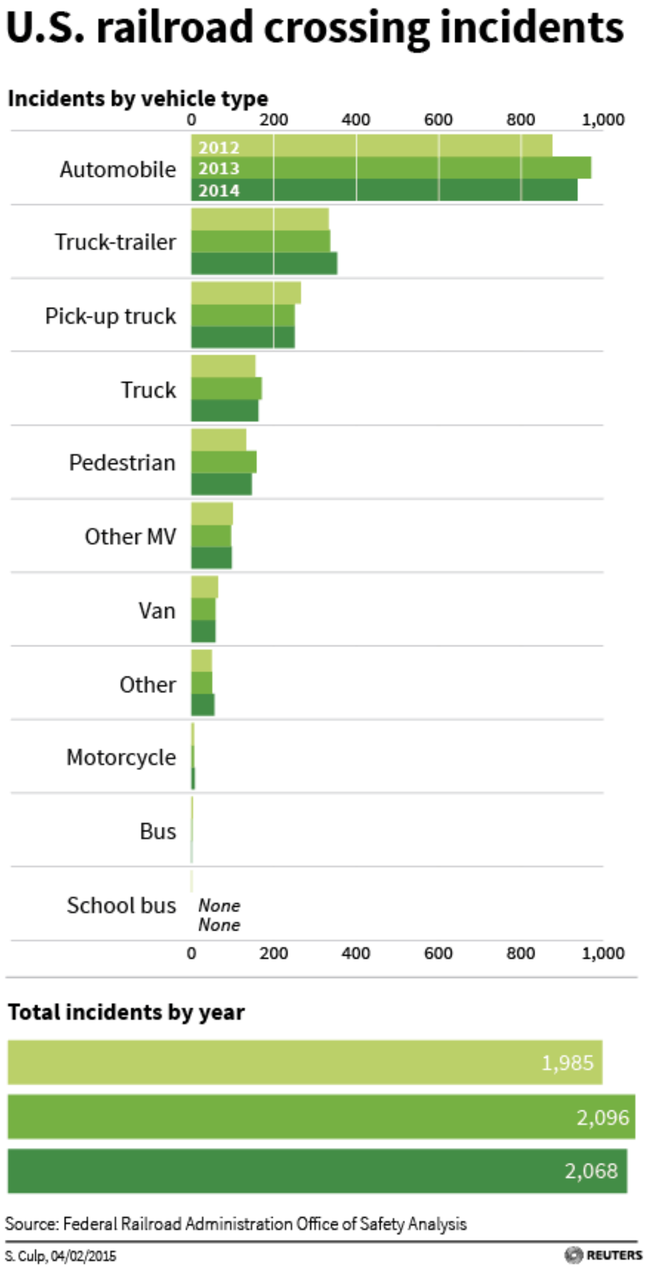
Let’s see what rhetoric can do for us

Can rhetoric defeat the laws of physics?

Street Smarts

Why do trains hit cars?

Why do trains hit cars?



Why do trains hit cars?

HUFF POST NEWS

Investigation Begins In Fatal Metro-North Train-SUV Crash

AP/Huffpost

Posted: 02/04/2015 10:08 am EST | Updated: 02/04/2015 7:59 pm EST

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Every day, trains travel across more than 212,000 highway-grade rail crossings in the U.S. There are an average of 230 to 250 deaths a year at such crossings, down over 50 percent from two decades ago, FRA figures show.

Risky driver behavior or poor judgment accounts for 94 percent of grade crossing accidents, according to a 2004 government report.

Why do trains hit cars?

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No! Because bad design makes it possible.

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Why do cars and trains hit pedestrians?

TABLE 2: CALIFORNIA COUNTIES WHERE PEDESTRIANS ACCOUNT FOR HIGHEST SHARE OF ALL TRAFFIC-RELATED DEATHS - 1999

RANK	COUNTY	PEDESTRIAN FATALITIES 1999	ALL TRAFFIC FATALITIES 1999	PEDESTRIAN FATALITIES AS PERCENT OF TOTAL
1	SAN FRANCISCO	26	48	54%
2	LOS ANGELES	203	684	30%
3	SAN DIEGO	81	284	29%
4	ORANGE	45	175	26%
5	SACRAMENTO	30	117	26%
6	ALAMEDA	20	90	22%
7	VENTURA	13	59	22%
8	SANTA CLARA	22	103	21%
9	SAN MATEO	7	35	20%
10	HUMBOLDT	4	21	19%

NOTE: 1999 Fatality and Injury Data is provisional. Sour:ce 1999 Provisional Report of Fatal and Injury Motor Vehicle Traffic Collisions, Department of California Highway Patrol; Statewide Integrated Traffice Records System (SWITRS) 1999.

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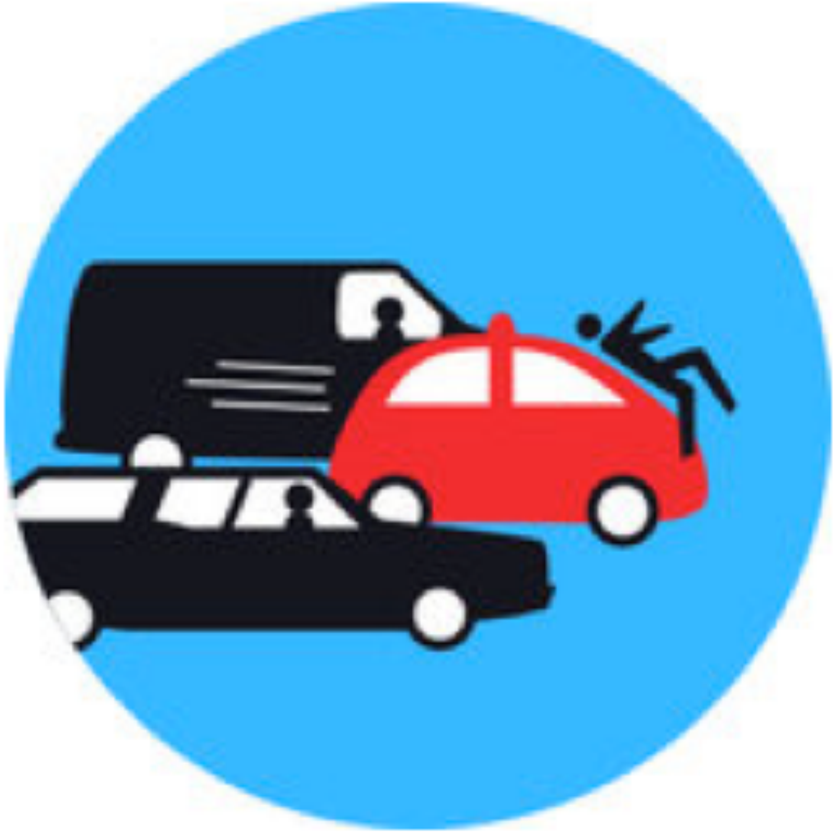
Why? Because bad design makes it possible

Driverless cars must also follow the laws of physics

ETHICS ON THE ROAD

Having to Make Tough Decisions



In the midst of busy traffic, a ball bounces into the road, pursued by two running children. If a self-driving car's only options are to hit the children or veer right and strike a telephone pole, potentially injuring or killing the car's occupants, what does it do? Should its computer give priority to the pedestrians or the passengers?

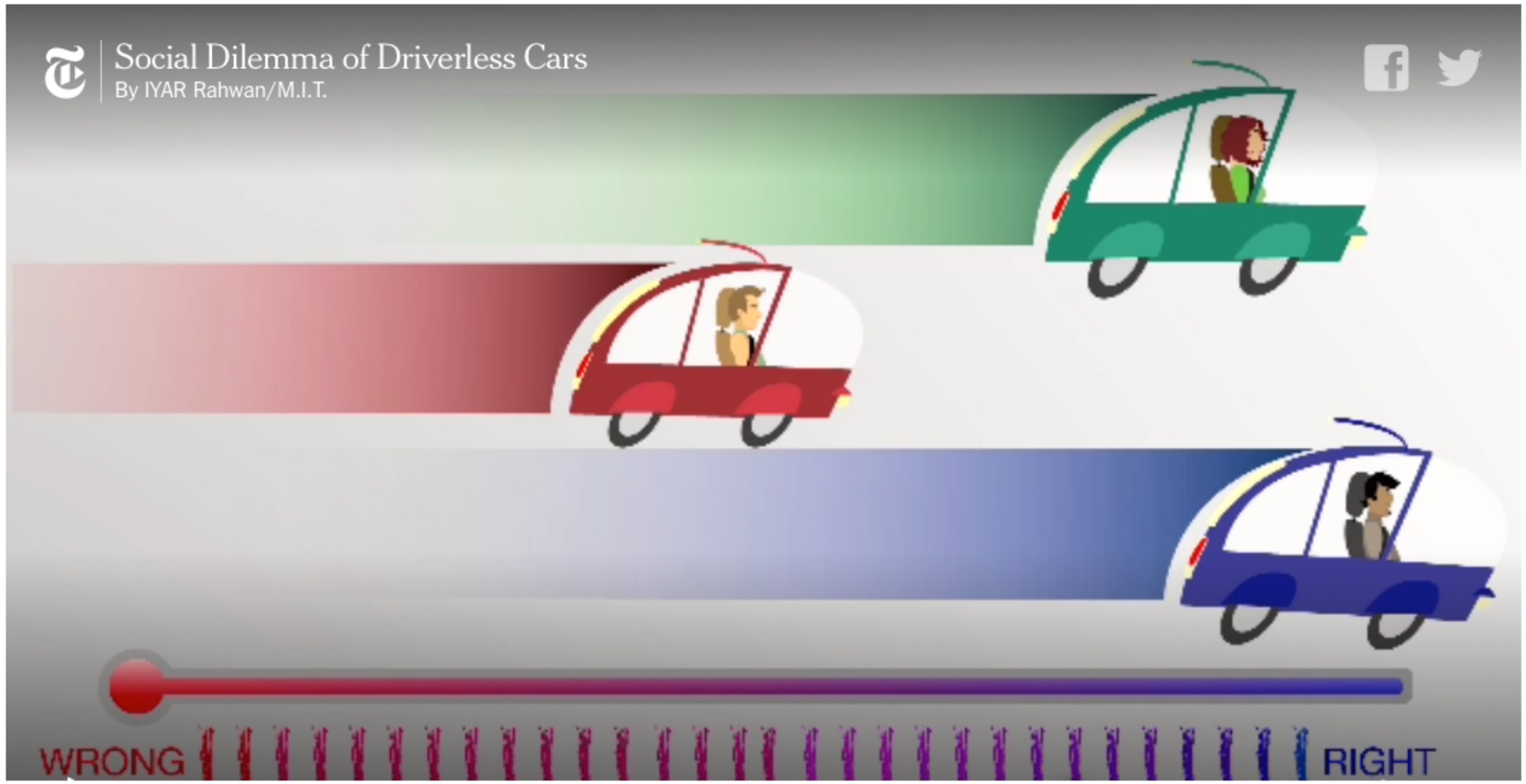
Driverless cars must also follow the laws of physics

The New York Times

TECHNOLOGY

Should Your Driverless Car Hit a Pedestrian to Save Your Life?

By JOHN MARKOFF JUNE 23, 2016



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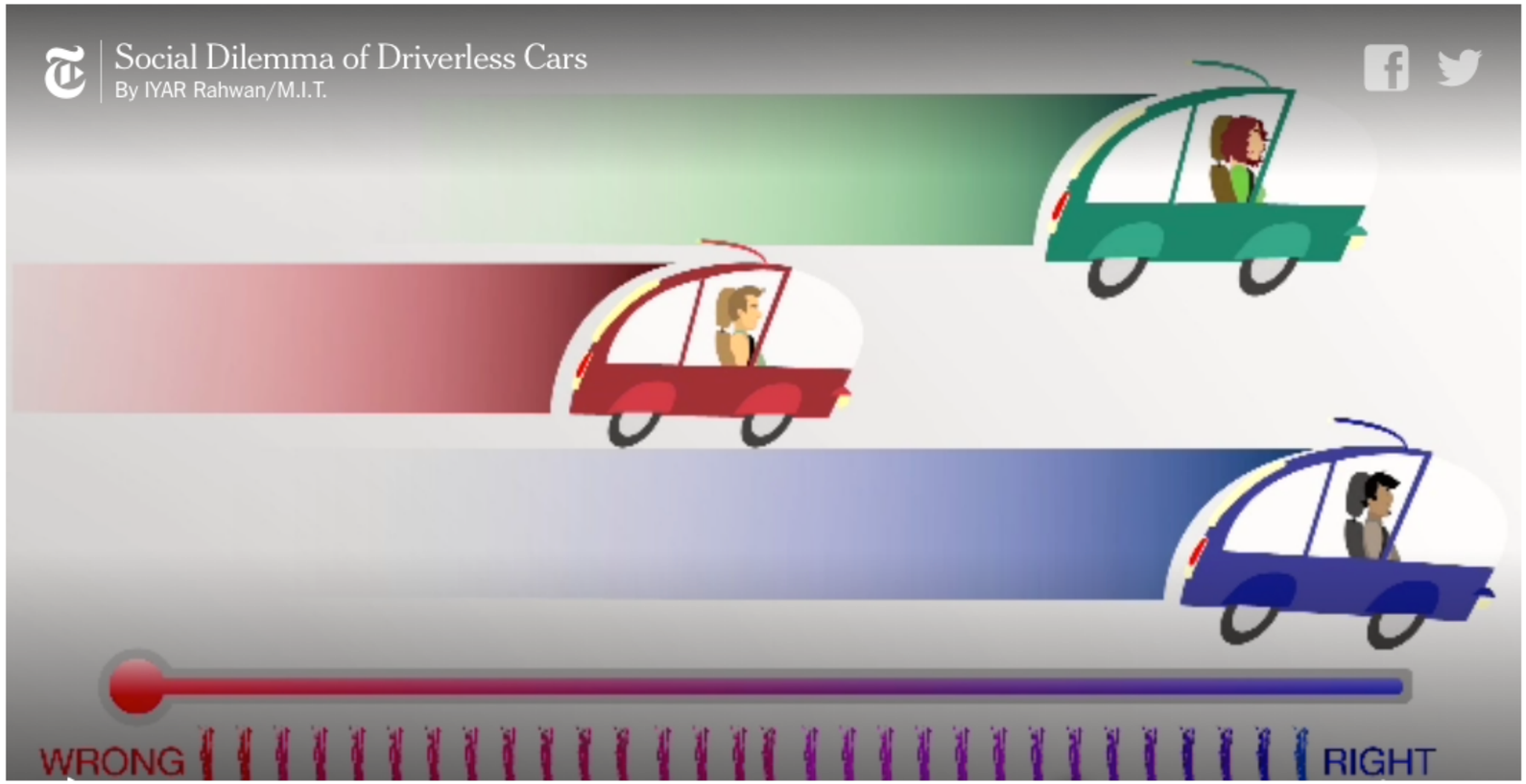

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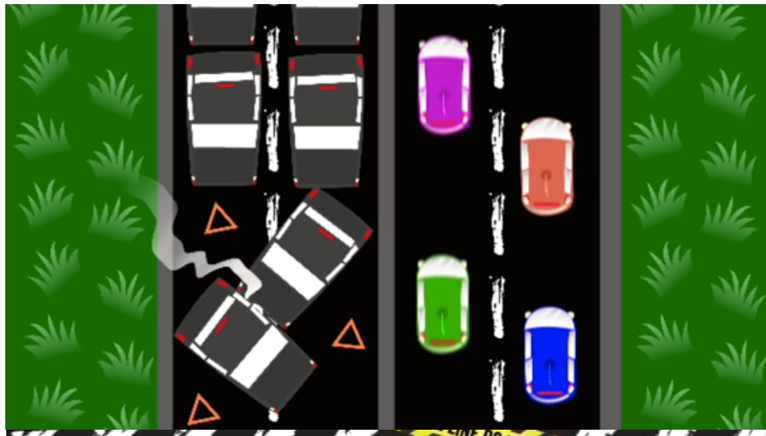

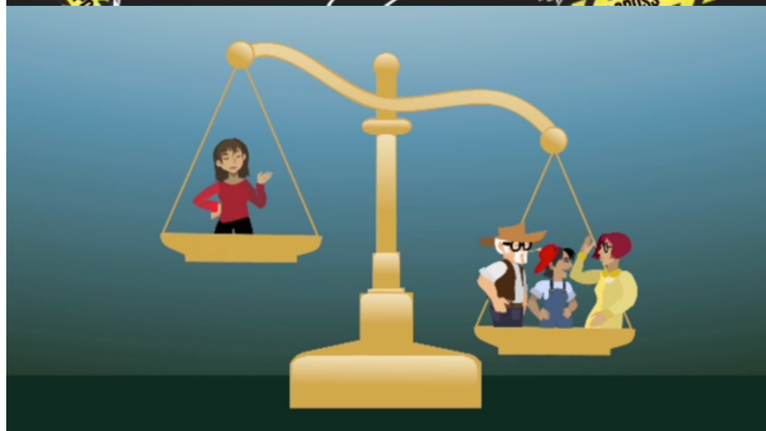

Driverless cars must also follow the laws of physics

The New York Times

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Why must you ask?
Because bad design makes it possible.

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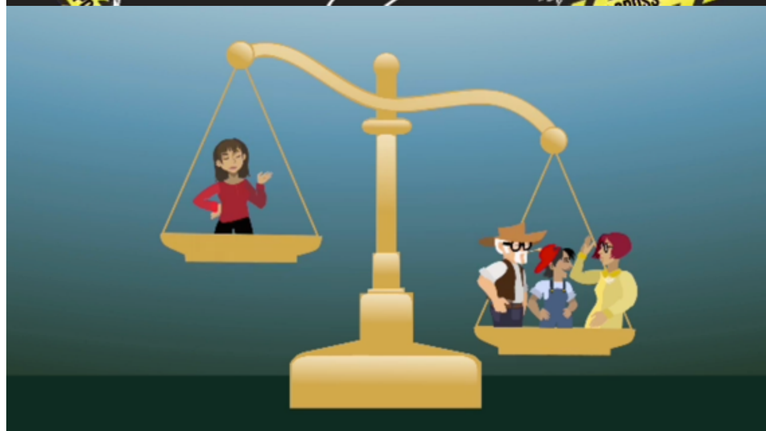


There are two approaches to safety

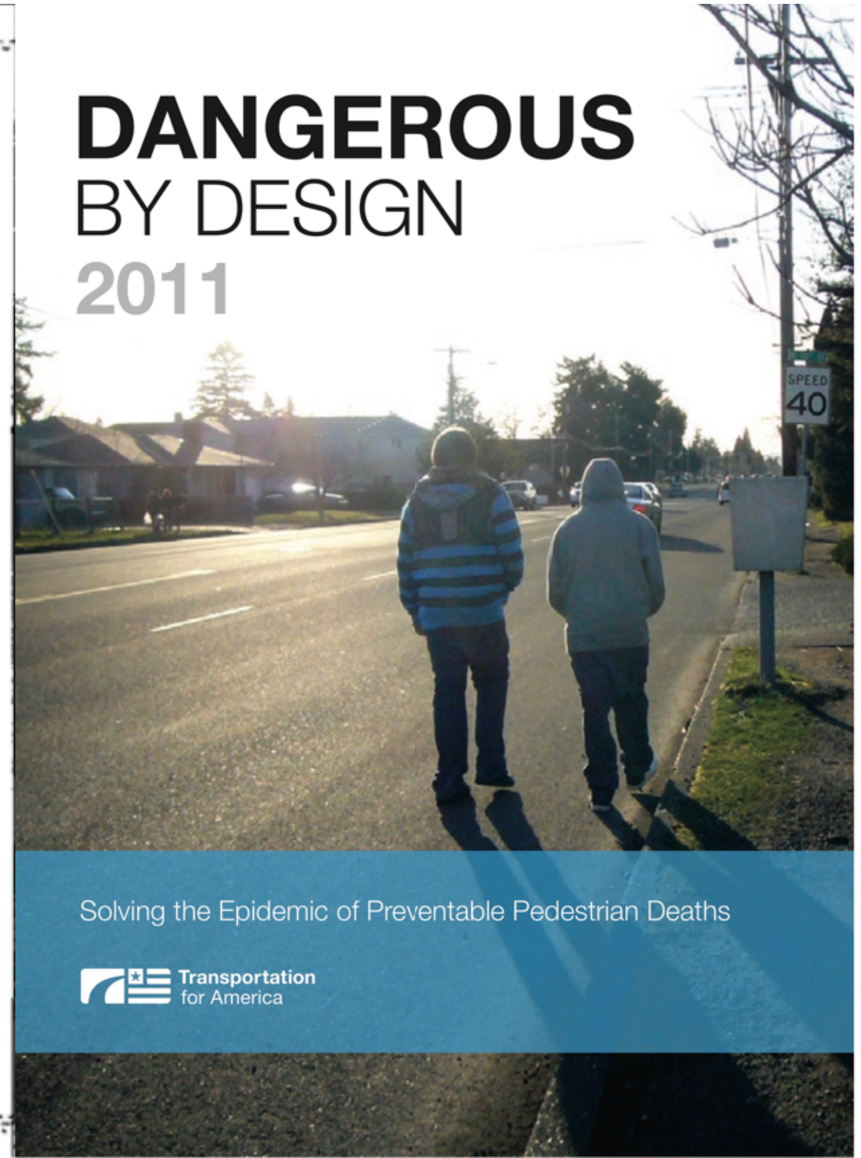
Rhetoric

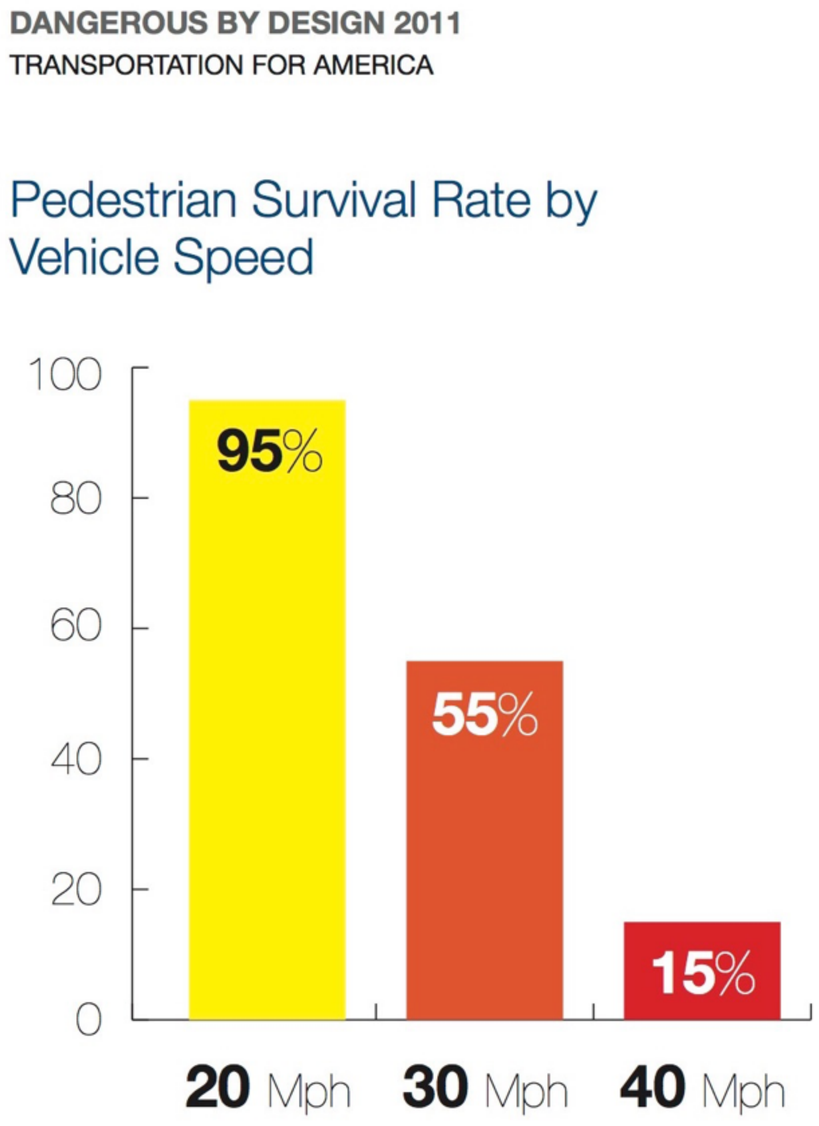
Physics

There are two approaches to safety

Physics

The problem has been obvious for 100 years but the rhetoric persists





Driverless cars will hit people – podcars can’t

Change

It is not necessary to change

Edwards Deming

*"It is not necessary to **change**.*
*Survival is not **mandatory**"*

It is time for us to change our priorities