

# Reinventing Societal Infrastructure with Technology



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**~700m people have a rich lifestyle... in environment, energy, housing, healthcare, education, food. 7B people want this!**

**Reinvention of societal infrastructure through technology is the only bridge...**

# Reinvention

**Innovation has the potential to...**

**multiply resources, achieve food goals, reshape cities, knit humanity, cure disease, mitigate climate change & enhance human capability**

**More true than not: what can be imagined technologically can be invented**

**enabled by entrepreneurs imaging  
unreasonable possibility & not afraid of the  
probability of failure**

**...those foolish & naive enough,  
knowledgeable & questioning enough to  
pursue this dream**

**“Reasonable people adapt themselves to the world, the unreasonable man adapts the world to them”**

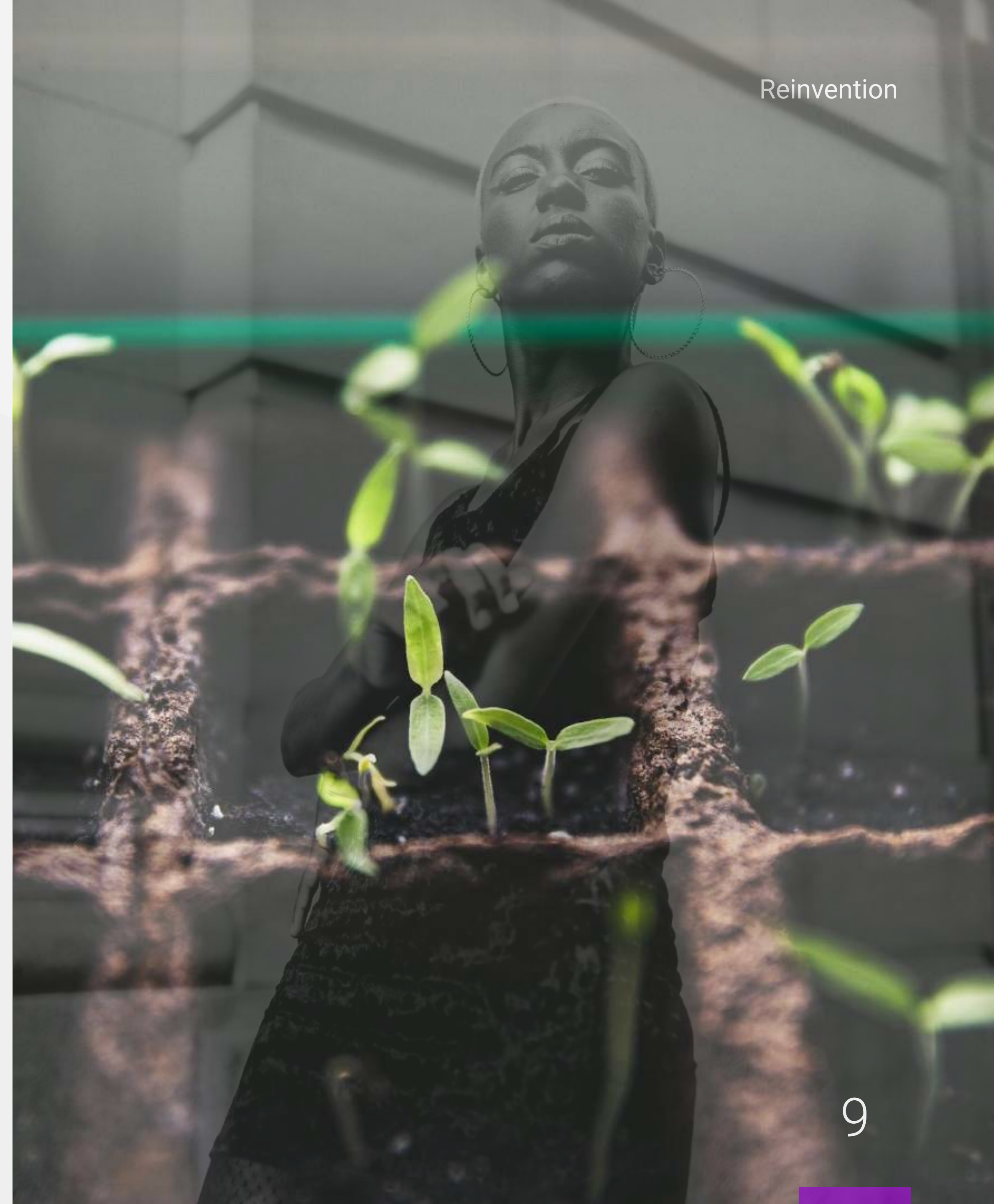
— George Bernard Shaw

**The future is not knowable, but it is “inventable”  
& discoverable ... invent the future you want!**

**ask “why not?” not “why no!”  
skeptics never did the impossible  
there is always a pessimist for every solution**

# Silicon Valley is a Culture Not a Place

...the mindset of “can do”,  
naivety, arrogance,  
hubris, permission that  
nurtures disruptive  
innovation



**What Silicon Valley does well: experiment,  
iterate, evolve, improve... blunder directional  
into a vision**

**...and it's only the improbable that's important**

**We're limited by what we think we can do,  
not by what we can do!**

**...and by lack of “willingness to fail” so  
“we fail to try”**

# Reinventing the GDP's Non-governmental Components

# Most Parts of GDP Open for Innovation



Health and Medicine



Transportation &  
Space



Food & Food Production



Manufacturing &  
Construction



Financial  
Services



Energy, Water &  
Climate

# Major Disruption is Mostly Non-Institutional

Amazon disrupt retail or Walmart?

Youtube/Twitter/Facebook/Netflix disrupt media or NBC?

SpaceX disrupt space or Boeing, Lockheed, Airbus?

Tesla/Waymo disrupt autos or GM, VW?

Apple disrupt music or SONY, Universal?

Uber or taxis or AirBnB/Hilton?

Sun/Microsoft or IBM do distributed computing?

Juniper/Cisco or Lucent/Alcatel reinvent networks?

Genentech or Pfizer/Novartis/Sanofi reinvent pharma?

Google or x?

we are beyond technology innovation for  
technology to **innovation for most parts of the  
GDP**

# Tools & Axes

# Axes & Tools of Innovation

As axes of innovation increase, possibilities for solutions increase

The lower the cost of experimentation, the more the innovation

Tools for experimentation exploding (computational, cloud, AI...)

# New Breakthrough Axes Enable a Hypercycle of Innovation

AI & data collection, tools

3D manufacturing

Bio: CRISPR, genomics, imageAI

Cloud & Quantum Computing

Software eating the world

Social networking

Robotics

Densification + Dematerialization (software, generative design, efficiency...)

Materials

....others coming

# Turbocharged by Older Innovations

Internet/mobile

Computer & clouds

Open source software

Sensors, cameras, tools, CAD,...

.... others

# Health v8 2050

## Consumers as CEO's of their health!

Data, biomarkers, images about ourselves everyday, quantitative physicals

Care fully personalized to “one”, not for the “average”

Predict cancer or disease; predict food/supplement optimization

AI physicians: primary care, psychiatrist, oncologist, cardiologist,...

Obsolescence of symptom based diagnosis (except trauma?)

Healthcare will be affordable, accessible, & better quality, on our terms

# Innovation Axes: “Practice of Medicine” to “Science of Medicine”

AI 24/7 “almost free” physicians...

data driven personalized care: 30k not 30 longitudinal biomarkers

“omics medicine” & imaging replacing symptom based medicine

new tools: CRISPR, DNA/RNA, microbiome

AI based Imaging, image diagnosis, enhancement, new imaging modalities

AI enhancement for tools (imaging, drug discovery, diagnosis, surgical robots...)

Accessibility, immediacy, affordability... the great equalizer

CRISPR organs, 3D printed organs/parts, microrobots,

....mostly new, unanticipated stuff!!!

# Transportation v8 2050

**Carbon minimal, accessible, pervasive, public!**

Autonomous public transit (point to point) with autonomous-only roads in cities

City transit \$1 point to point (no fixed routes public transportation) in 200lb pods

Trains replaced by on-demand 2-6 person autonomous “pods”; hyperloops for distance?

Flying taxis, autonomous aircrafts, and rocket ships to China?

People travel “time”: range/land for “30 minute commute” housing will increase, decreasing parking lots & freeing up space

# Tools and Axes of Innovation

Robotics

Electrification

AI and computer vision, radar, lidar,...

3D metal printing, 3D composites printing, 3D new materials

New materials & configurations, software design & testing

....mostly new, unanticipated stuff!!!

# Housing, Construction, Cities v8: 2050

**Dematerialized, dense, efficient carbon minimal!**

Densification & dematerialization of city environments: more virtual SW based services

Enhanced services: transportation, food, furniture, sharing/social

Dematerialized services: medical, education, shopping, entertainment, exercise, social/sharing... @home, SW

Reuse of space, robotic delivery, robotic kitchens, mostly public transit

Larger commuting distance “within 30 minutes”

Freed up parking = space for parks/communities/housing; elimination of 80% of cars

Rethinking city design in more sustainable, more affordable, more efficient way

# Axes of Innovation

Reconfigurable interiors: “transformer” furniture with robotics & sharing (WeWork/AirBnB)

AI/Generative design for optimization; factory manufacturing, CNC/3D printing

Autonomous sensors dynamically provisions energy, security, health monitoring & services

Rethinking of materials: New materials & smaller material amounts; composites, polymers, ...

Shared and fractional ownership

Larger commuting distance with new transportation innovation

....mostly new, unanticipated stuff!!!



## 2020 v1: Mighty Building home construction with 3D Printing

# Manufacturing v8: 2050

**Dematerialized, efficient, just in time, diverse local!**

Dematerialized designs; generative designs; composites; new materials

Short supply chains; changing warehousing/supply configurations

More customized, more local “just-in-time” 3D printed/assembled products & smaller inventories

Robotic assembly line workers & delivery/assembly/warehousing/supply robots

Automated just in time warehouses multiply space 10X through frequent ordering

# Axes of Innovation: Manufacturing

Generative design

3D metal, composites, investment casting

Robotics

AI-based design and verification; Virtual testing of products

Computational design of materials

New materials

Blockchain based supply chains

Revenge of shitty robots (cheaper less precise robots augmented by AI)

....mostly new, unanticipated stuff!!!

## **2020 v1: Arevo, Velo3D, DDM, Digital Alloys, Carbon**

Arevo: True 3D printed Composites & software design/testing/QA

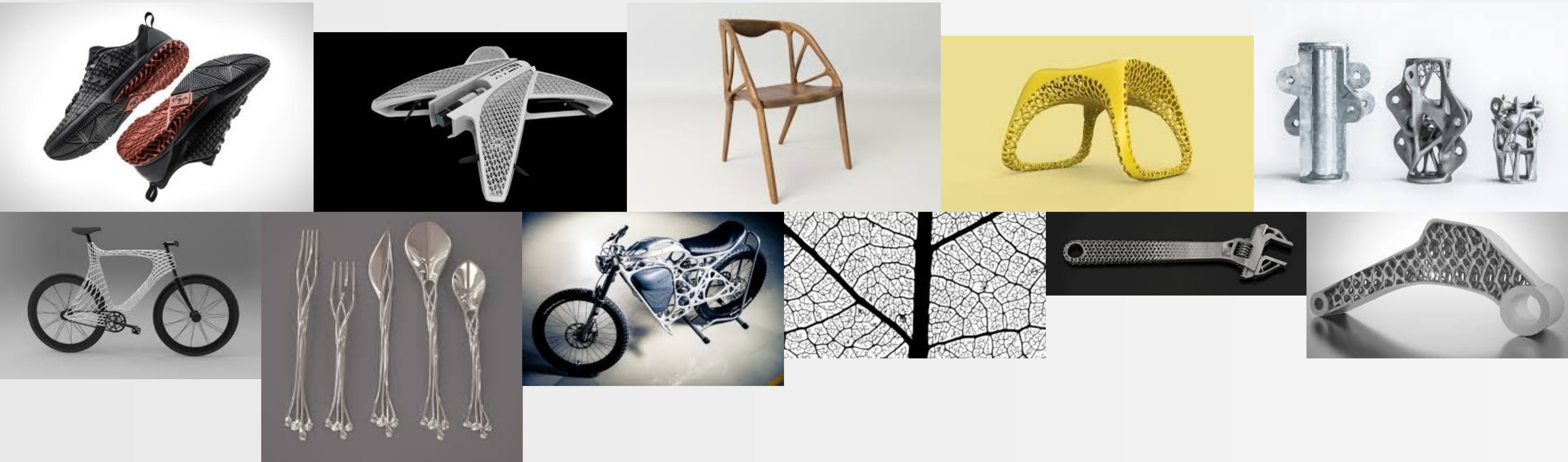
Velo3D: “Impossible metal parts” manufacturing for design freedom

DDM: 3D printed investment casting; ceramic 3D; ceramic parts

Digital Alloys: very low cost 3D metal wire based printing

Carbon: Polymer printing

# 2020 v1: 3D



# Food & Ag v8: 2050

**Better, less land, chemicals & resources, less factory!**

Future of food: less cost, less environmental impact, quality

Reduce impact of meat production

Reduce chemical input

Optimize land use; create local specialize farming (vertical?)

Rethink supply chain efficiency (local)

De-carbonize, de-nitrify, de-land, de-chemical, de-factory food chain

# Axes of Innovation: Food + Ag

Meat & dairy alternatives; cell culture; bio-production

Reinventing Food: Eggs, dairy, insects, inedible proteins ...

Robotics for plant by plant care/chemicals/fertilization/water

AI for imaging and data analysis, space

AI for yields, breeding, GMO, ...

Vertical farming

....mostly new, unanticipated stuff!!!



## 2020 v1: Impossible Reinventing The Burger

80% less water, inputs

80% less greenhouse gases

80% less cruelty to animals



## 2020 v1: Blue River reducing Ag Chemicals

# Financial Services 2050

**Inclusion & fairness for all thru auditable AI!**

AI financial & insurance services advisors

AI legal services, removing bias & cost, improving equal access

Global financial inclusion: banking, access to investments, advisory

Insurance easier, all cheaper for all (housing, jobs, ...)

# Axes of Innovation: Financial services

Broader credit & less biased algorithms; pervasive data

AI & cloud services; reduction of human intervention; data

More transparency & trust in the system

Blockchain, new currencies, new crypto, new secure computing

....mostly new, unanticipated stuff!!!

# Energy & Sustainability 2050

Sustainability with 7B people having rich energy lifestyles through 80% reduction in resources, 80% reduction in greenhouse gas emissions, cost reductions, cheaper cleaner energy production

Limited mining impact, awesome cleanup...

# Axes of Innovation: energy/decarbonization

Large problem, need to increase talent inflow

Transportation decarbonizing

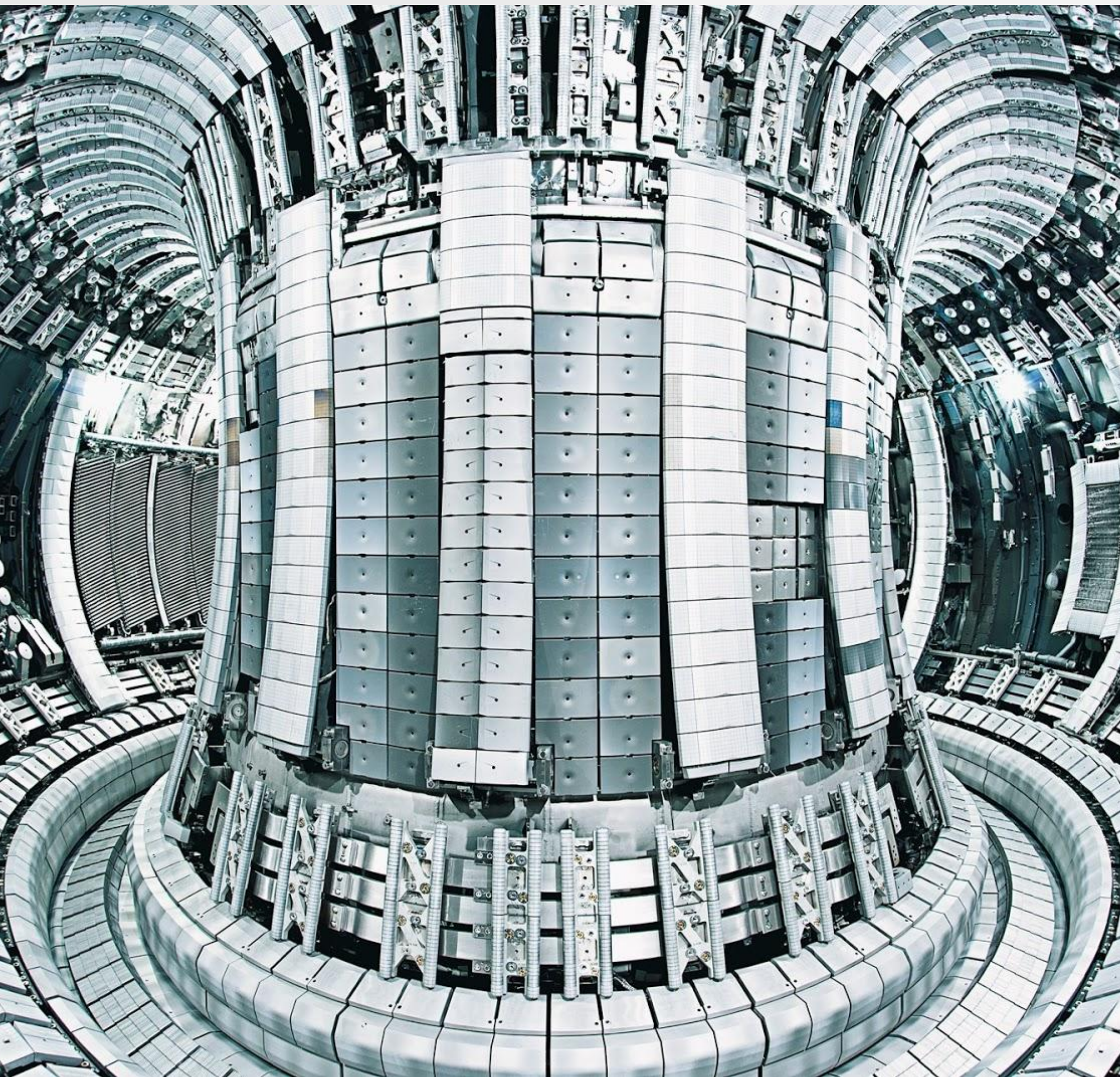
Decarbonization of food

Buildings & construction efficiency

New energy sources like nuclear and geothermal

Energy storage for solar and wind

....mostly new, unanticipated stuff!!!



## 20xx: CFS Fusion Rethinking Energy, Geothermal

# Education & consumer services 2050

Inclusive, diverse, fair, quality

Serve the human: learning, utility, entertainment, engagement

# Axes of Innovation: Education & Consumer Services

AI, can we eliminate the need to work?

...too many opportunities to talk about: AI tutors, elder care robots, personal advisors, personal doctors, ck12 education ...

**If there is a 90% chance of failure on a transformative project then we have a 10% chance of transforming the world. That's pretty great.**

**Rewarding, impactful & profitable ... calling all entrepreneurs!**

**Comments?**

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