



# SENECA SOLAR WEBINAR

Let's Build Solar Panel Factories for  
Underserved Communities

11 August 2022



Seneca Solar – Proprietary and Confidential

# PRESENTERS

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## Devon Hartman

Devon, Executive Director of CHERP, Inc, is focusing his 35 years of experience in architecture, construction, and strategic business development on the field of energy efficiency and solar PV. He is an expert in strategic business systems development, consumer-facing sales and marketing strategies and energy efficiency management operations in home performance. After retiring from his decades-long role as Co-Founder and President of HartmanBaldwin Design/Build, Inc., he founded CHERP, Inc. (Community Home Energy Revolution Project) to form collaborative partnerships with cities, counties, community organizations, and contractors to promote sustainable building practices and the reduction of fossil fuel use in buildings throughout California and beyond.

Devon's award-winning architecture and construction work has garnered over 50 national awards, including the Gold Nugget Grand Prize from the Pacific Coast Builder's Association and the Grand Prize Design Award from Remodeling Magazine. His work has been featured in numerous articles and interviews including Preservation, Wall Street Journal, Remodeling Magazine, LA Times and HGTV and he has worked in France, Peru, Brazil and Egypt. Devon is a General Contractor, Designer, Developer of VGM Santa Barbara, LEED AP, Green Point Rater, lecturer; consultant; and community organizer/educator.



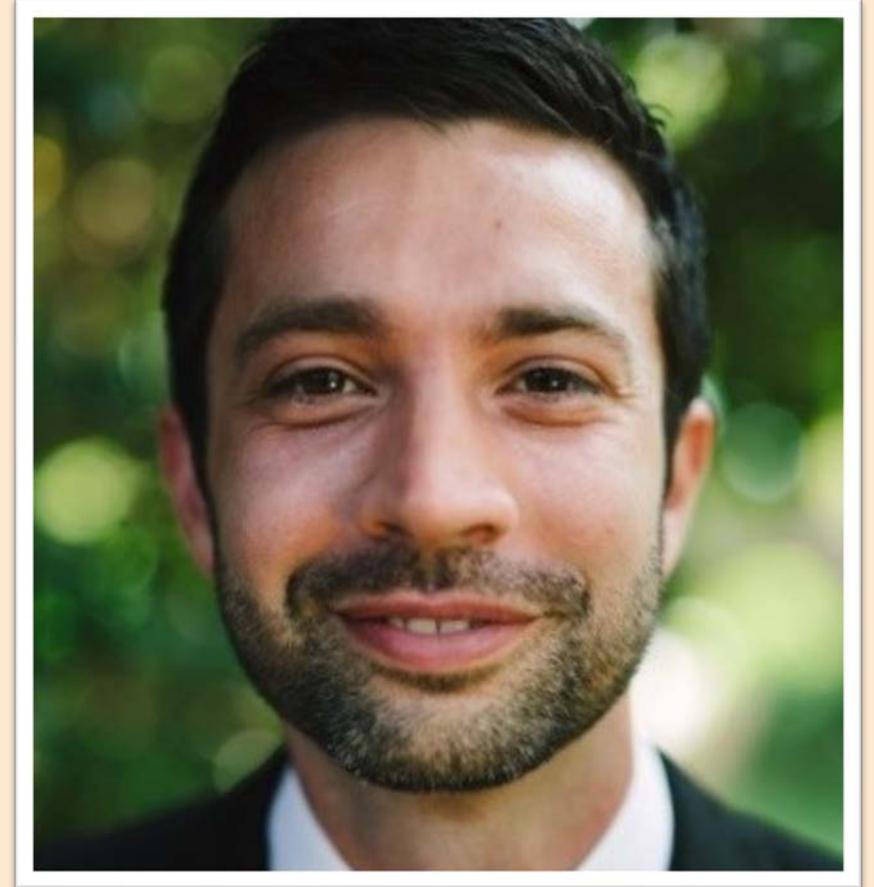
# PRESENTERS

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## Matt Renner

Matt serves as Vice President of Seneca Solar, a tribally owned and controlled Earth-healing solutions company focused on helping commercial customers achieve ambitious climate goals while supporting the long-term well-being of the Seneca Nation and other Indigenous people. His work focuses on partnership development and customer acquisition to create unprecedented collaboration and profitably accelerate climate action.

Matt has worked as a nonprofit executive in clean energy, climate policy, and journalism for over a decade, focusing on the near-term social and economic impacts of climate change. He began his career as an investigative reporter and later became the Executive Director of the World Business Academy to focus on the transition to a climate-constrained economic paradigm.



# PRESENTERS

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## Hanna Sheridan

Hanna, Engagement and Operations Coordinator for Seneca Solar, is an enrolled member of the Seneca Nation, Bear clan. Her upbringing, culture, and educational background have shaped her deep motivation to work for the betterment of Indigenous nations and to heal the relationship between people and Mother Earth, our shared home. Hanna graduated from Yale University, where she earned a bachelor's degree in History with a focus in Native Studies. At Yale, Hanna was deeply involved with the Yale and Ivy Native communities, which inspired her to work for Indian Country.

Hanna previously worked for the Seneca Gaming Corporation (SGC), a wholly owned, tribally chartered corporation of the Seneca Nation that operates all of the Nation's Class III gaming operations in Western New York. Hanna then moved to Seneca Holdings, LLC, whose purpose is to pursue non-gaming related investment and development opportunities to diversify and strengthen the Seneca Nation's economy. Through Holdings, Hanna joined the Seneca Solar team, where she is beginning her career in tribal energy, focusing on creating immediate progress and impactful change. In the fall of 2022, Hanna will begin an MBA program at the University of Buffalo.



# THE SENECA NATION



The Seneca, “Keeper of the Western Door,” were the largest of 6 Native American nations in the Iroquois Confederacy, a democratic government predating the US Constitution.

- › Total current enrolled population of > 8,000.
- › Nearly half live on the Allegany Territory and the Cattaraugus Territory in Upstate New York.
- › Over 10,000 acres of Seneca territory were flooded by dam, devastating the Nation.
- › Land is extremely important to Seneca and other Native people.
  - » Have always been stewards of land and prioritized caring for Mother Earth.
  - » Share a history of broken treaties and lands being taken away.



# SENECA NATION BUSINESSES

- › **Seneca Gaming** is a major economic driver for Seneca Nation.
  - » Income goes directly to fund education, culture, health, critical infrastructure, workforce development
- › **Seneca Nation Group** companies provide products and services to federal government.
- › **Seneca Holdings** aims diversify revenue sources for Seneca Nation.
- › **Seneca Solar** aligns most with Seneca Nation values.
  - » Ensuring positive impact on Seventh Generation
  - » Caring for the Earth
  - » Including and taking direction from Native people, who are experts in these areas but have historically been left out



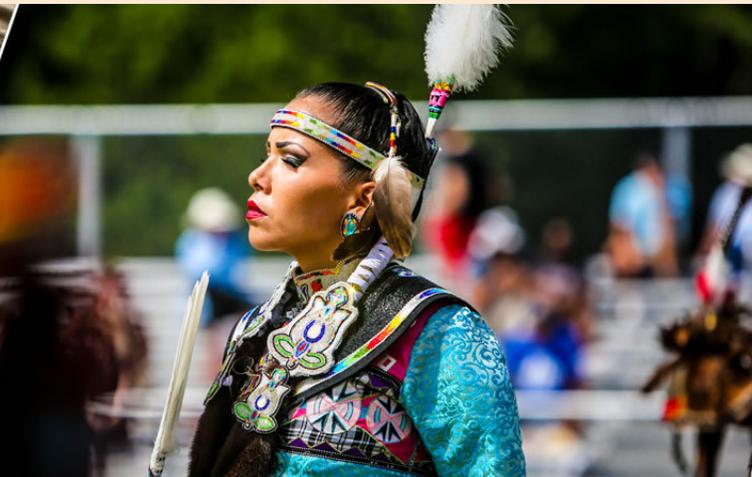
**SENECA**  
NATION OF INDIANS



# ABOUT SENECA SOLAR

Our mission is to **profitably and equitably deliver innovative renewable energy solutions that heal the Earth.** We strive to do the most good for current and future generations.

- › Seneca Solar is a division of Seneca Holdings, which delivers over \$250M in products and services annually.
- › Seneca Holdings is wholly owned by the Seneca Nation and provides income to support the on-territory needs of the members of the Seneca Nation.
- › Seneca Solar is certified under the National Minority Supplier Diversity Council (NMSDC).





# OUR VALUES. OUR LEGACY.

## Heal the Earth with Urgency

We feel urgency to maximize and accelerate healing of the Earth; our business is dedicated to restoring balance to humanity's relationship with our planet.

## Deliver Exceptional Solutions for Our Clients

We are professionals dedicated to exceeding expectations of our customers; we hold ourselves to delivering products and services of the highest quality.

## Train and Employ Native People and Underserved Communities

We are committed to ensuring that Senecas and other Indigenous people around the world can participate in the clean-energy economy.

## Advocate for Future Generations

The Native principle of the Seventh Generation compels us to advocate for future generations; Seneca Solar is a financial investment for future Senecas and an investment in humanity.

## Facilitate Thoughtful Collaboration

Accelerating the transition to renewable energy at speed and scale will require unprecedented collaboration. With our partners, we strive to do the most good.



# OUR SERVICES

We help our clients achieve their goals while **maximizing benefits to the environment and society**. We offer:

- › **Strategic advisory services:** We help clients develop collaborations, strategies, and projects that meet the goals of diverse internal and external stakeholders. This includes helping clients identify and realize advanced attributes that maximize the climate and ESG benefits of their sustainability projects – we call these “+1s”.
- › **Consulting and project management:** We leverage our experience and strength in project execution to help clients to manage projects, maximize benefits (+1s), and proactively mitigate risks of environmental sustainability projects.
- › **Solution development and delivery:** We have the capacity, experience, and partners to deliver a wide range of Earth-healing solutions across the U.S. and abroad.
- › **Tribal engagement:** We bridge trust gaps with tribes and other Indigenous groups on environmental project planning and delivery.

# SENECA ENERGY

- › Utility department of the Seneca Nation.
- › Leveraged DOE & NYSERDA grants for 1.5 MW wind turbine project.
- › Developed 2 MW solar array on Allegany Territory.
- › Manage natural gas, renewable projects, and broadband services for residents and businesses of the Seneca Nation.



**SENECA  
ENERGY** LLC

**Ensuring the security, prosperity, and independence of the Seneca Nation by building a sustainable energy platform through wind and solar while also lowering energy costs for the Seneca Nation and its residents.**



# SENECA ENERGY PORTFOLIO OF PROJECTS

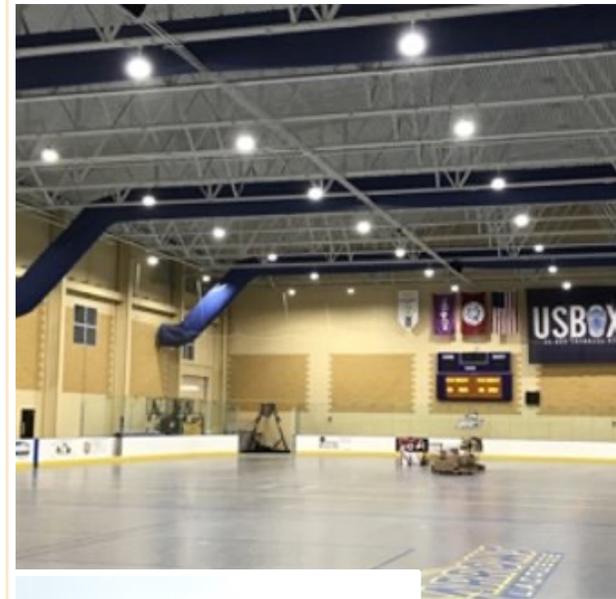
**2014** Plugged and abandoned 30 natural gas wells on Cattaraugus Territory.

**2017** Developed two renewable energy projects for the Seneca Nation.

- » On Cattaraugus Territory, secured \$2.5 million in grant funding from DOE and NYSERDA to construct a 1.5 MW wind turbine that significantly defrays annual energy costs for the Seneca Nation.
- » On Allegany Territory, built a 2 MW solar array on 7.5 acres, generating enough electricity to power over 200 homes annually.

**2019** Converted Seneca Nation-owned facilities in Allegany and Cattaraugus to LED lighting; incorporated LED technology in all new construction.

**2020** With Seneca Telecommunications, began construction on a 50-mile fiber network on Cattaraugus Territory that give residents and businesses access to high-speed broadband for internet and digital phone service.



**SENECA  
ENERGY LLC**



**SENECA  
SOLAR**  
A DIVISION OF SENECA HOLDINGS

# WORKFORCE DEVELOPMENT



With jobs, training, and mentoring, Seneca Solar is building a **Tribal workforce** and Native enterprise capacity to **benefit current and future generations.**

In all our business activities, Seneca Solar prioritizes workforce and skills development for Senecas and other historically underserved communities.

We are committed to hiring a local workforce for our projects that includes historically underserved communities and prioritizes hiring Indigenous people.

Through workforce development and building long-term economic self-determination, we are empowering the communities we serve to participate in the new clean energy economy.



# Let's do the most good. Together.

To heal the Earth, we need **unprecedented collaboration and urgency.**

Collaborate with us to maximize your impact:

Deploy **profitable renewable energy solutions** that meet your business needs.

Enable a clean-energy economy that **benefits the Seneca Nation and other Indigenous communities.**

Help us **build a tribal workforce** — with jobs, training, and mentoring — that can meet increasing demand for trained labor.



# CONTACT INFORMATION

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**Seneca Solar, a division of Seneca Holdings**

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Chantilly, VA 20151

[www.senecasolar.com](http://www.senecasolar.com)





# CHERP Solar Works

an **American** Solar Manufacturing Renaissance

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We build micro solar factories  
with non-profit organizations  
in disadvantaged communities  
across America



**THE FIRST NON-PROFIT SOLAR MODULE ASSEMBLY FACTORY IN THE WORLD**

POMONA  
CALIFORNIA



 an American Solar Manufacturing  
Renaissance



**OUR MISSION:**

**STOP GLOBAL WARMING  
BRING BACK MIDDLE-CLASS JOBS  
STIMULATE LOCAL ECONOMIES  
FOCUS ON JUSTICE AND EQUITY**



# HOW WILL WE DO THIS?

## OUR STRATEGIC ADVANTAGE

1

**MOST ADVANCED SOLAR TECHNOLOGY**

2 Patents issued, 6 Patents pending

+

2

**BLENDED NON-PROFIT / FOR-PROFIT BUSINESS MODEL**

**= COMPETITIVE ADVANTAGE OVER  
TOP GLOBAL COMPETITORS**



1

# Most advanced solar technology

Head-to-head field trials against conventional panels:  
zero hot-spots / more power

**HARVEY  
MUDD  
COLLEGE**

## our technology:

- Made in America in the heart of our most disadvantaged communities
- Radically simplified manufacturing
- Industry standard tooling and processes
- Fewer, less expensive materials / parts
- More powerful / longer life modules
- Lower Levelized Cost Of Energy (LCOE)

*Competitive advantage over global competitors*

1

# validated/field tested technology



...we tested and confirmed Kernahan's panel-level solution that anticipates and eliminates hot-spots in real time.

From upcoming peer reviewed article in IEEE Journal of Photovoltaics

Dr. Richard Haskell, Professor of Physics, Harvey Mudd College

Dr. Peter Saeta, Professor of Physics, Harvey Mudd College

[Link to IEEE journal Article](#), [Link to White Paper](#)

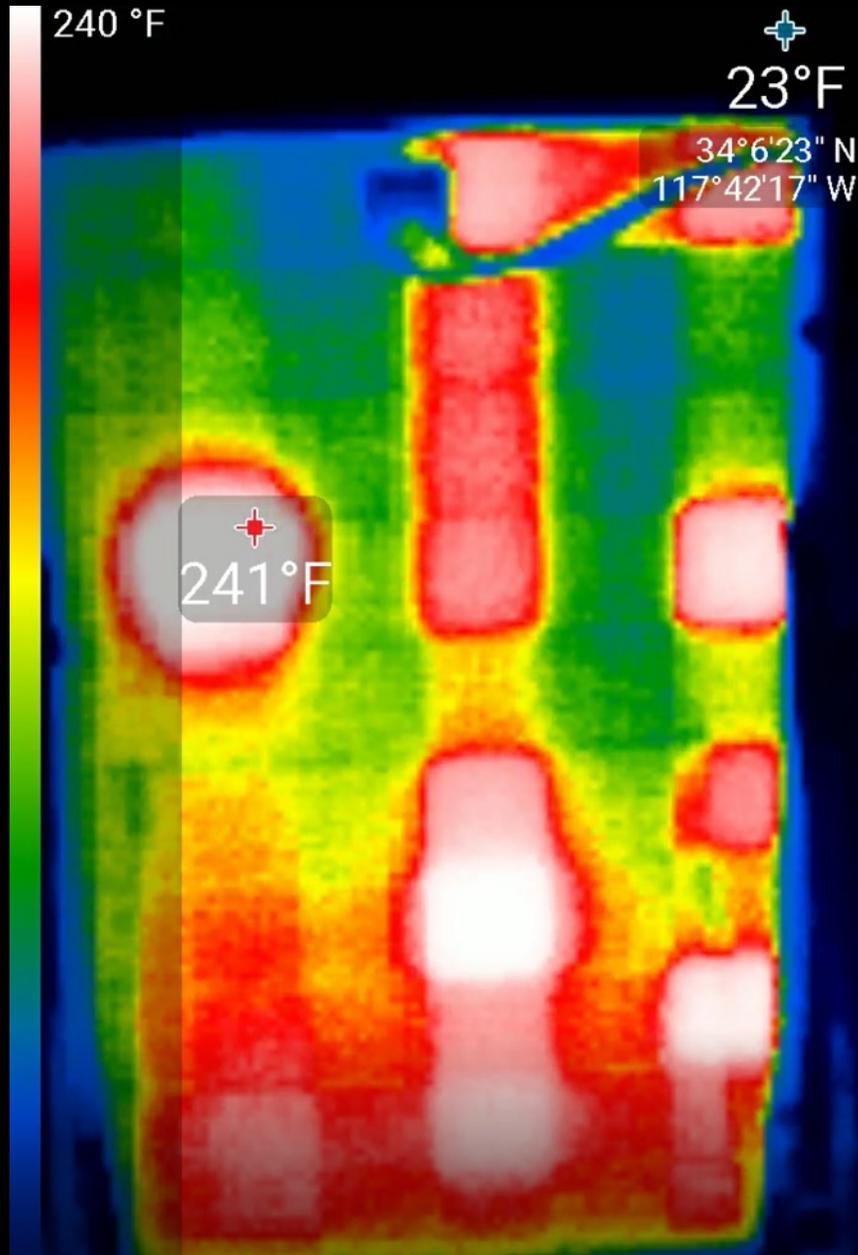


...negative voltage bias leads to the flow of reverse current across the junction in a cell, resulting in failure of the cell and subsequently, the panel. IdealPV has been able to overcome this device, panel and system limitation by incorporating its patented Forward Only Zero Hot Spot technology.

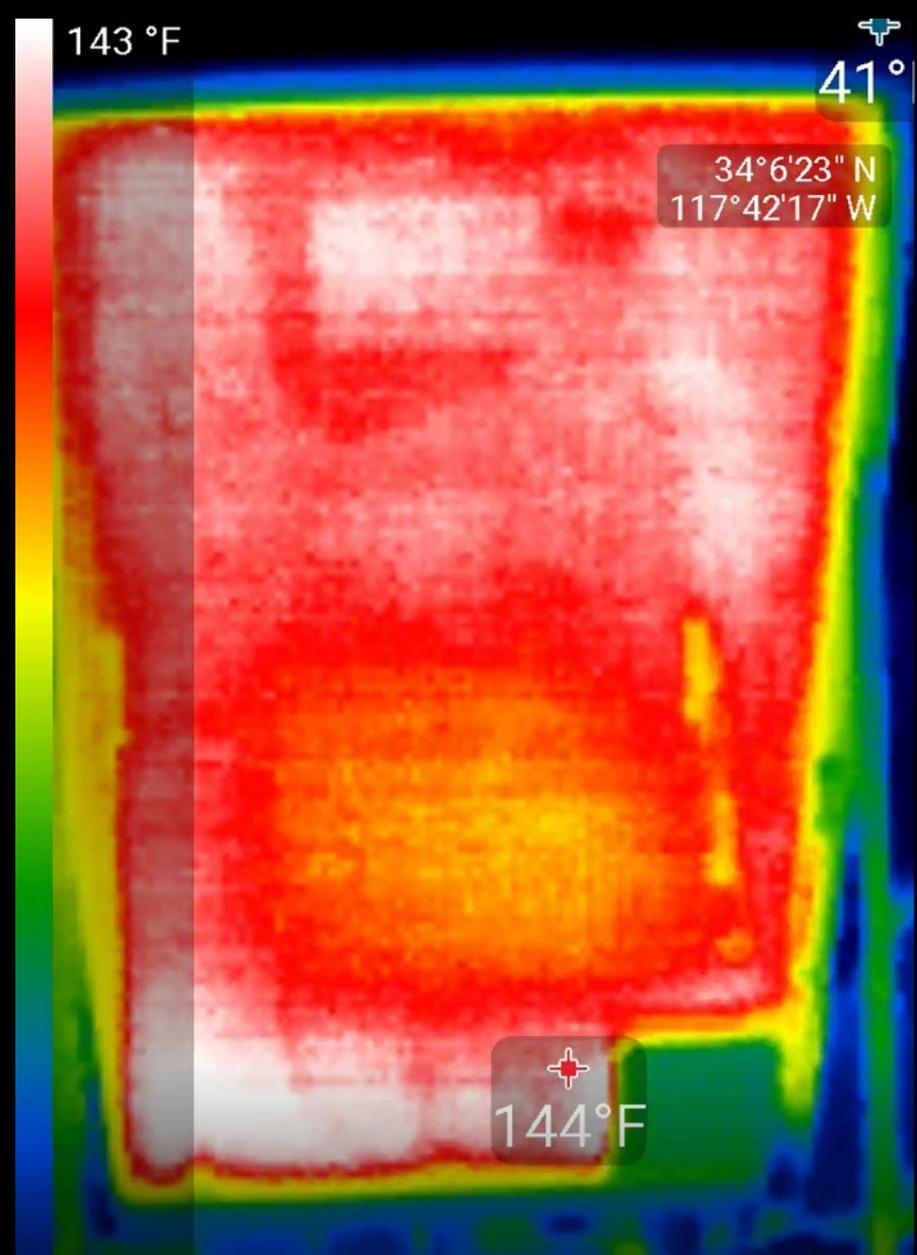
Dr. N.M. Ravindra, Professor of Physics, New Jersey Institute of Technology

[Link to confirmation](#)

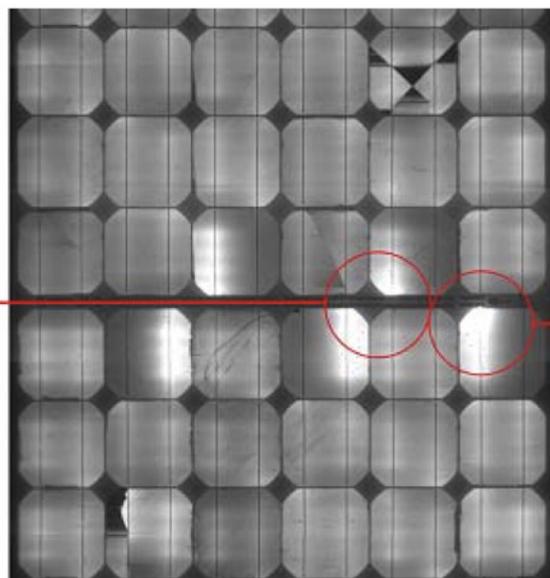
# Russel Ohi, 1941



# Kent Kernahan, 2015



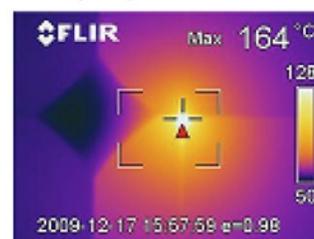
T(MPP) = 132 °C  
T(SC) = 215 °C



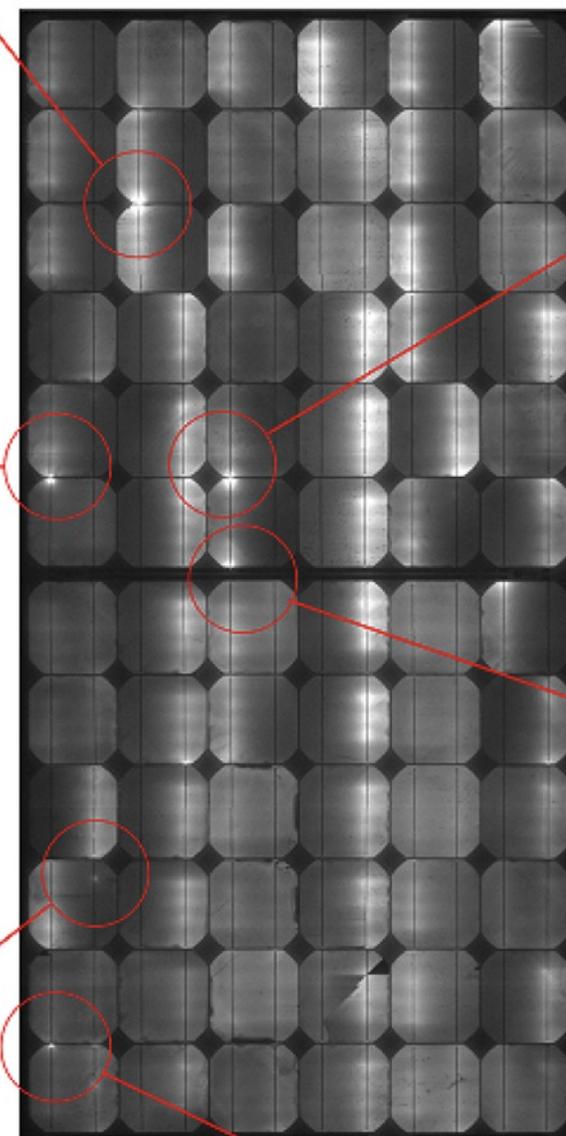
T(MPP) = 91 °C  
T(SC) = 126 °C



T(MPP) = 113 °C  
T(SC) = 164 °C



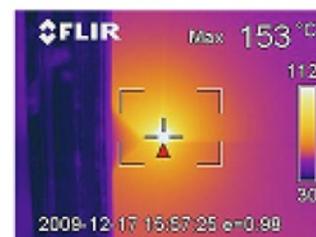
## Sample A



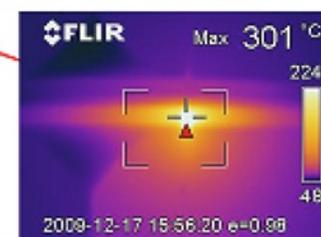
T(MPP) = 100 °C  
T(SC) = 153 °C



T(MPP) = 110 °C  
T(SC) = 153 °C



T(MPP) = 144 °C  
T(SC) = 301 °C



T(MPP) = 71 °C  
T(SC) = 201 °C

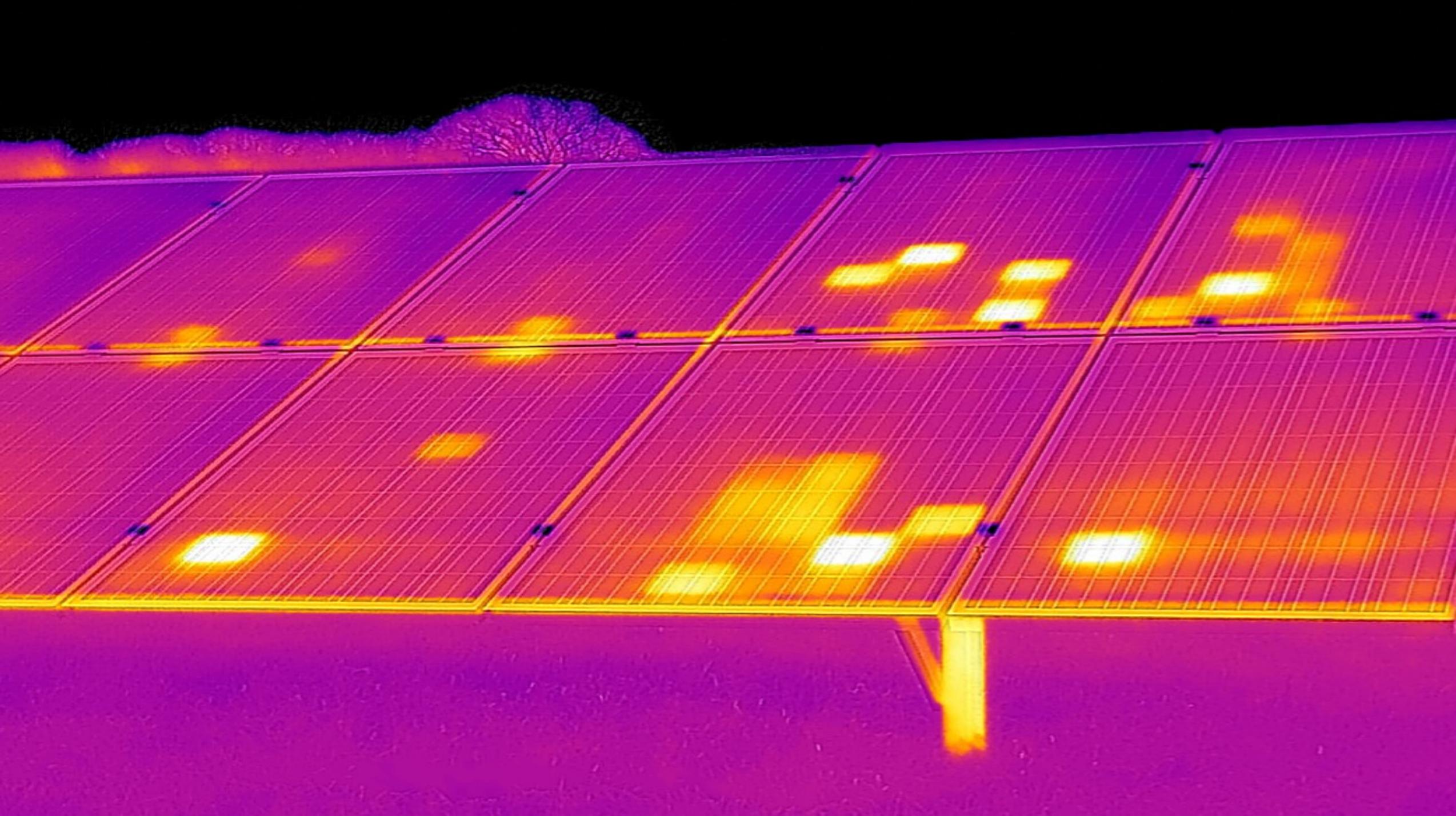


T(MPP) = 96 °C  
T(SC) = 137 °C



Some broken cells were observed in module

The most severe hot spots observed in the



FIRE SALE —

# After seven roof fires, Walmart sues Tesla over solar panel flaws





**HARVEY  
MUDD  
COLLEGE**

## **MITIGATION OF RISK – SAFE SOLAR**

- **FRSS**
- **SAS**
- **Zero single point to catastrophic failure**
- **Failure Mode Effects Analysis (FMEA)**
- **Redundant interconnects**
- **Repairable cells**
- **Upgradeable electronics – software defined**

# Real-Time Anticipation and Prevention of Hot Spots by Monitoring the Dynamic Conductance of Photovoltaic Panels

William P. Lamb, Dallon E. Asnes, Jonathan Kupfer, Emma Lickey, Jeremy Bakken, Richard C. Haskell, Peter N. Saeta, and Qimin Yang

**Abstract**—Hot spotting in photovoltaic (PV) panels causes physical damage, power loss, reduced lifetime reliability, and increased manufacturing costs. The problem arises routinely in defect-free standard panels; any string of cells that receives uneven illumination can develop hot spots, and the temperature rise often exceeds 100°C in conventional silicon panels despite on-panel bypass diodes, the standard mitigation technique. Bypass diodes limit the power dissipated in a cell subjected to reverse bias, but they do not prevent hot spots from forming. An alternative control method has been suggested by Kernahan [1] that senses in real time the dynamic conductance  $|dI/dV|$  of a string of cells and adjusts its operating current so that a partially shaded cell is never forced into reverse bias. We start by exploring the behavior of individual illuminated PV cells when externally forced into reverse bias. We observe that cells can suffer significant heating and structural damage, with desoldering of cell-tabbing and discolorations on the front cell surface. Then we test PV panels and confirm Kernahan’s proposed panel-level solution that anticipates and prevents hot spots in real time. Simulations of cells and panels confirm our experimental observations and provide insights into both the operation of Kernahan’s method and panel performance.

**Index Terms**—hot spots, hot-spot-prevented PV panels, maximum power point trackers, photovoltaic cells, photovoltaic systems, solar power generation

## I. INTRODUCTION

A growing body of literature recognizes the dangers of hot spots formed in photovoltaic panels as shaded cells

but since that time the power generated on a panel has increased by a factor of three, providing three times the power to feed a hot spot.

While bypass diodes are routinely included in the design of present-day PV panels, they have been termed “inadequate” or “insufficient” to prevent hot spots in currently available high-power panels [3], [7], [13]–[15]. Multiple research groups have proposed alternative techniques to detect the onset or presence of hot spots [2]–[4], [8]–[12], and in some proposed techniques, additional actions are recommended to mitigate, prevent, or isolate hot spots [3], [4], [7], [9], [10]. We are aware of only one technique that can both sense the onset of a hot spot *and* take action in real time to prevent its occurrence, thereby avoiding potential damage to the panel [1]. This patented technique has negligible dead time and can continuously handle rapid changes in shading of cells.

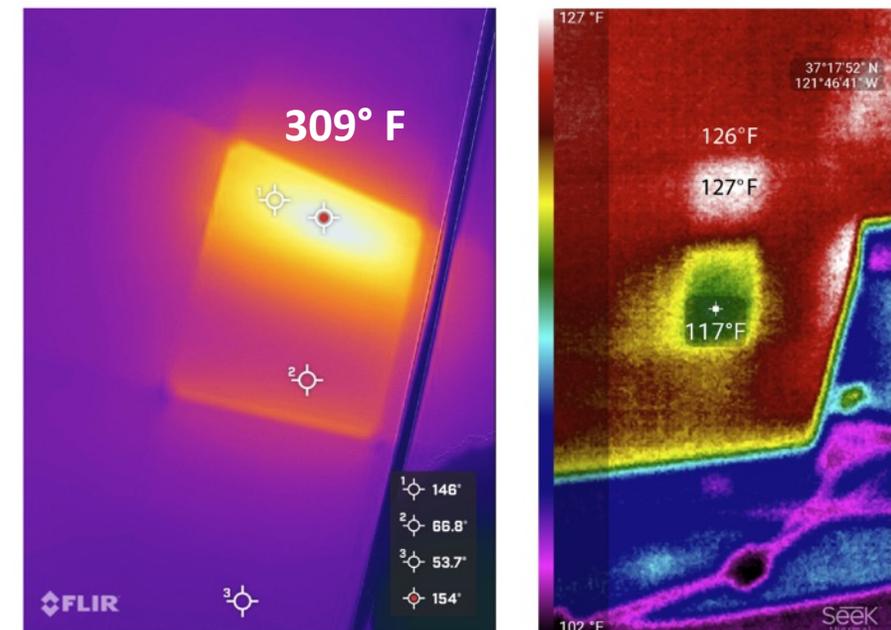
Kernahan’s technique [1] constantly monitors the dynamic conductance of a string of cells, defined as the absolute value of the local slope  $\tilde{G} = |\Delta I/\Delta V|$  at the operating point on the  $I$ - $V$  curve. (We will use a tilde to indicate the *dynamic* conductance,  $\tilde{g}$  for a *cell* and  $\tilde{G}$  for a *string*.) As discussed in Section III, a shaded cell that is in danger of being forced into reverse bias by the fully illuminated cells in the string exhibits a progressively smaller cell conductance, which quickly dominates the conductance of the entire string. Kernahan’s technique simply adjusts the string current to keep



Richard C. Haskell, PhD



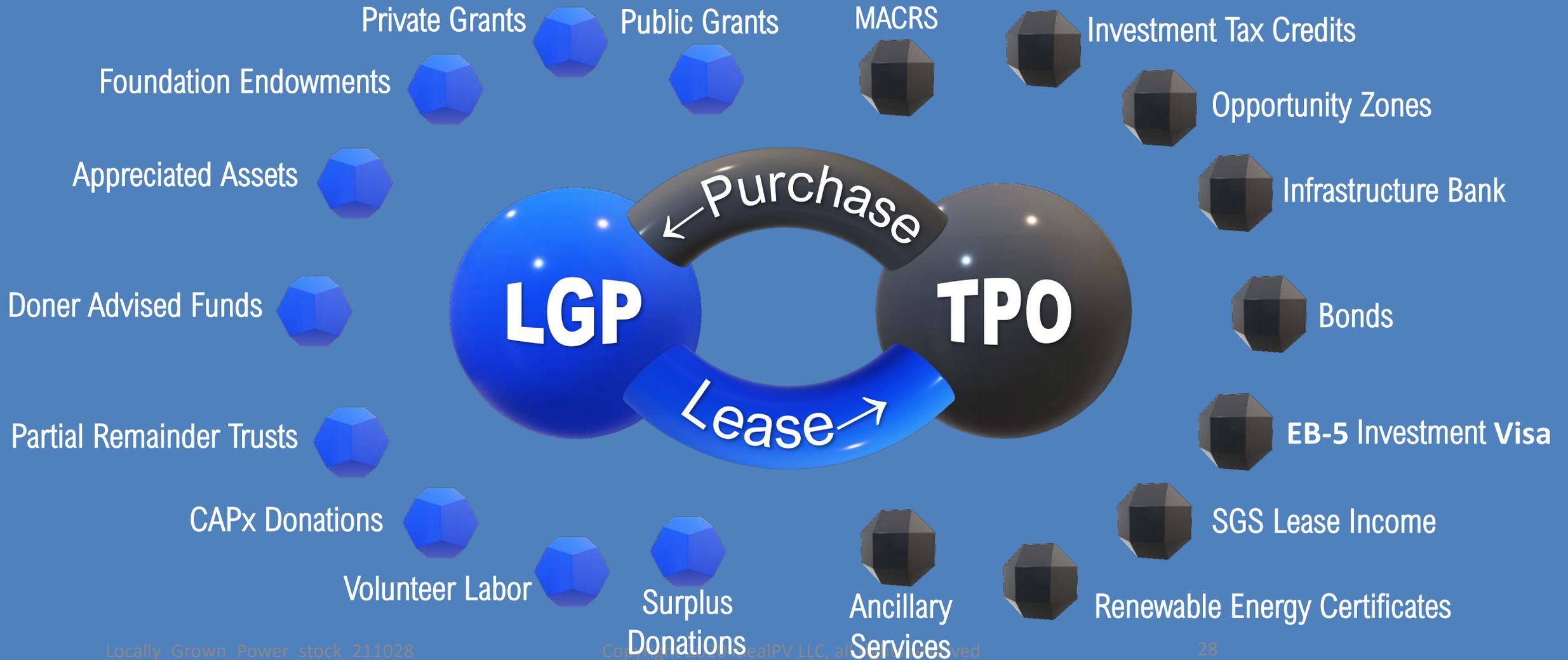
Peter N. Saeta, PhD



2

# blended non-profit + for-profit business model

personal choices AND corporate incentives





Mt Baldy

Azusa

Covina

ALTA LOMA

Ran

Cucar

Claremont

Upland

Montclair

Pomona

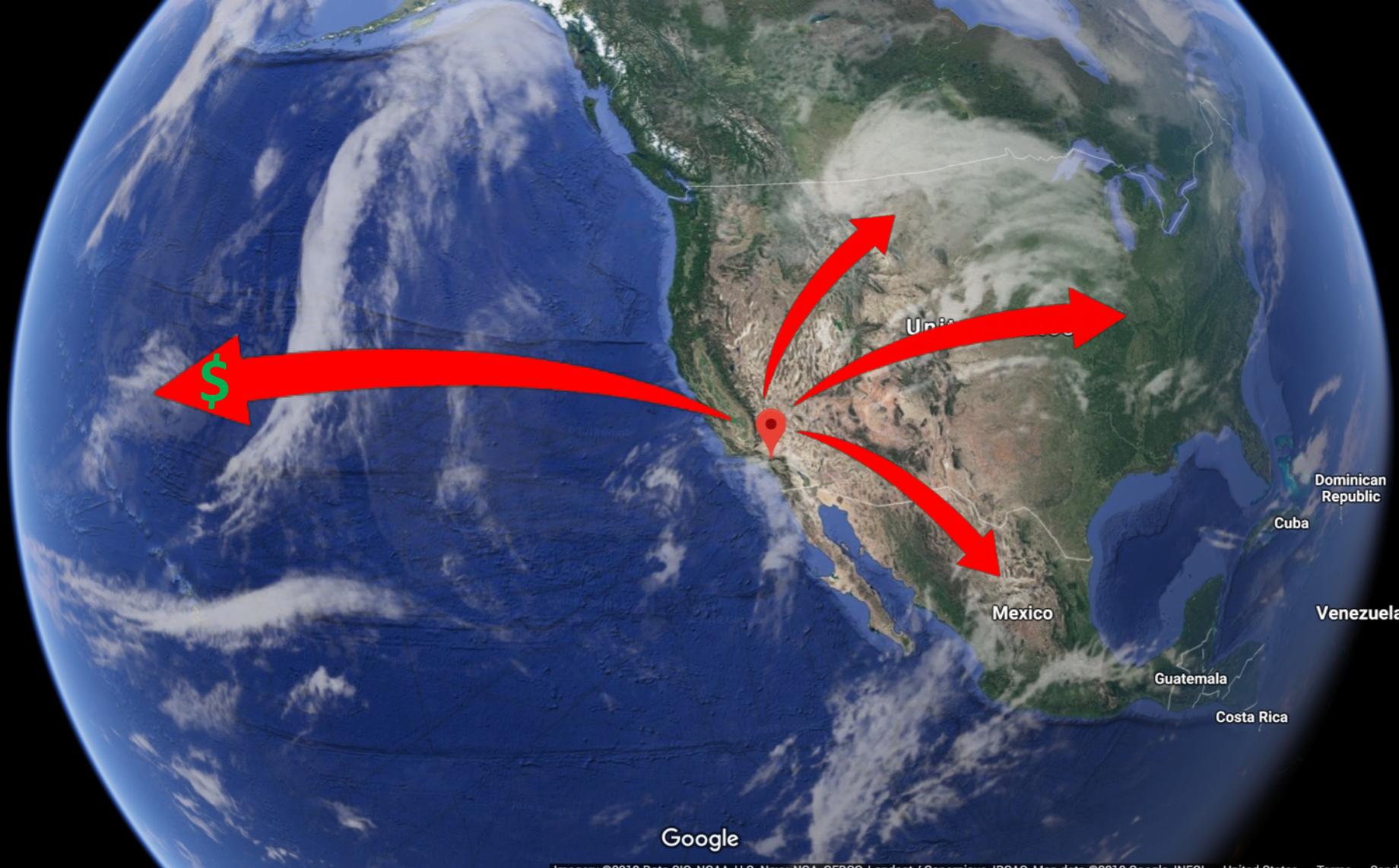
Ontario

Diamond Bar

Chino

BAPS Shri Swaminarayan Mandir

Chino Hills



Google



is forest

Mt Baldy

Azusa

San Dimas

Claremont

Upland

ALTA LOMA

Ran

Cucar

ovina

Montclair

Ontario

Pomona

Diamond Bar

Chino

BAPS Shri Swaminarayan Mandir

Chino Hills

Chi

City Of Pomona Boundary

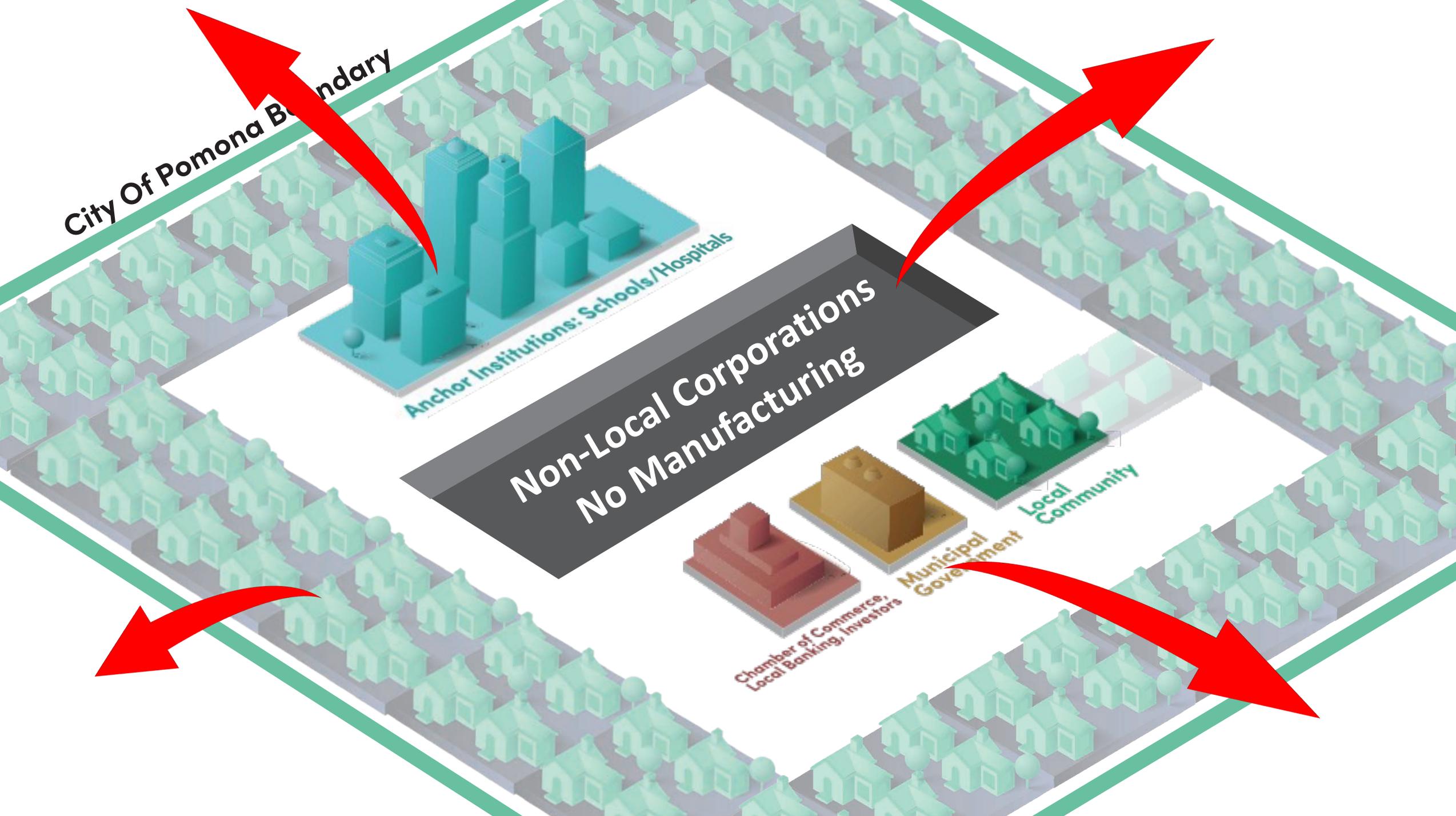
Anchor Institutions: Schools/Hospitals

Non-Local Corporations  
No Manufacturing

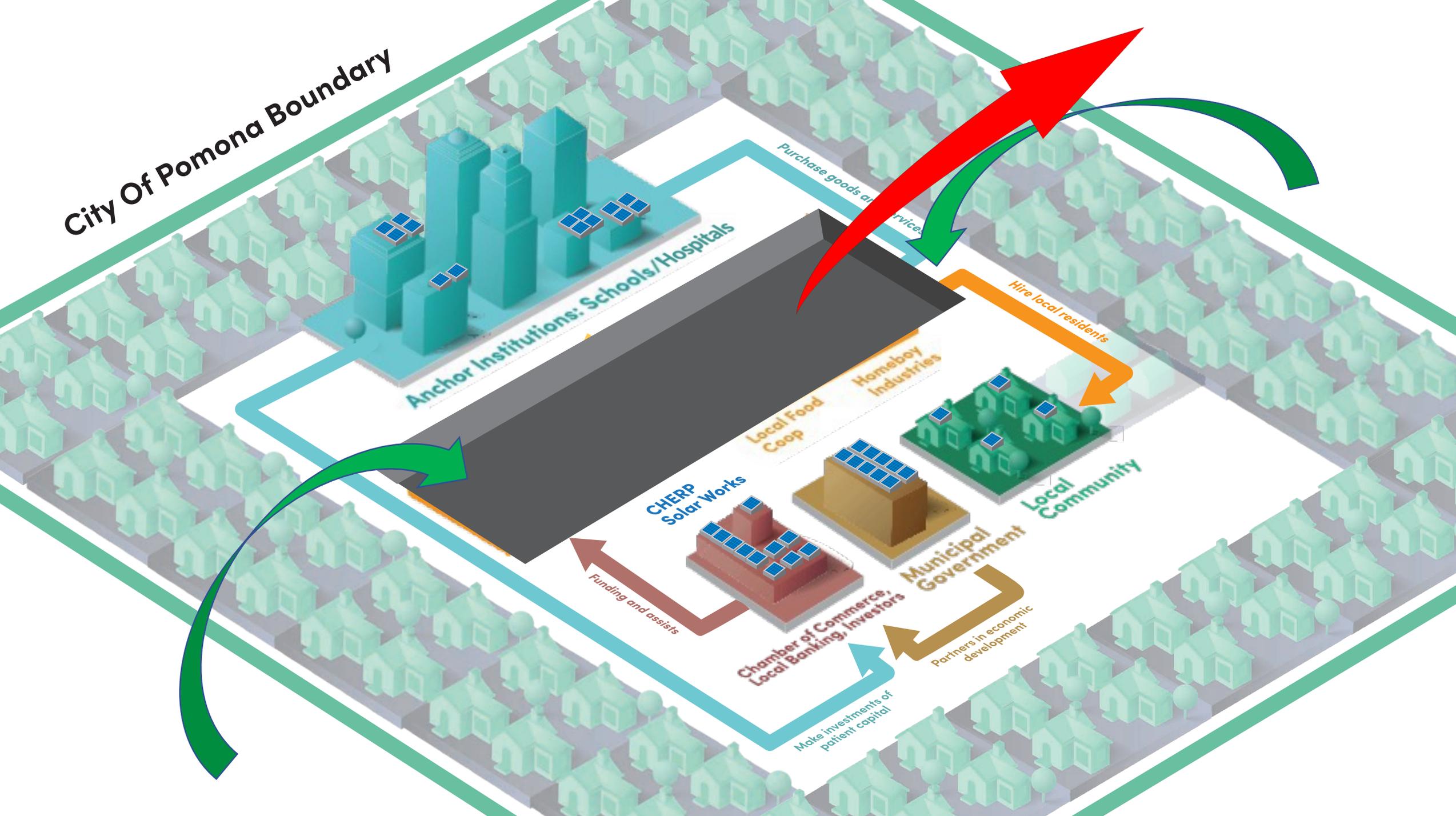
Local Community

Municipal Government

Chamber of Commerce,  
Local Banking, Investors



City Of Pomona Boundary



Anchor Institutions: Schools/Hospitals

Purchase goods and services

Hire local residents

Local Food Coop

CHERP Solar Works

Municipal Government

Local Community

Chamber of Commerce, Local Banking, Investors

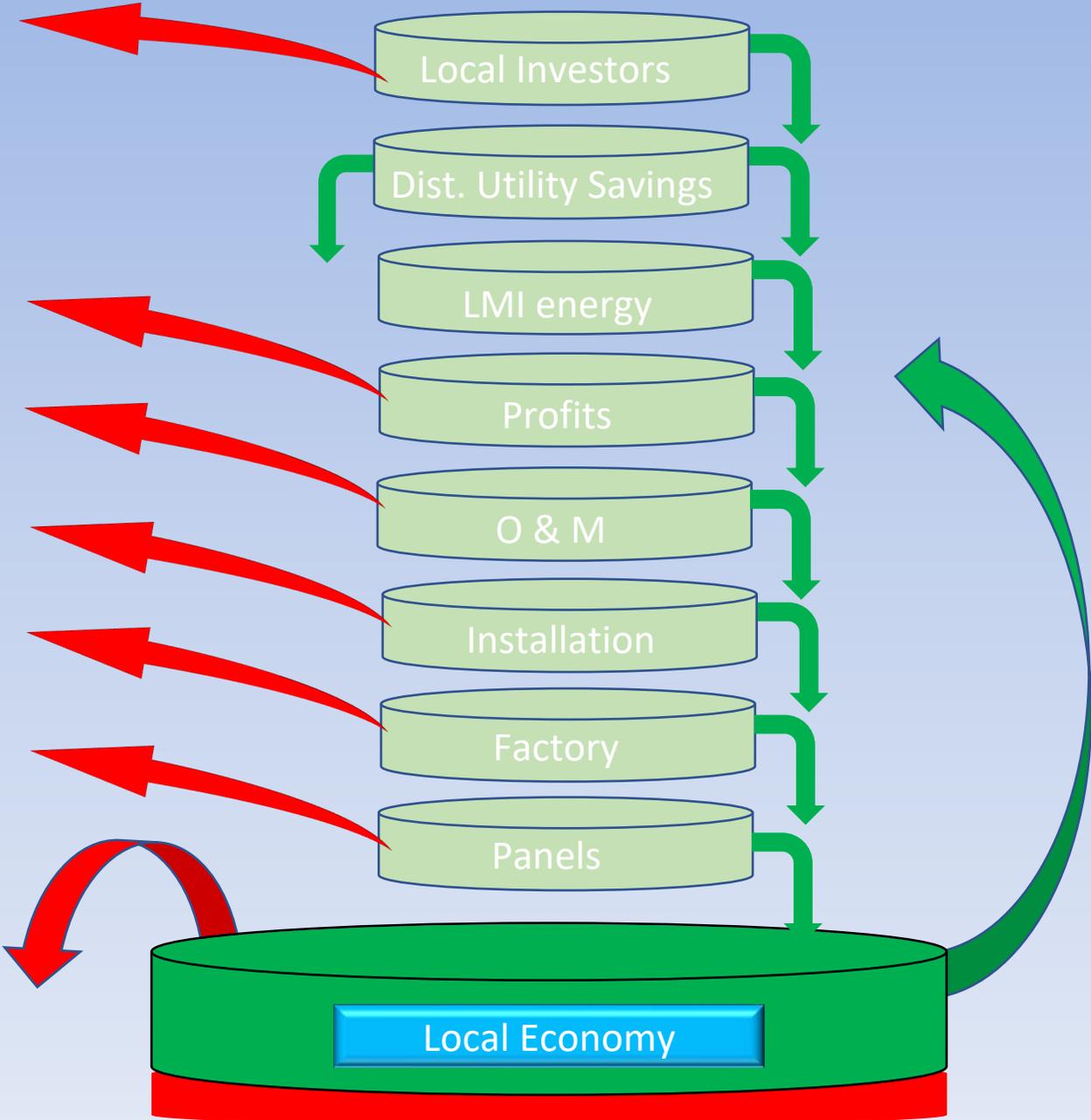
Funding and assists

Partners in economic development

Make investments of patient capital



# Values Aligned Power Purchase Agreement - VAPPA



Economic Expansion  
Multiplier = 7

Based on REMI Input/Output Model



School District paying Utility	\$0.23	
School District pays CHERP	\$0.14	
<b>School District saves</b>	<b>\$0.09</b>	<b>39%</b>
CHERP produces energy for	\$0.06	
CHERP sells energy for	\$0.14	
<b>CHERP makes per kWh</b>	<b>\$0.08</b>	

**TARGET MARKETS**  
 SCHOOL DISTRICTS  
 GOVERNMENTS  
 UNIVERSITIES  
 COMMUNITIES (CCAs)  
 OTHER NON-PROFITS

**VAPPA**      \$.23 kWh

**Business Model:**  
 energy sale profits to make  
 free energy for LMI families

**TPO(LLC)**

\$ \$0.06



\$0.14

**\$ Profits**

**HOMEBOY INDUSTRIES**

**SOLAR FACTORY**  
East Los Angeles



**LOCAL COMMUNITY**  
 LOW INCOME  
 HOUSEHOLDS &  
 RENTERS



# An American Solar Manufacturing Renaissance

...starting in Los Angeles, California



NON-PROFIT  
FACTORY BUILDERS

+

***Locally Grown Power***<sup>tm</sup>  
***LGP***

NON-PROFIT  
FACTORY NETWORK

# Locally Grown Power<sup>tm</sup> LGP

## AMERICAN SOLAR MANUFACTURING NETWORK

...starting in Los Angeles California



- Local Non-Profits NOT Global
- Equity/Justice Focused
- Mutually Cooperative
- Resilient NOT Encumbered
- Regenerative NOT Extractive

## Prototype Factory

**GHG: 26,700 MT CO<sup>2</sup> per year**

**JOBS: 763 Dir/Indirect**

**ECONOMY: \$147 million 15 yr.**

**JUSTICE: 6,000 LMI HOMES**

**\$6.5M D.P.I. per year**

## 10 Factories

**GHG: 260,700 MT CO<sup>2</sup> per year**

**JOBS: 7,630 Dir/Indirect**

**ECONOMY: \$1.47 billion 15 yr.**

**JUSTICE: 60,000 LMI HOMES**

**\$60.5M D.P.I. per year**





# The Los Angeles County Sustainability Plan

boldest county sustainability plan in the nation

## GOAL 7A:

10 GW new distributed energy resources by 2045

## PROBLEM

30 million new solar modules by 2045

\$5 billion leaving LA economy and the country

SOLUTION:



LA Factories  
For the Future

- 15 solar factories
- 30 million solar modules
- >10,000 jobs
- \$5B invested locally
- \$35B GDP expansion

Multiplier of 7 - RIMSII

**Locally Grown Power™ LGP**

**SOLAR MANUFACTURING NETWORK**







# Our Strategic Partners

## Partners in Factory Replication



## Supporters

