cascade catalysts

CASCADE CATALYSTS, INC. OVERVIEW

Core developer of intelligently designed catalyst systems that facilitate more efficiency and less waste for the world's most important industrial processes

The low cost, bio-mimicking technology beneficially impacts $30 trillion in annual industrial production including energy generation, energy storage, EV batteries, wind & solar, fertilizers, clean water, predictive geophysical surveys, semiconductors, reforming and cracking, plastics & glass manufacturing, emissions abatement, fine chemical synthesis and others

Cascade's innovations significantly reduce balance-of-plant expenditures, enable market entry & real competition, produce more affordable products for consumers and provide for distributed production that create local jobs within a more safe & robust national infrastructure

Inspired by nature's own catalysts, all Cascade process designs operate effectively at atmospheric pressure and low-to-moderate temperatures enabling highly cost-effective deployments capable of--

solving-for-one

WHAT CAN YOU DO BY SOLVING-FOR-ONE?

- One idea
- One EV car
- One solar & wind farm
- One apartment building
- One desalination plant
- One remote piece of land
- One municipal water supply
- One home
- One town
- One region

Efficient, affordable abundance without waste

CATALYSTS: 30 TRILLION REASONS WHY THEY SHOULD MATTER TO YOU

- Catalysts forge the conversion of two or more inputs into new products-- and catalysts can be reused over and over again. Nature does this very efficiently in ambient conditions using enzymes, while man-made catalysts often require high pressure & heat to become active. Nature's catalysts are far more efficient, less costly and less polluting

- Man-made catalysts enable more than two-thirds of all manufactured products in the world—approximately $30 trillion annually. This includes the entire industries of energy generation, energy storage, EV batteries, wind & solar, fertilizers, clean water, predictive geophysical surveys, semiconductors, reforming and cracking, plastics & glass manufacturing, emissions abatement, fine chemical synthesis and others

- Until now, no one has been able to understand why catalysts actually do what they do—catalysts are discovered and then technology tries to find appropriate uses for them

- Many catalyst-driven processes were discovered before WWII and have remained largely unchanged since then

So…

(Continued)

- The most active catalysts to date involve expensive platinum group metals and rare earth elements, but the scarcity and high cost of these elements limit their widespread use
- Most industrial catalysts require very high pressure & heat to operate effectively and give off unwanted byproducts like CO2, NOx and waste heat both in order to become active and when they actually produce products
- It is difficult to fundamentally improve the characteristics of man-made catalysts if you don't know how and why they work
- All too often dominating corporate interests use the high capital cost of inefficient manufacturing to limit the market entry of competitors-- that's about to change
- Cascade understands a great deal about why catalysts do what they do, and this means that optimized catalysts can be modeled and designed for most industries
- In fact, we know enough about catalyst design that we can remove expensive and exotic elements from our catalysts and replace them with more earth-abundant materials while becoming far more efficient and far less polluting—more like nature's blueprint
- Fundamental innovations in man-made catalysis reverberate loudly throughout the entire world economy

CARBON: THERE'S AN EASY WAY, AND A HARD WAY

- There are two specific characteristics that natural catalyst conversion processes possess that make them eminently more desirable than traditional man-made processes:

  (1) their ability to operate effectively at ambient temperature and pressure, and
  (2) their capacity to do so without waste (consumption and reuse)

- Nature's design provides a blueprint for us to model more efficient catalyst-driven conversion systems

- Enzymes— nature's catalysts— are essential for all living things. Without enzymes there would be no life anywhere. Enzymes convert inputs into new compounds without the need for high pressure and high temperature, meaning minimal activation energy is required and no unwanted waste products are produced. The total amount of carbon on earth never changes— nature has simply developed highly efficient ways to convert it and reuse it in beneficial ways

- In contrast, most of the catalyst-driven conversion processes we currently use in industry to produce more than two-thirds of the world's products were discovered before WWII. These processes require very high pressure & heat in order to operate and still produce far more waste products like CO2 and NOx than we would like

What to do?...

ABUNDANCE WITHOUT WASTE

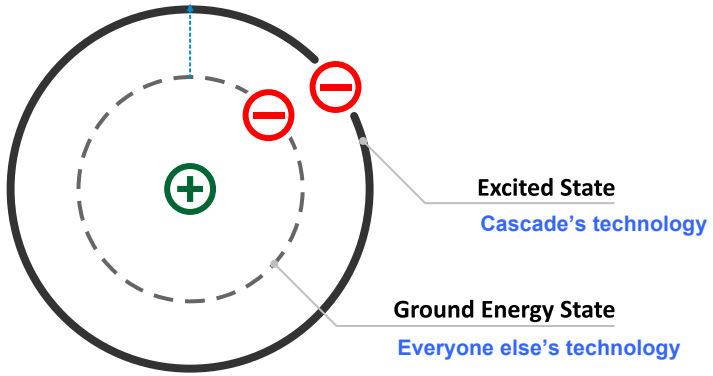
- The limiting factors in addressing the issues of carbon and efficiency are knowledge and will, not brute force or coercion
- Knowledge is the key to creating highly efficient catalysts that mimic those processes found in nature that operate so effortlessly. "Abundance without waste" does not serve the interests of those powerful entities that rely upon inefficient, expensive and wasteful processes to limit market entry and deny competition. Those are not democratic ideals
- The real answers are there, we just need the will to embrace and employ them
- All of Cascade's catalyst-driven processes operate effectively at atmospheric pressure and low-to-moderate temperatures. While we don't pretend to know everything about catalysts, we are learning to better mimic nature's designs every day. In fact, modern Cascade catalysts can now be designed to effectively consume, convert and re-use waste products like CO2, NOx and waste heat that are common to the vast majority the pre-WWII catalyst processes still in use. For example, the Haber-Bosch process (1910) makes most of the world's ammonia & fertilizers yet consumes more than 2% of global energy due to high pressure & heat requirements, and produces almost the same percentage of global CO2. We can do better
- The easy way is to mimic nature, the hard way is to keep doing what we've been doing. Abundance without waste is preferable to the planet and to each one of us

TECHNOLOGY OVERVIEW:
DOING FAR MORE WORK WITH FAR LESS ENERGY

- Every technological process strives to be effectively operational with the least effort & expense—on our planet the ideal parameters are therefore atmospheric pressure and ambient heat
- All Cascade innovations in catalysis consist of generally two distinct parts:

1. **A quantum excitonic generator** that harnesses massive amounts of naturally available energy contained within every atom of every element and compound (common core technology)
2. **An optimized elemental formula** purposefully designed to direct quantum energy to do specific work as quickly and efficiently as possible (specific to each application)

An atom with nucleus (+) and electrons (-)



Oxygen:

Excited state oxygen molecules contain 25 times more energy (eV) than ground energy state oxygen.

Cascade's innovative, near-ambient catalyst technology is based upon actionable understandings in quantum modeling and design including the key roles of:

1-nanostructures (specific sizes)
2-quantum chemical structures
3-surface concentrations of excitons
4-channeling of excitonic condensate to do work

EXAMPLE: QUANTUM-ELECTRICAL POWER GENERATION AND STORAGE SYSTEMS

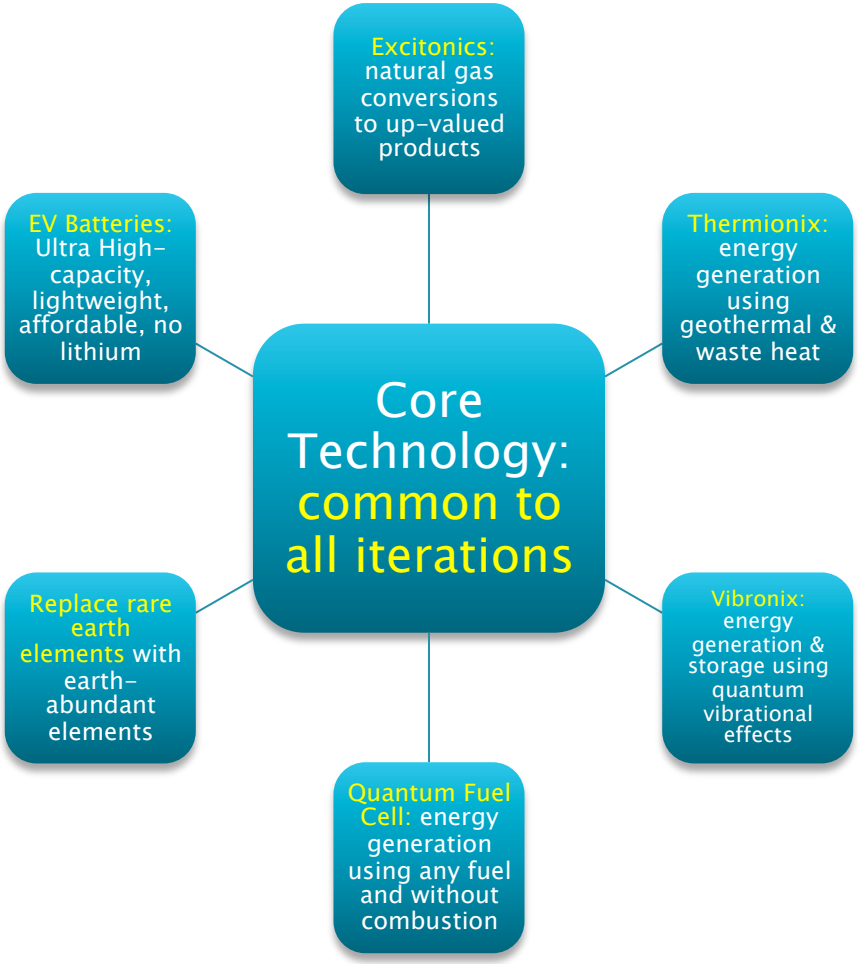
- No rare earth elements or PGMs
- Highly efficient
- Powered by any heat source
- Multi-fuel capable including solar, wind and carbon-free
- No moving parts
- Safe
- Scalable down to individual units
- Grid-supporting or grid-independent
- Affordable & abundant

Photo of lab prototype quantum energy generator

CASCADE IS PREPARING TO PURSUE MULTIPLE INDUSTRIAL SECTORS

Catalysts enable most industrial manufacturing in the world.
Our fundamental improvements in catalysis:

- Make existing manufacturing more efficient
- Save valuable resources by **replacing rare earth elements**
- Reduce or eliminate waste & emissions
- Reduce production costs
- Facilitate real competition in the marketplace
- Enable predictive & confirmatory technology with detailed characterization and high accuracy for global geophysical mineral and resource surveys



MARKET DRIVERS

Multi-billion dollar plants and factories are currently built around the strengths and weaknesses of the catalysts at their core. Many of today's inefficient catalyst reactions were discovered more than 100 years ago and have changed little. The problem was that no one truly understood what made catalysts tick.

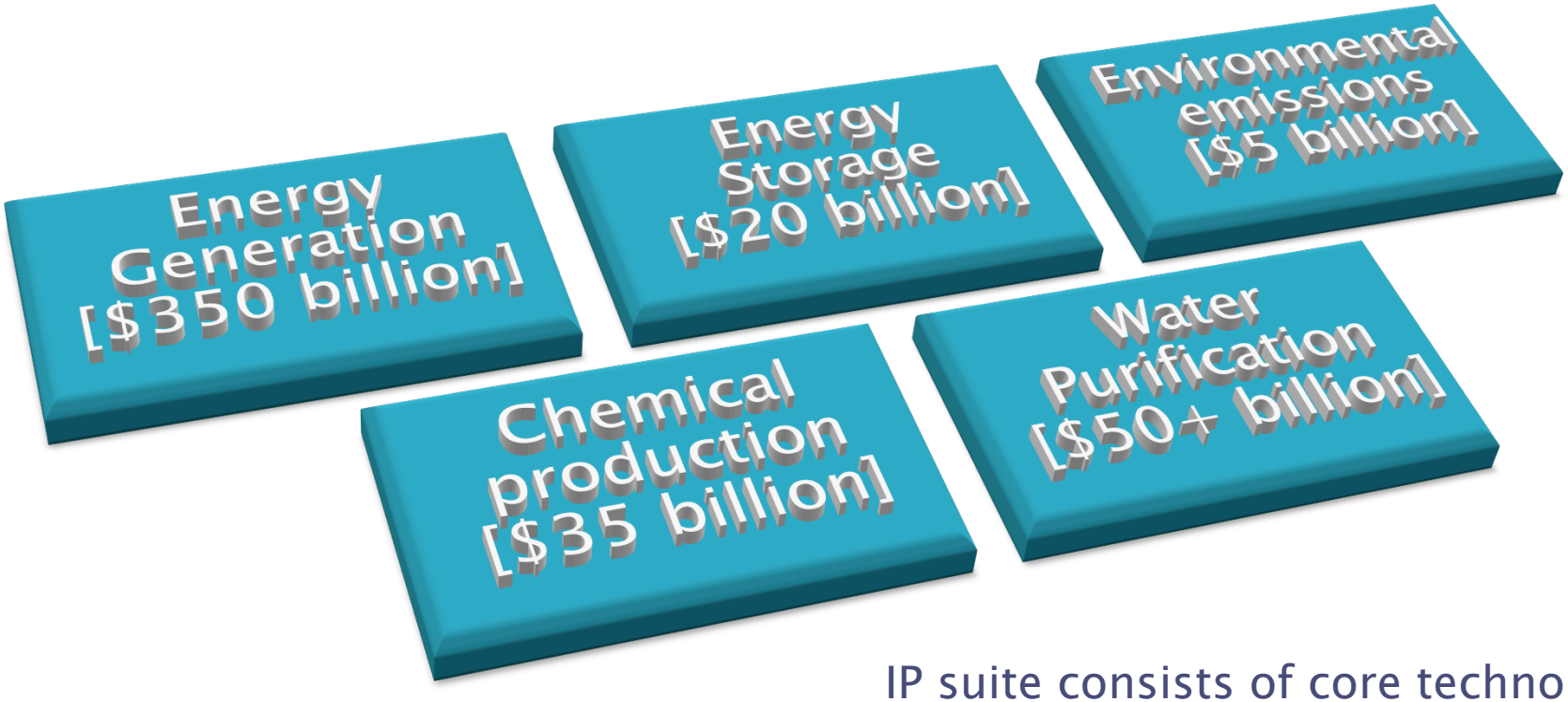
Add to this:

- More stringent emissions legislation
- Economic impact of supply chain disruptions
- Increasing demand for clean energy generation & utilization
- Critical demand for new EV energy storage solutions
- Demand to replace rare earths in semiconductor applications
- Reduction in environmental and societal impact of rare earth element mining

The times, they are a changing

Cascade's core technology has the capacity to fundamentally change the entire landscape of industrial manufacturing, energy generation & utilization, EV adoption and exotic & rare earth element usage worldwide.

INITIALLY TARGETED MARKETS



IP suite consists of core technology, application-specific patents and know-how

COMPETITIVE LANDSCAPE

There are currently no known competitors using excited-state chemistry for any catalyst-driven applications

- Practically all industrial catalysts today utilize platinum group metals and/or rare earth elements at ground energy state

BASF
The Chemical Company

ISHIFUKU
Ishifuku Metal Industry Co., Ltd.

JM
Johnson Matthey

Tanaka Kikinzoku Group

umicore
Precious Metals
Chemistry

- Cascade's catalyst power systems use normal, readily-available oxides at elevated energy states for higher power densities and unparalleled efficiencies at a fraction of the cost

THE TEAM

Paul Leonard

- CEO
- 30+ yrs experience in bringing technology to market on 3 continents
- Extensive experience in energy, healthcare and environmental technology sectors
- Managed large multi-disciplinary engineering teams in all aspects of product development cycle

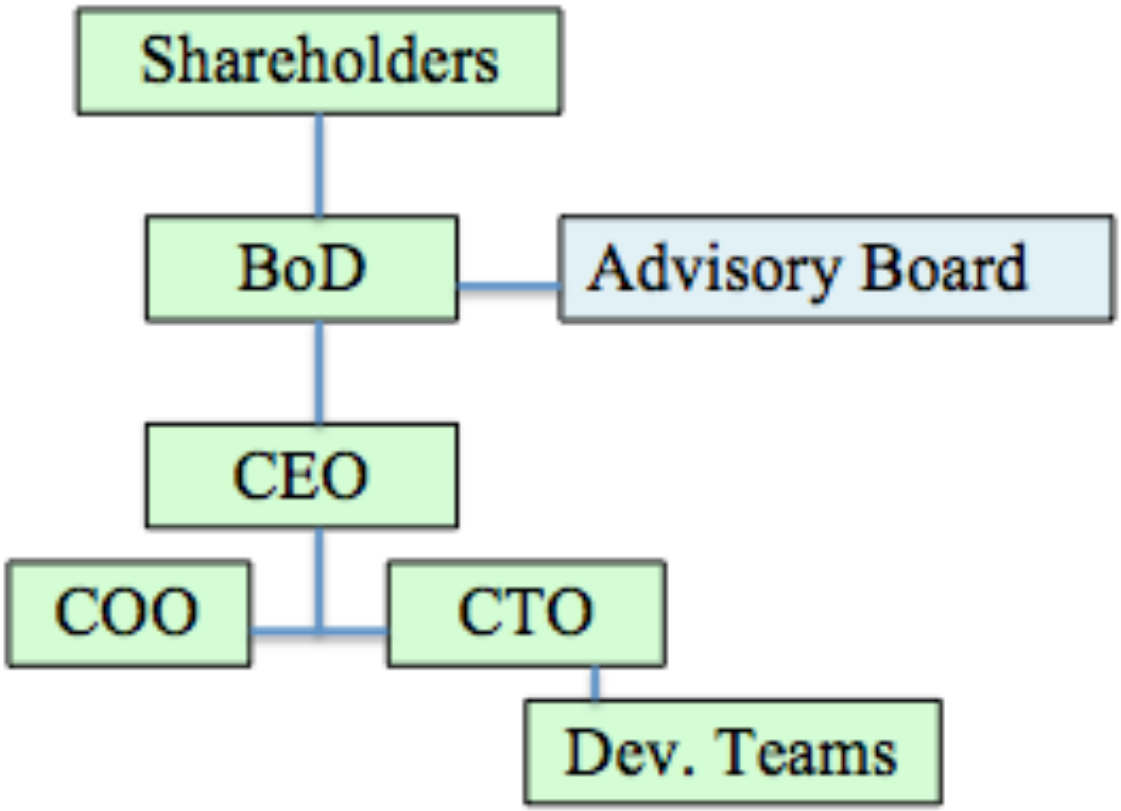
Dr Vladimir Kopylov

- CTO
- Core technology developer
- 40+ yrs experience in fundamental and applied materials science
- Professor of Chemistry, Research Engineer
- Led multiple technology development and implementation initiatives at regional and federal levels
- Multiple patents

Romeo Prescott

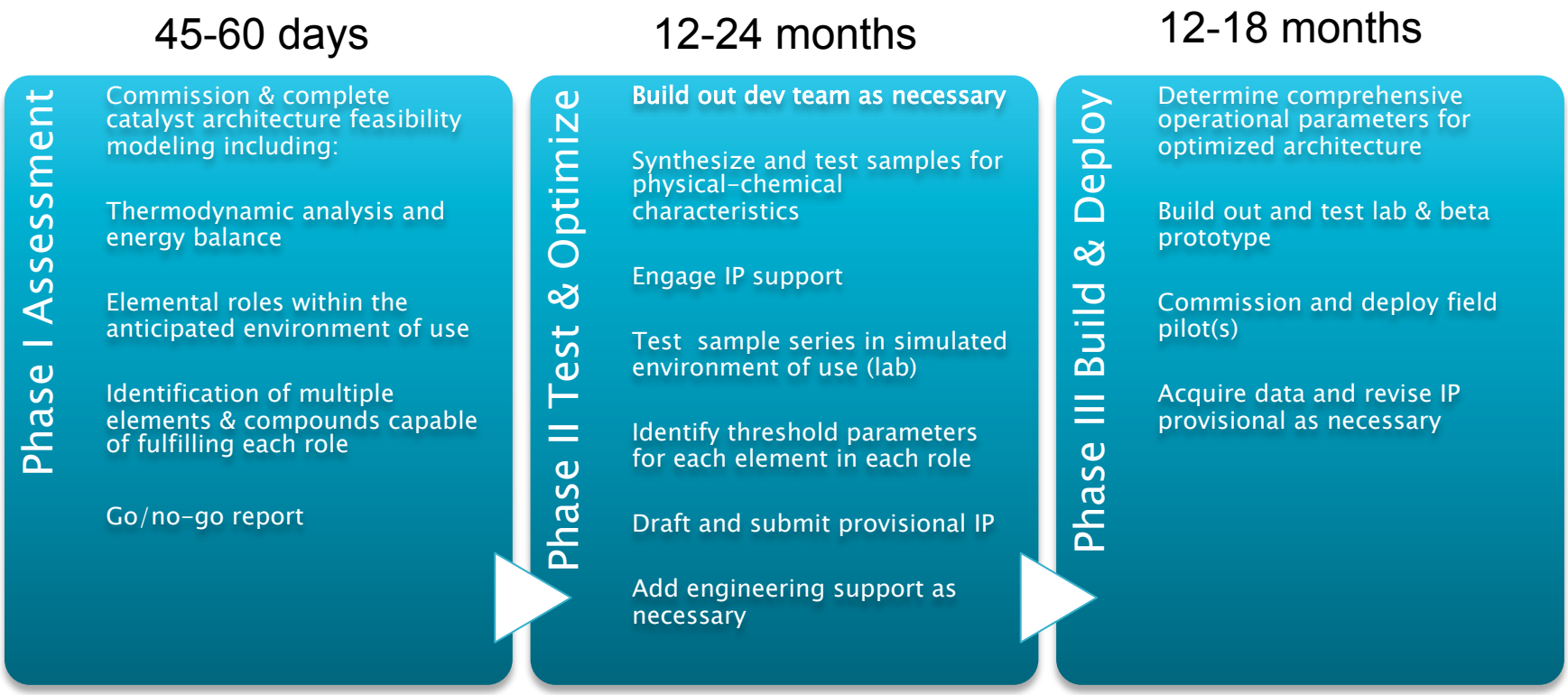
- VP Business Development
- 25+ yrs experience in financial and capital markets
- Experienced entrepreneur and problem-solver
- Extensive public company experience in USA and Canada
- Experienced in modeling and engineering innovative blockchain solutions for businesses

CORPORATE STRUCTURE



◆Energy Generation ◆Energy Storage
◆Chemical Synthesis ◆Emissions Abatement
◆Specialty Catalysts & Materials

TYPICAL DEVELOPMENT TIMELINE SUMMARY



INTELLECTUAL PROPERTYAND KNOW-HOW

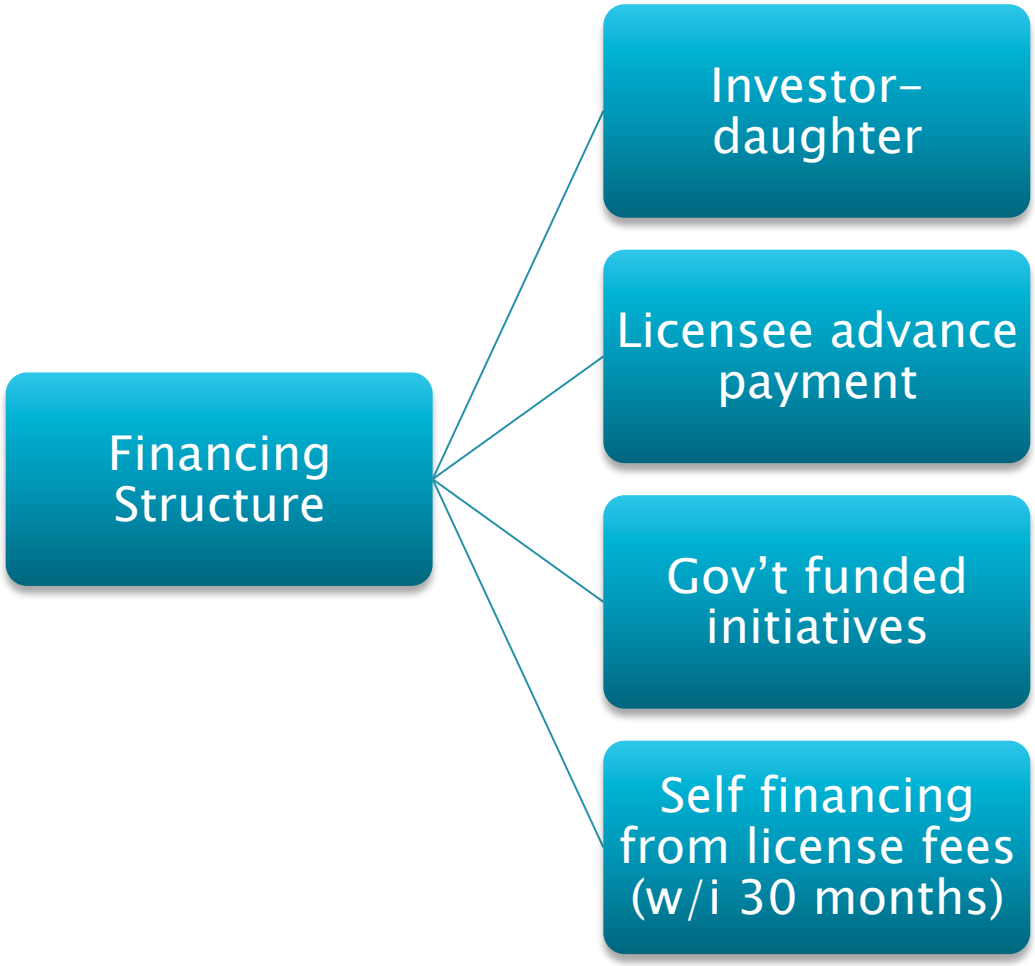
- Core intellectual property including design modeling will be continuously improving. All core-related IP will be held exclusively by Cascade Catalysts, Inc. Core enablers and all related improvements will be provided by license to all participating daughter companies or licensees.

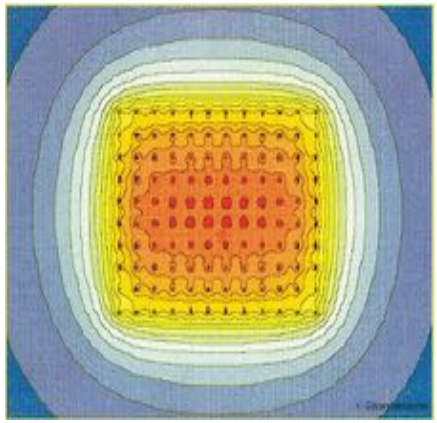
- Patents and know-how to application-specific processes can be held by daughter companies and licensees provided that this does not prohibit other technology recipients from freely pursuing their own markets.

REVENUE MODEL

- Cascade Catalysts, Inc. will focus on core technology development that enable and enhance all industry-specific, targeted applications with all anticipated revenues coming from licensing agreements & royalties

FINANCING STRUCTURE





For more information contact:

Paul Leonard: pleonard@cascadecatalysts.com

For further reading, please see our recent scientific-technical paper published on the chemRxiv preprint server entitled: (free download)

"New Materials Design Using Excitonic Quantum Effects: Applications for Fuel Cells, Catalysts, Superconductive and Bioactive Materials."

https://chemrxiv.org/engage/chemrxiv/article-details/60c73cc0842e65bc1ddb169e