

Sustainability through People Process and Product Innovation

Jean Claude Roumain FACI
JC Roumain & Co

Ana Maria Workshop X
Nov 4-6, 2009



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A Technology Transfer Co.

Jean Claude Roumain FACI

Adjunct Senior Scientist

**School of Engineering Computer Science (SECS)
Applied Research and Technology Institute (ARTI)**



UNIVERSITY OF
DENVER

Senior Research Scientist to provide general support for the Research activities of ARTI, including:

- Building collaborative research and educational activities between ARTI and the academic departments of SECS
- Working with ARTI and SECS faculty to define research goals and strategies for the school.
- Helping to broadly identify research opportunities, and writing funded research proposals in collaboration with ARTI and SECS faculty
- Identifying and cultivating potential industrial partners, and serving as liaison to companies to generate joint research proposals and to cultivate as possible funding sources
- Establishing dialogue with international universities to help recruit Master and PhD candidates for SECS
- Offered occasional teaching assignments which will be compensated on a course by course basis
- Occasional teaching assignments



Delivering Concrete Solutions



Jean-Claude Roumain FACL

Vice President of Technology Applications

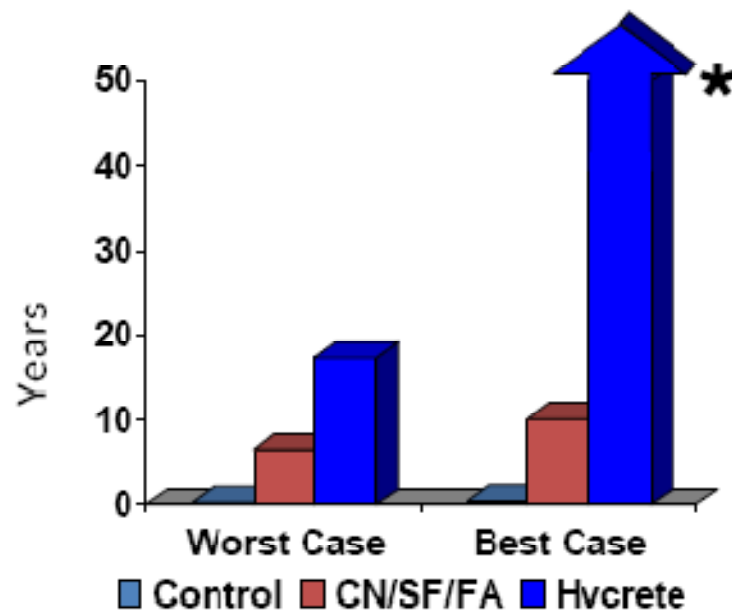


Hycrete Delivers \$\$\$ Savings



Life 365™

Time to Corrosion Initiation



* Note: Examples did not corrode implying a theoretical "best case" of 150 years



"The use of Hycrete is expected to lead to extended service life and to aid in minimizing maintenance costs...VDOT would save \$1.5 million dollars each year through the use of Hycrete." - VTRC

Source: Influence of Hycrete DSS on Virginia Department of Transportation Class A4 concrete mix designs - 2007 VTRC Report by H. Celik Ozyildirim and Stephen R. Sharp



CONFIDENTIAL

Slide 2

The Cheapest and Greenest Structure Gets Built Once

Long-term, the cheapest greenest structure is the one that gets built once...not rebuilt multiple times



Hycrete makes concrete more durable

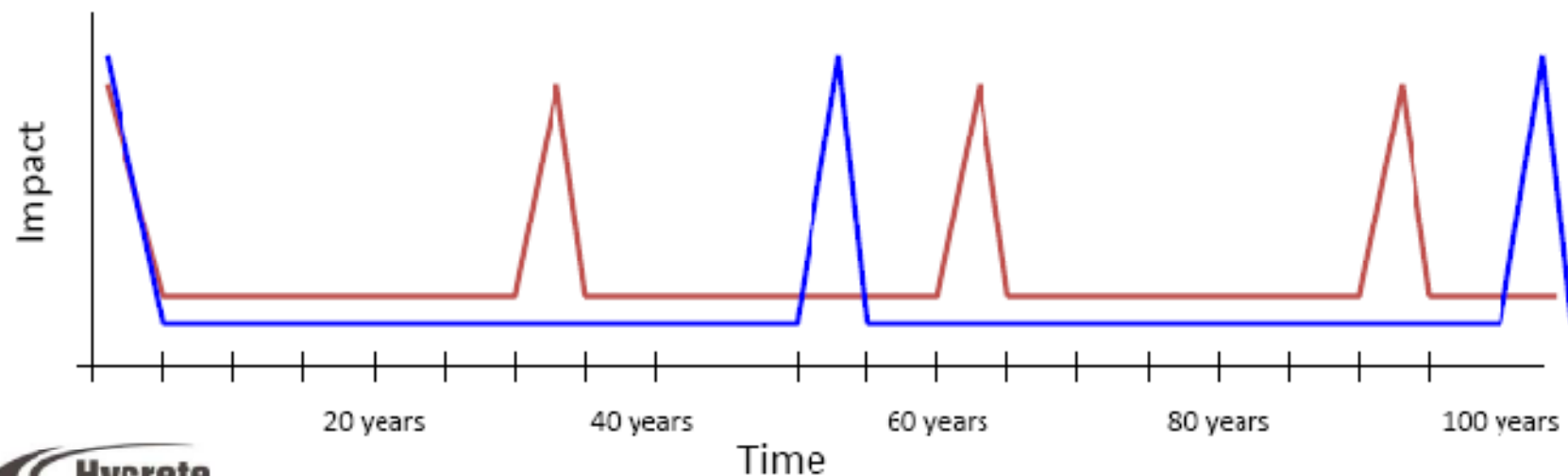
- Water stays out of the concrete
- Aggressive chemicals stay out of the concrete
- Corrosive agents stay out of the concrete
- Rebar is protected from corrosion internally



Traditional



Hycrete



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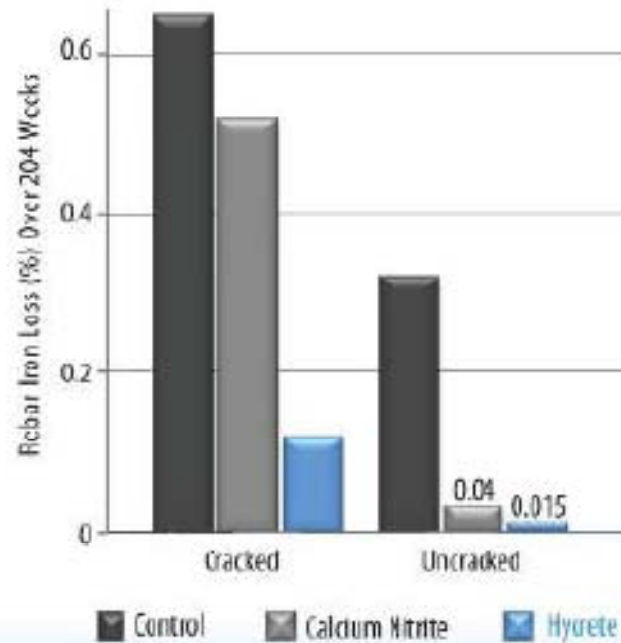
Slide 3

Hycrete is a Superb Corrosion Inhibitor

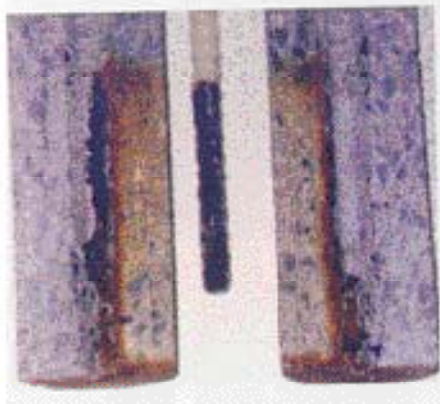
Control



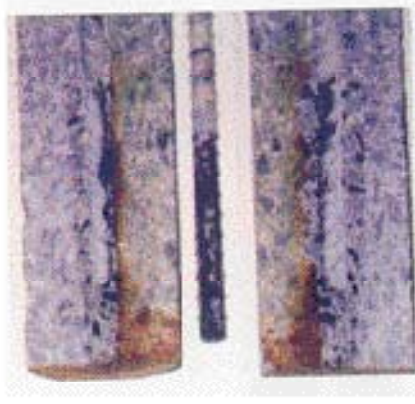
rebar in lab



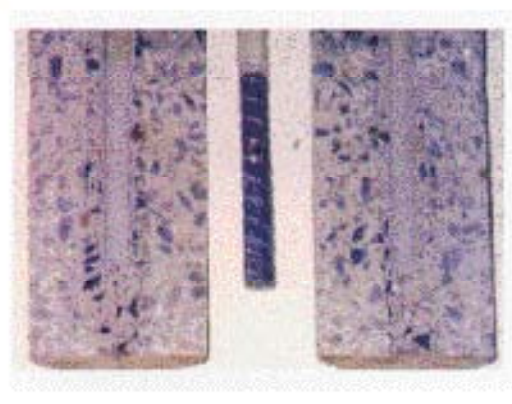
Hycrete



rebar in concrete



with inhibitor



with Hycrete



Definitions

- Greenhouse gas emissions – gases that trap heat in the atmosphere (greenhouse effect). The principal greenhouse gases that enter the atmosphere because of human activities are: carbon dioxide, methane, nitrous oxide, and fluorinated gases. (US EPA)
- Carbon footprint – total amount of carbon dioxide and other greenhouse gases emitted over a full life cycle of a product or service. It is meant to be useful for individuals and organizations to conceptualize their personal (or organizational) impact in contributing to global warming. (Wikipedia)
- Embodied energy - refers to the quantity of energy required to manufacture, and supply to the point of use, a product, material or service. (Wikipedia)
- Global warming – the increase in the average temperature of the Earth's near-surface air and oceans in recent decades and projected continuation. (Wikipedia)



Definitions

- **Cap And Trade:** Financial incentive for organizations and corporations to reduce their carbon foot print.
The total carbon emissions for a particular country, region, sector are capped at a certain value
Organizations are issued permits to emit a fraction of the total emissions
- Those who emit less than target can sell their excess carbon emission
- Anthropogenic GHG: Man made CO₂



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Position on the Environment

- **Deniers:** Mankind impact on this planet is minuscule and climate change is a hoax
- **Alarmist:** Mankind has created irreversible damage to climate change on the planet
- **Environmentalist:** Would rather save a tree or endangered animal specie at the expense of mankind
- **Conservationist:** Maintain and improve our desired standard of living through the efficient management of our non renewable natural resources
- **Opportunist:** Using the green effort solely to maximize profits (Green washing such as their logo etc.)



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Sustainability

“ We do not inherit the earth from our
ancestors;

We borrow it from our children. “

- *Native American proverb*

“ No civilization can survive the physical destruction of its resource base.”

Bruce Sterling



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Creating a balance in satisfying the two important needs of society

Building an infrastructure to support our desired standard of living



Protection of our environment and efficient use of our natural resources

In Balance



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Sustainability



Life Cycle



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Today's Challenges

- Concrete industry is fragmented and diverse
- Antiquated standards
- Slow to investigate and adopt new technology
- Reluctance to change
- Gap in product knowledge



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Content: The three P's

- **People** : To communicate and establish a culture of “Sustainability” through Knowledge transfer
- **Process**: Durable Concrete is a Process. We must identify all barriers and eliminate them. We must facilitate the use of alternate materials to replace non renewable resources. And promote efficiency in Manufacturing, Delivering, and Application of Durable Quality concrete. Speak with one voice of the vision and goals of the industry
- **Product Innovation**: To create an environment that is conducive to innovation, value creation, and the ability to sustain successful utilization of sustainable material such as Concrete with high content of “**Mineral Component**” or even **Zero clinker factor Hydraulic cement**



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People



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People's Role

“Despite conventional wisdom, People – not Technology – play the biggest role in creating successful green buildings”

**Tom Paladino, PE, AIA, LEED AP
USGBC, Board of Directors Vice Chairman**

A simple assembly of “green” products is
not an adequate solution for
sustainability
LEED 3.0



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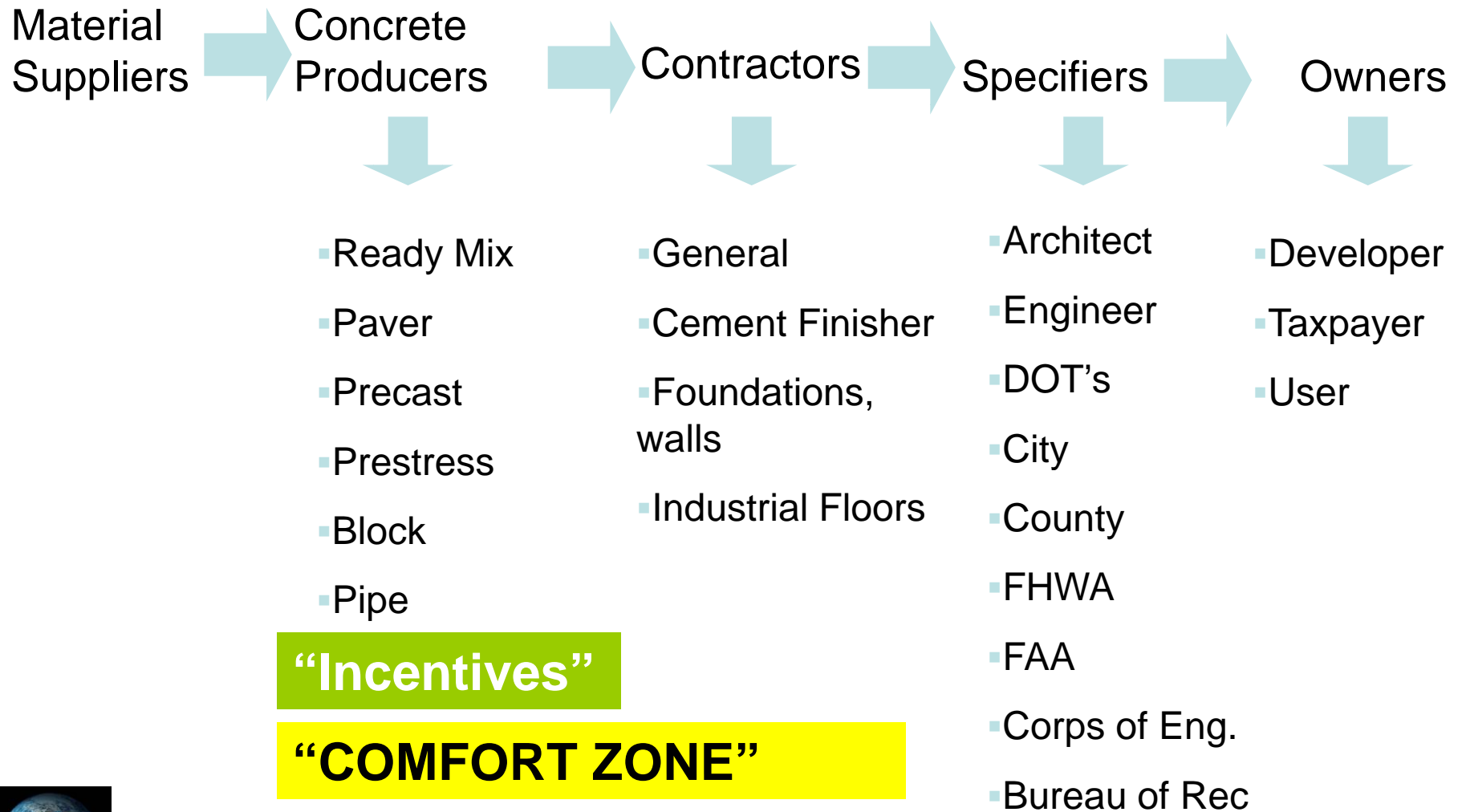
Sustainability

- The role government is to facilitate Industry's efforts to implement sustainability. Not to create legislation that will impede it
- Corporations need to establish a culture of sustainability with firm commitments to execute.
- Individuals must make the personal commitment to promote sustainability



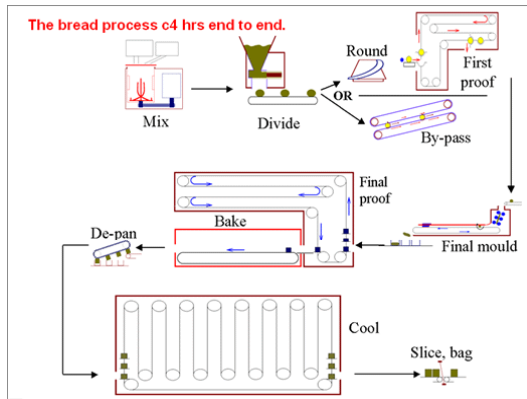
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Who are the players?

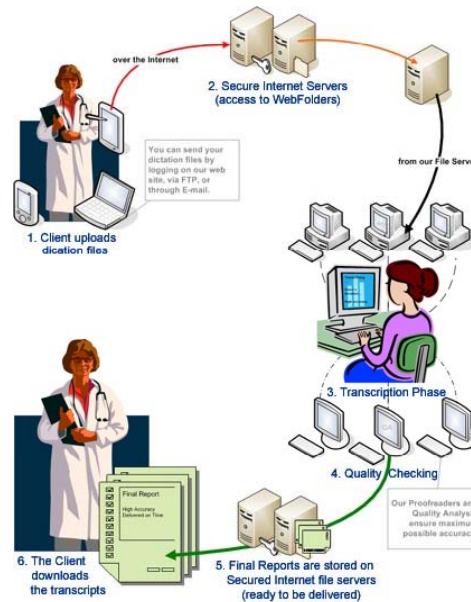
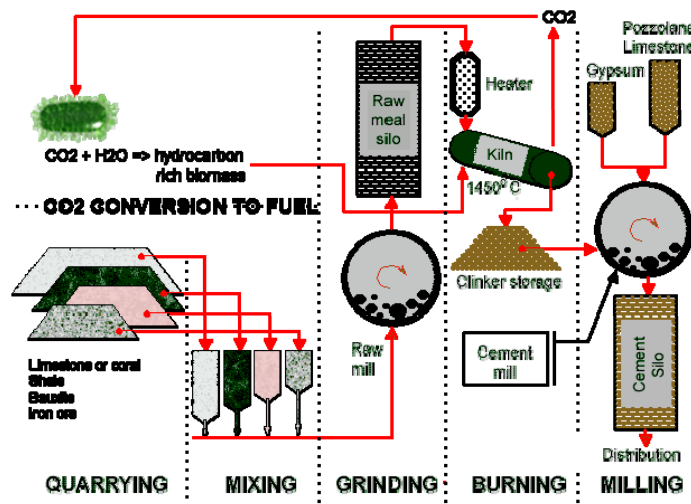
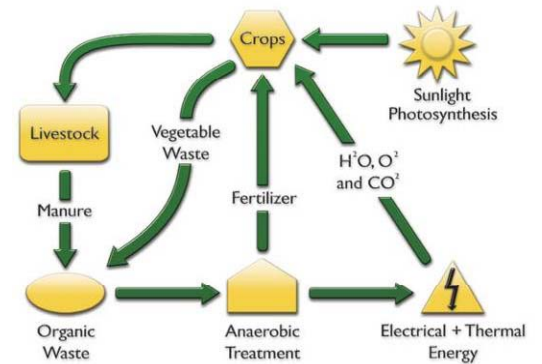
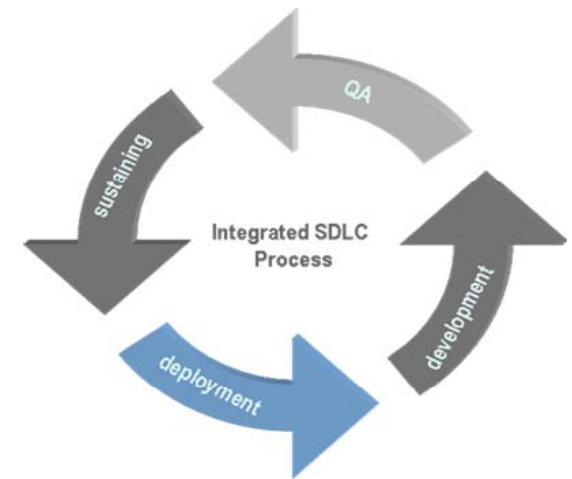
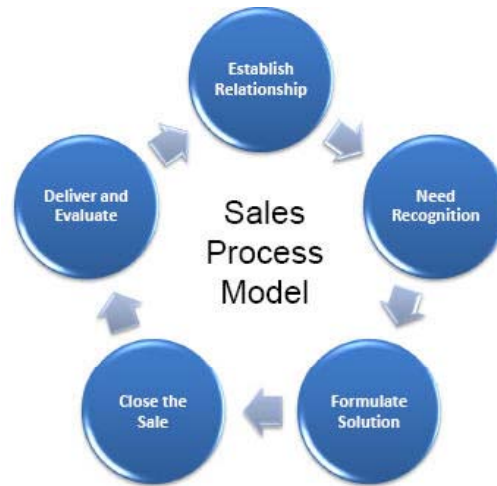


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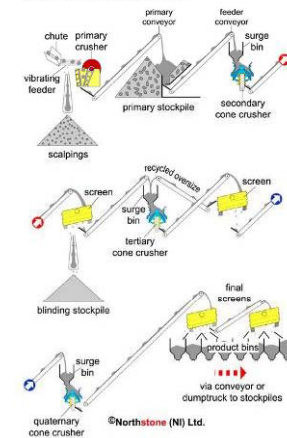
▪ JC Roumain 1992



Process

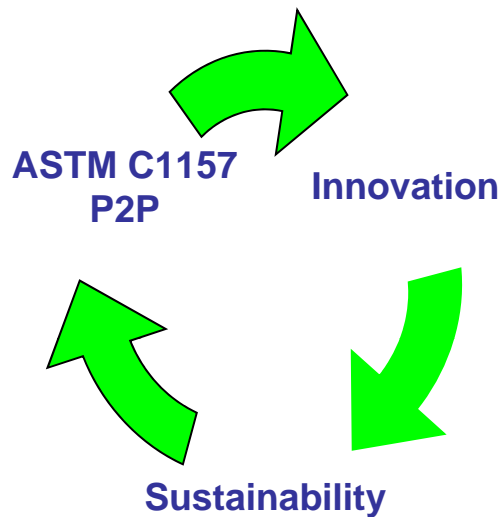


CRUSHING & SCREENING



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Sustainability



- Performance specification is the catalyst
- Technological change or Innovation does not occur in a vacuum. It frequently sparks a response from the legal, political or social environment
- Sustainability is the objective



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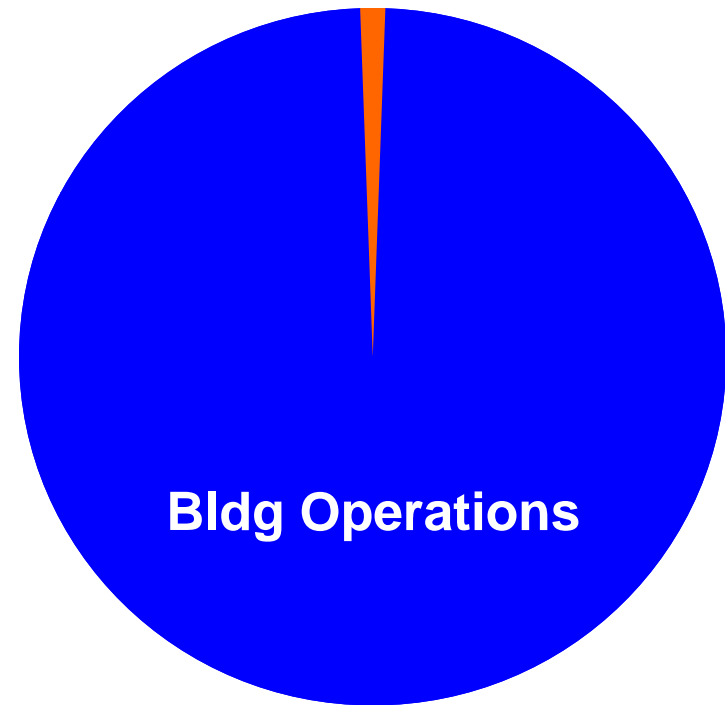
What other Human Activities produce CO₂?

- The cement Industry accounts for approximately 5% of the World CO₂ Emissions
- And Approximately 1.5% of the US CO₂ Emissions
- Heating And Cooling our homes 33%
- Driving our Cars and Trucks 27%
- Industrial Operations 19%



Make it better - Applications

- Life Cycle
Assessment studies
reveals:
 - 98% of impact for residential is during operations phase
 - 2% is in materials manufacturing/
construction



The Sustainable Attributes of Concrete

- locally derived- produced- placed and can be recycled as aggregate
- once in place consumes CO₂ from the atmosphere
- is non toxic
- is generally reinforced by 100%- recycled steel and generally incorporates other industrial by-products
- is resource efficient: the ingredients require little processing and generate little waste
- is exceptionally strong in uses where resistance to fire progressive collapse- seismic disturbance or blast are concerned



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The Sustainable Attributes of Concrete

- in roadways- reduces rolling resistance and thus fuel consumption
- can be made pervious to water- thus preventing run-off
- is reflective- therefore cool- safe and saves on artificial lighting
- is exceptionally durable when properly designed and placed to last a century or more
- provides excellent thermal mass that can enable substantial reductions in heating and cooling costs
- has natural beauty in architectural applications
- Provides great flexibility in design options



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Ten Steps to Reduce GHGE

- 1- Increase use and promotion of SCM
(Fly Ash, GGBFS, Metakaolin, RHA, Calcined clay, Natural pozzolan, Other ashes)
- 2- The use of Fine and Ultra fine Mineral Fillers
(Ground limestone, ultra fine limestone, fly ash, other minerals)
- 3- Process Improvements / More Efficient Cement production
- 4- Use of CO2 Neutral Fuels
(Alternate Fuels, Biomass etc)
- 5- Capture and Management of CO2
- 6- Revised Construction Practices
(Specifications, Life cycle inventory, Life cycle Assessment)



Ten Steps to Reduce GHGE

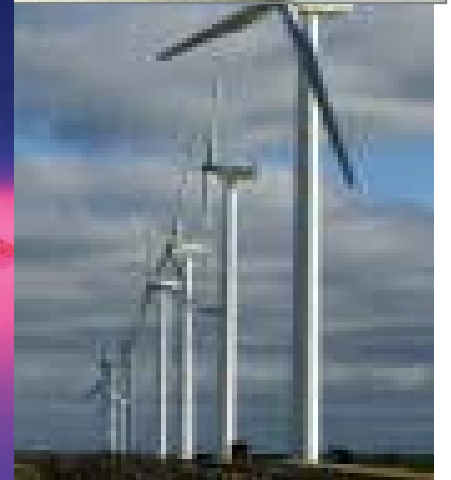
- 7- Revised Construction Practices
(Codes and Specifications, Life cycle inventory, Life cycle Assessment)
- 8- Alternative Binders
(Geopolymeric cements–Alkali activated Alumino silicates)
- 9- Efficient Use of Chemical Admixtures
(Mid and Super water reducing admixtures – Rheology modifiers)
- 10- Recarbonation of Concrete



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Product Innovation

- Technological Innovation
- Hybrid automobiles
- Wind and solar power
- **Cement ? Concrete?**



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Yes, we can predict the future



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Yes, we can predict the future



Invent IT



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R & D in Cement and Concrete

» 2000 patents/year

- ~ 30 International conferences (~ 50 papers)/year
- ~ 40 International journals (~120 papers)/year



PROGRESS?

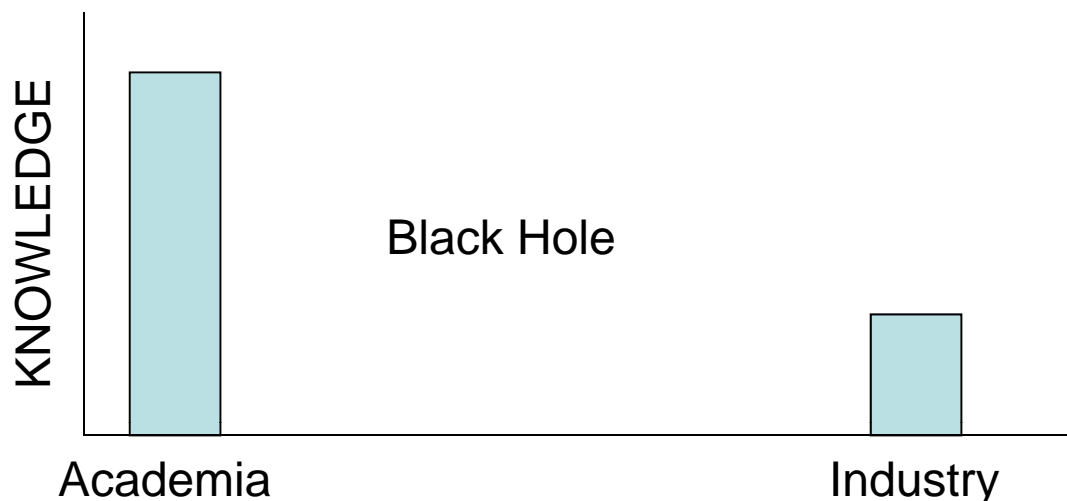
- Adequate, satisfactory (fitting to the interest of the building industry/society)
- Not satisfactory (little progress in the last 50 years)



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The future is Here Today

- At our Universities
- Upstart Companies
- Someone's garage
- Someone's Head



INNOVATION

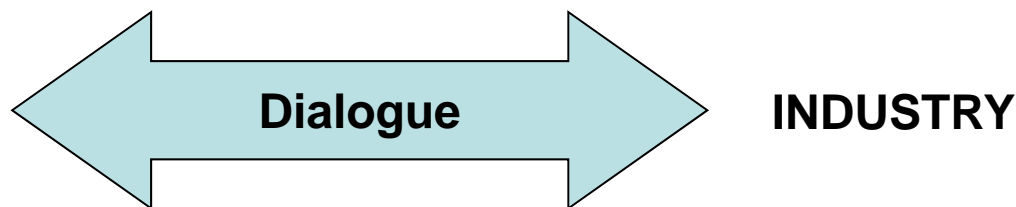
Is only limited by the extent of
OUR IMAGINATION

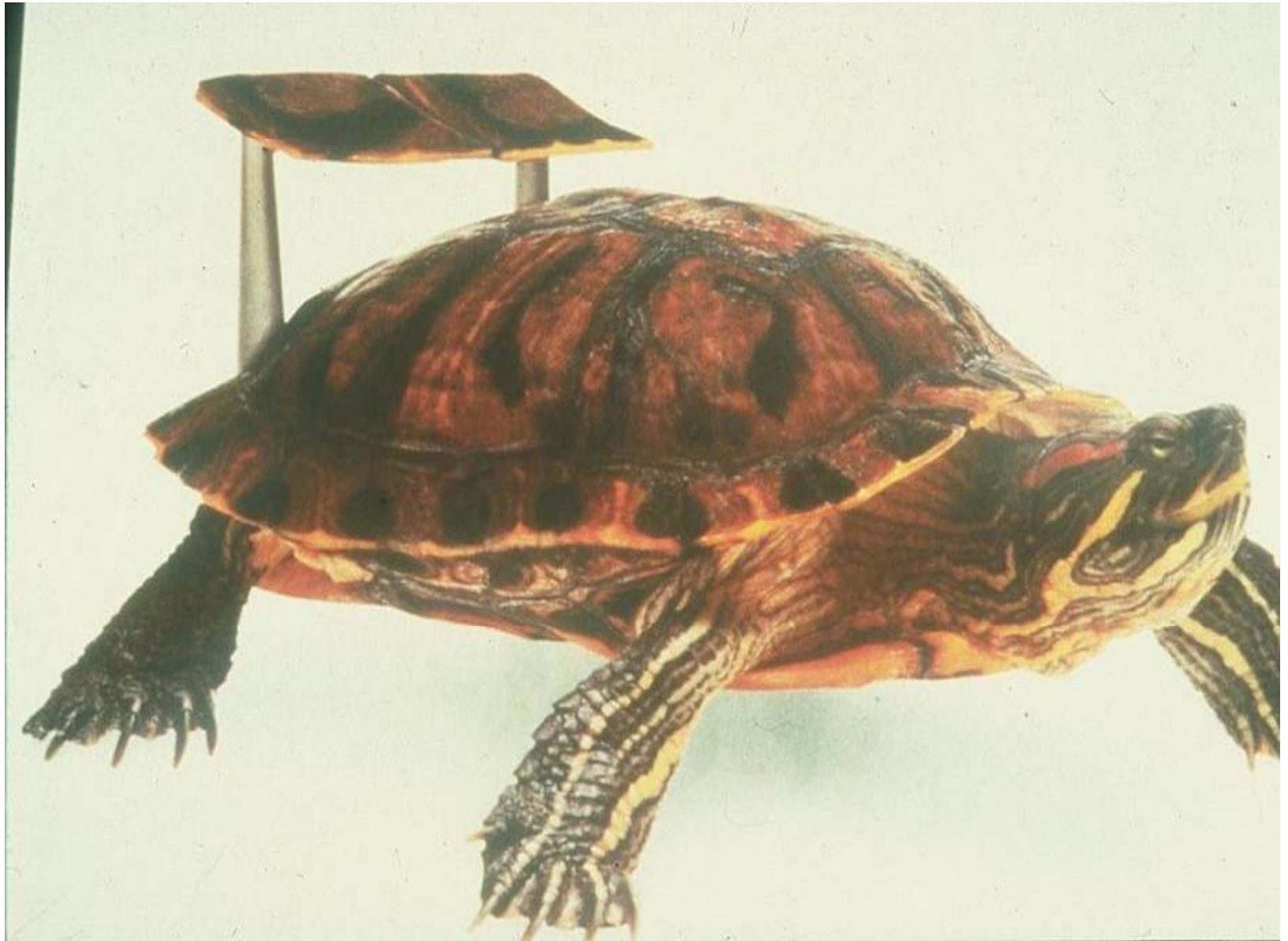
ACADEMIA

Interdisciplinary group
Organic and Inorganic Chemistry
Biologist, Botanist, Physicist
Ceramic Engineers

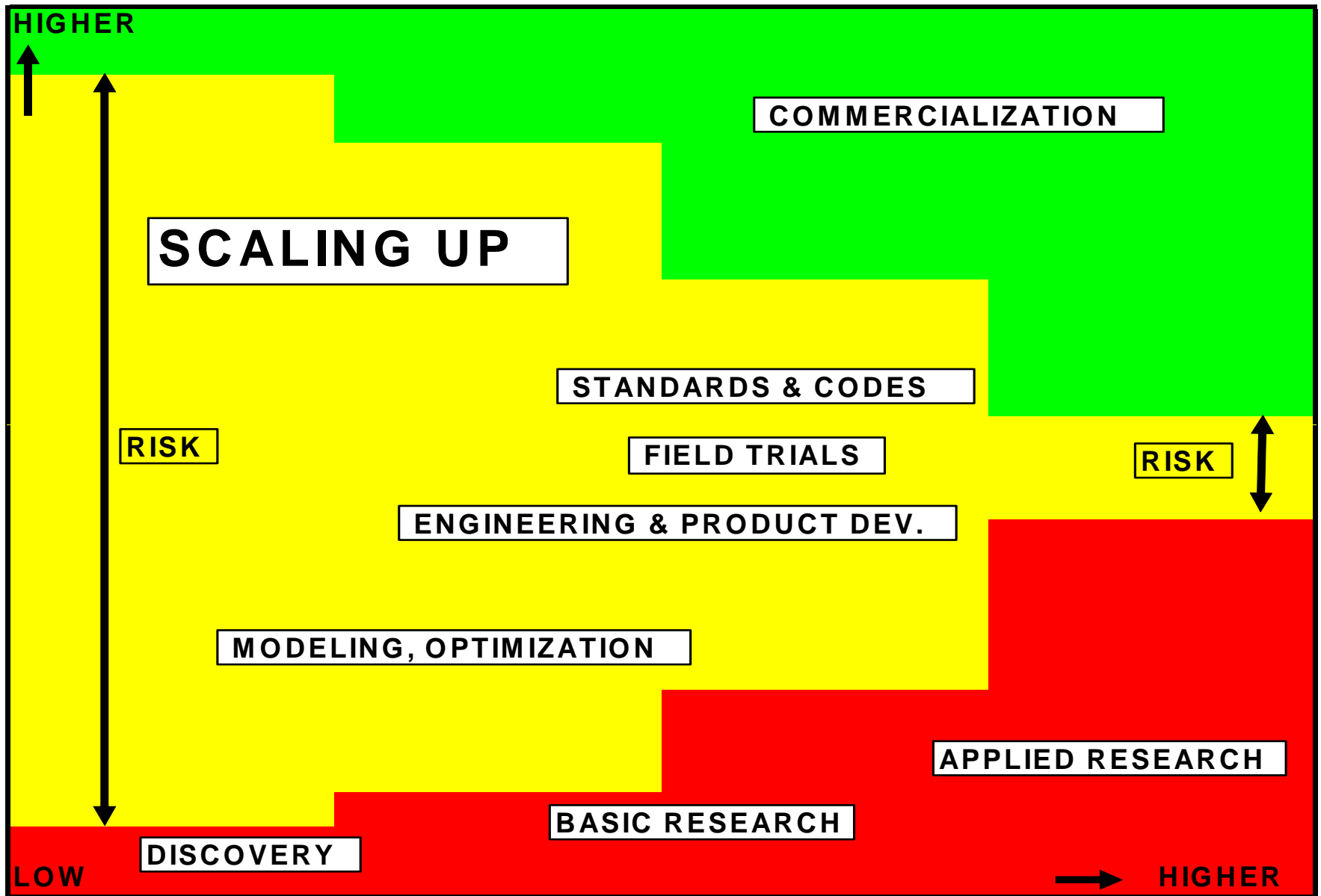


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Return on Innovations

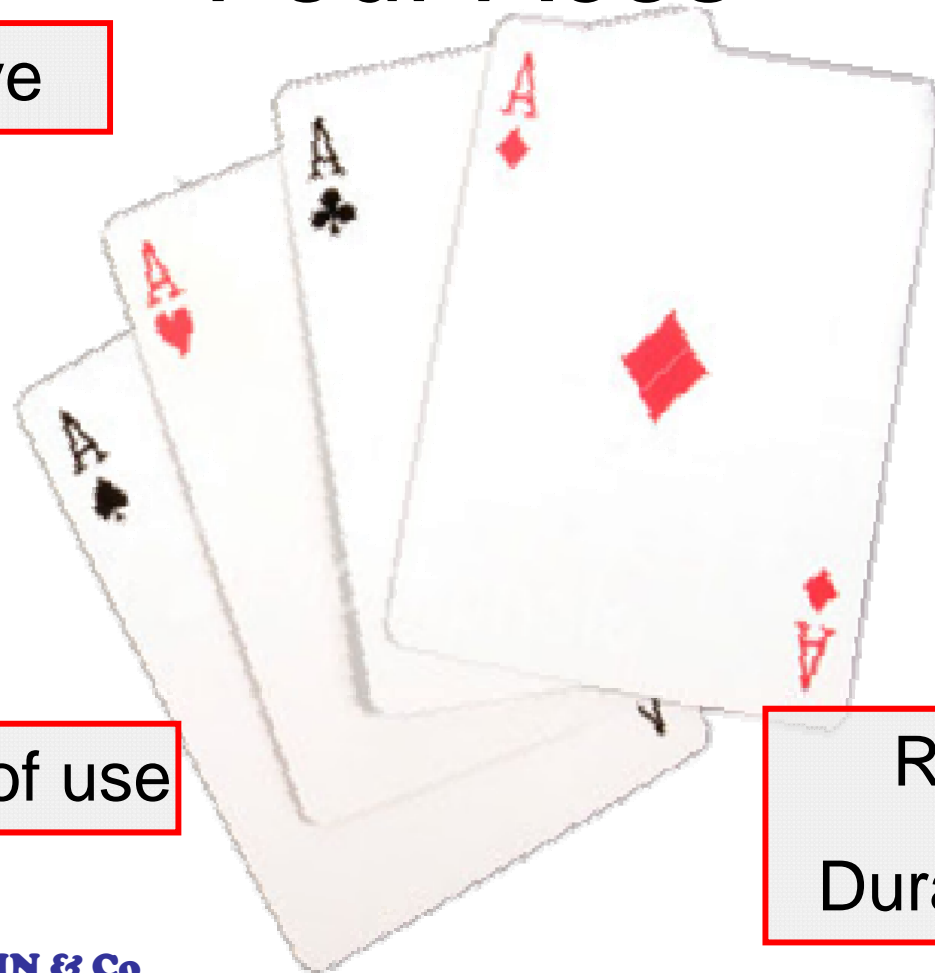
Four Aces

Cost effective

Sustainable

Ease of use

Robust And
Durable material



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Why SCC Concrete?

....Just to avoid this mess at the jobsite...

48 men.... Who is doing what?...

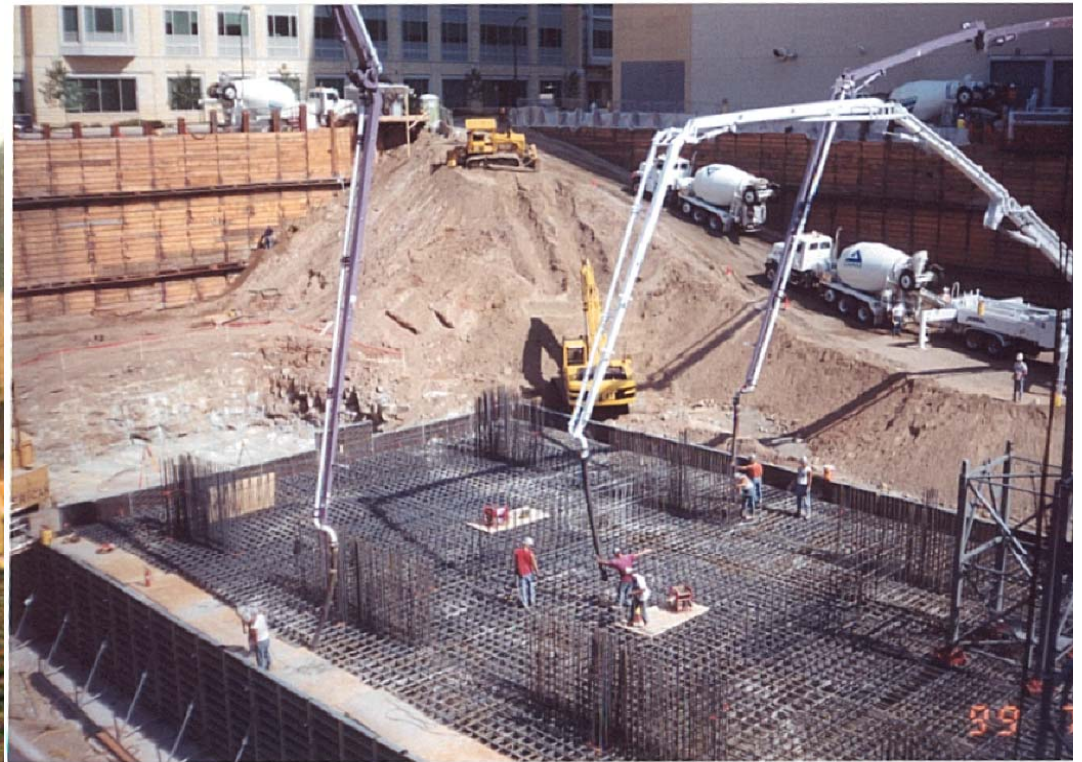


JCI
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Why SCC Concrete?

Productivity-Durability

Improve the working environment “Productivity” And above all concrete durability



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Green Properties Of HPC

- Lower Portland cement content
- Use of byproduct from industry up to 80%
- Greater productivity ,Easier placement through SCC properties (less noise, less labor)
- Less concrete production delivery placement (less volume of concrete, Thinner panels or bridge deck slabs)
- Greater strength per lb or Kg of cement
- Greater Durability Longer life cycle



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EXTRUSION TECHNOLOGY



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Biogenic silica

Renewable Cementitious Material



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■ **Rice Field (Upland Cultivation)**

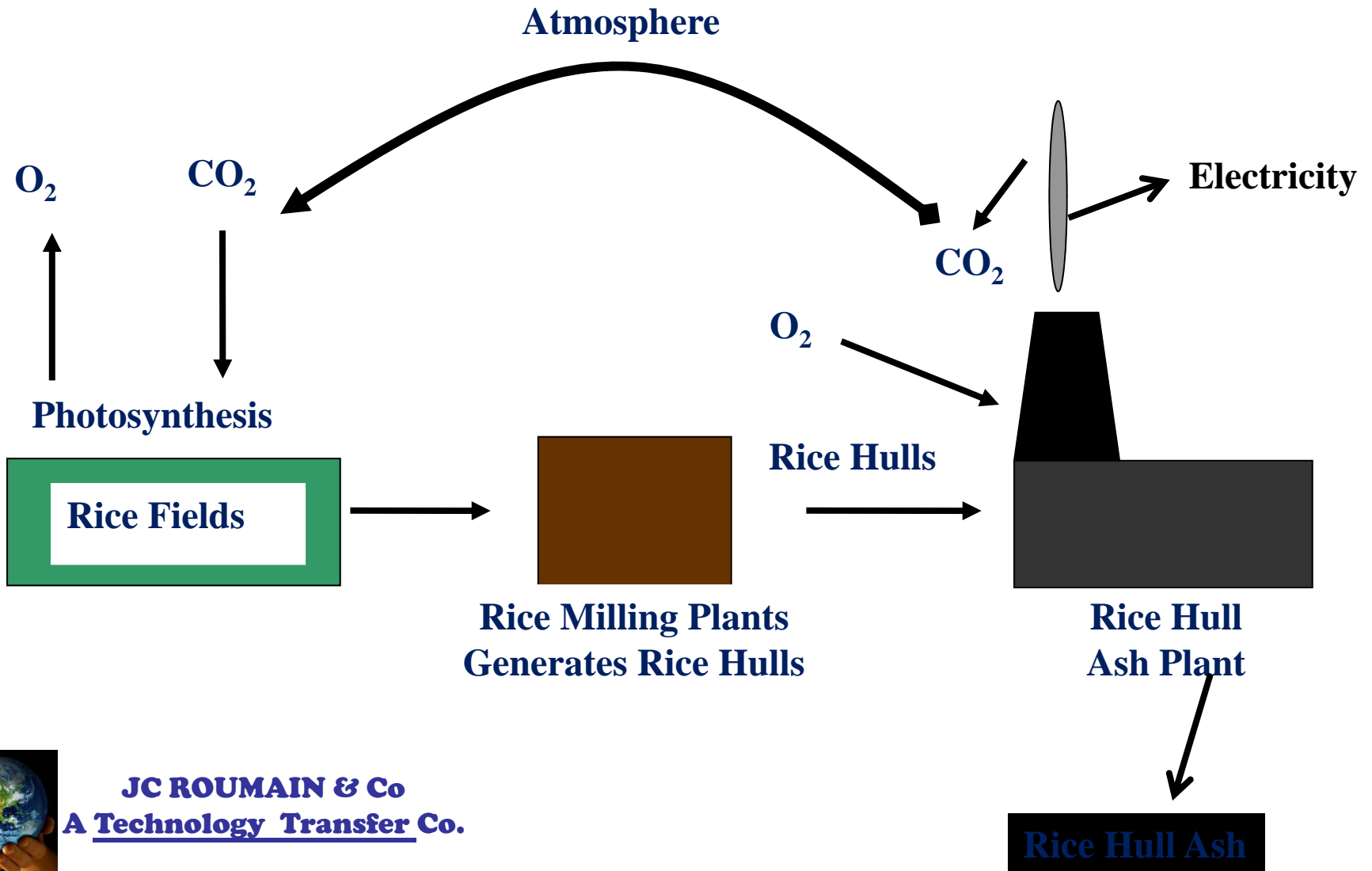
Project Goals and Environmental Benefits

- **Generate Electricity or Use Heat for Other Industrial Applications**
- **Manufacture Amorphous Off White Rice Hull Ash**
 - **Biomaterials**
- **Sustainable Product**
- **Energy Saving and Green Buildings**
- **Unlike Other Food Products used in Bio-Fuels. The Rice Production for Human Consumption Unaffected.**
- **Generate Revenues for Rice Farmers**
- **Create Jobs in Rural Areas**



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Carbon Neutral Cycle



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RHA Off White to Lighter Color



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Sustainability

**Supporting our commitment to
sustainable development**

**Low Energy cements or
“0” Clinker factor Cements**

Nano Technologies

Noble Cements

From Biofuels to Biosilicas

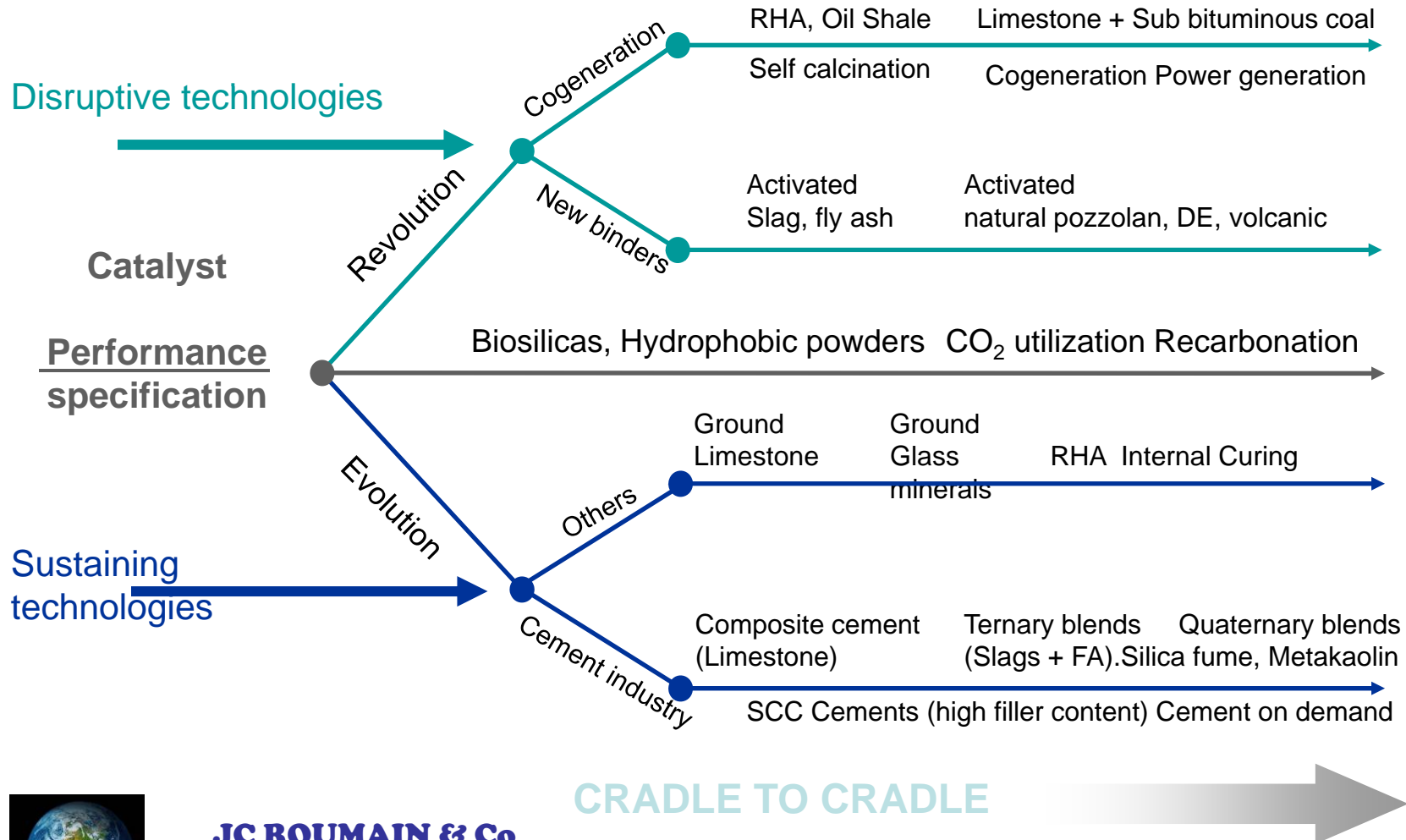
To Biocements to Biocrete

Inorganic to Organic



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Transformation of Binders for Concrete

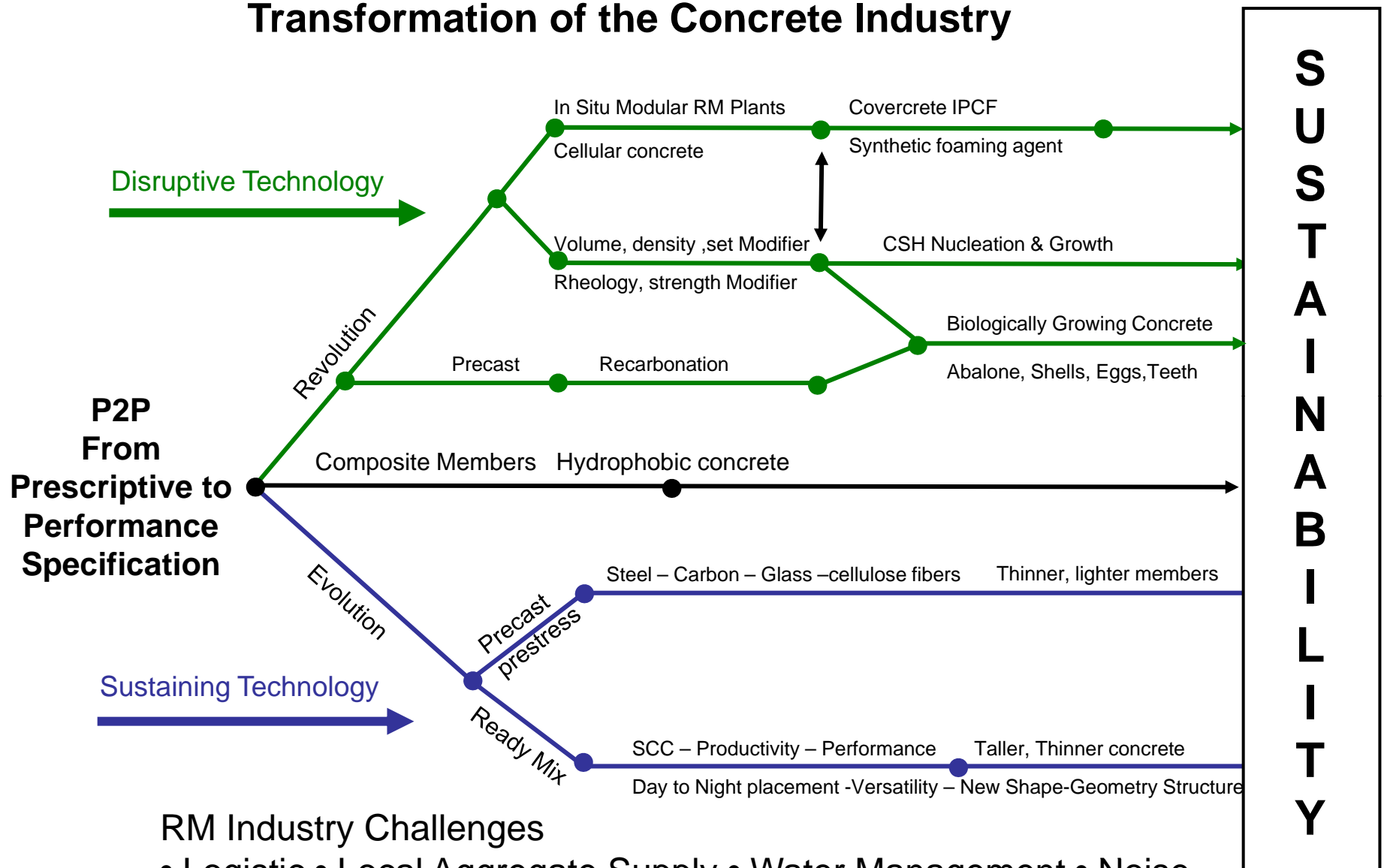


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Transformation of the Concrete Industry



RM Industry Challenges

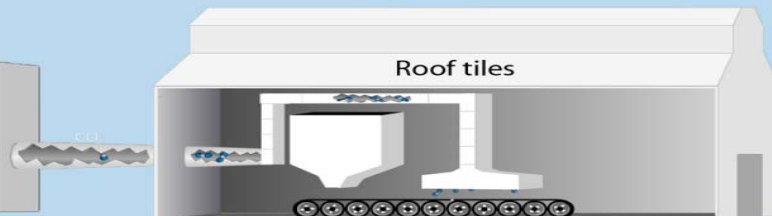
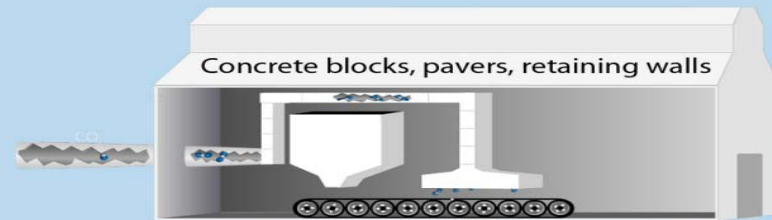
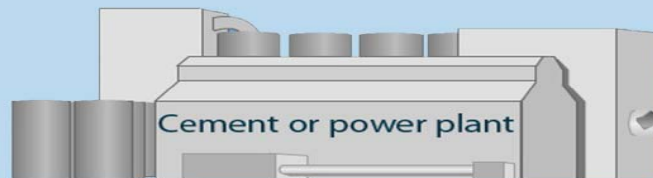
• Logistic • Local Aggregate Supply • Water Management • Noise

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Jean-Claude Roumain (2007)





A

The Challenge?

- Industry Mindset
- Short term thinking VS Long Term
- Return on investment 5 to 10 years
- Risk Analysis factor



The Challenge?

- Design and construction Mindset
- Safe and functional structure
- First Cost or lowest bid
- Liability- Warranty
- Vehicle for change?
- Performance Specification?
- What is the transition plan from Prescriptive to Performance?



As the old saying goes. . .

 There are those who make things happen

 Those who watch things happen

 And those who wonder what happened.

 Who are YOU?



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Thank You

A firm commitment for a Sustainable Future

- Jean-Claude Roumain FACI



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