



Two Models of Green Innovation

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CTO, Big Green Innovations, IBM

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IBM's Big Green Innovations



Context: “green” has resonated with IBM’s culture - and our bottom line - for 35 years

- 1971 - First corporate policy on the environment
- 1976 - Think! (IBM magazine) devoted whole issue to IBM conservation programs
- 1987-2006 - 95% reduction in hazardous waste
- 1989 - First take-back program
- 1990-2006 - saved 18.8 billion kwh of energy (= 9.7 million tonnes CO2), valued at \$291m
- 1992 - Founder member of EnergyStar
- 1996 - Cited by Al Gore for our PFC reductions
- 1997 - First global ISO 14001 certification
- 2006 - 96% of each computer we recycle is reused
- 2007 - 100,000 IBMers are mobile or work from home, saving \$90m per year in real estate costs
- 2009 - Numerous “green communities” in IBM
- 2009 - World #2 brand: green must be part of that!

Collaborating to develop solutions ...

WORLD RESOURCES INSTITUTE

climate savers

A Better Planet

CCA

WWF

The Nature Conservancy
Protecting nature. Preserving life.™

ENERGY STAR

GRIDWISE

the green grid™

CLIMATE LEADERS
U.S. Environmental Protection Agency

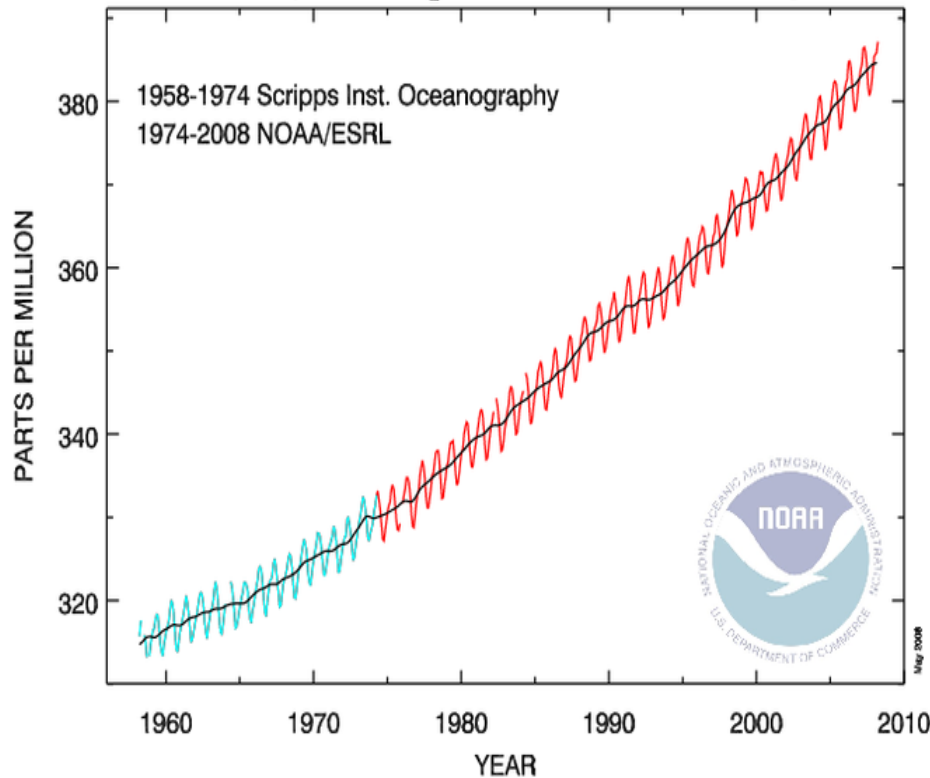
blade.org

CARBON DISCLOSURE PROJECT



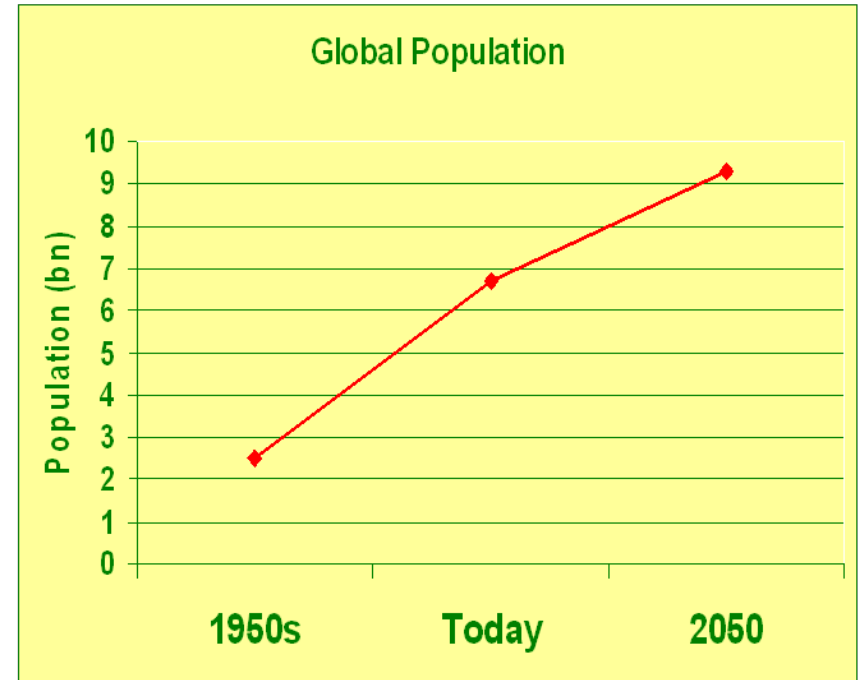
Context: is climate change a threat or an opportunity?

Atmospheric CO₂ at Mauna Loa Observatory



Source: http://www.esrl.noaa.gov/gmd/ccgg/trends/co2_data_mlo.html
Blue: Scripps Institute data; Red: NOAA data

Global Population



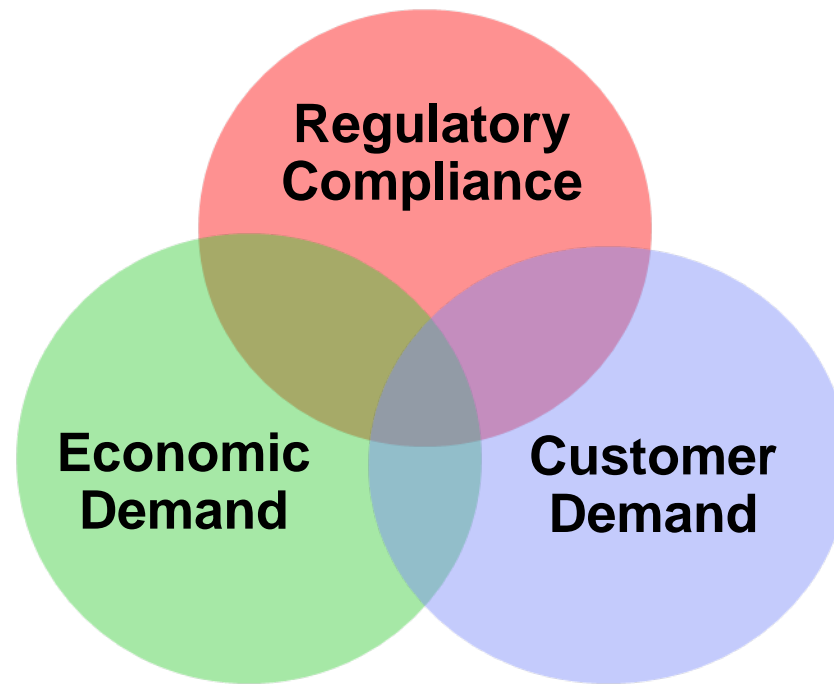
Source: <http://www.unfpa.org/6billion/pages/worldpopgrowth.htm>



Context: the need for innovation is clear...

- Increasing regulatory requirements - many enforced globally
- **Drives a new focus on compliance**

- Rising energy, raw material, waste disposal costs
- GHG emissions, water increasingly being priced
- Environment costs becoming strategic
- **Drives a new focus on efficiency and effectiveness**



- Customers becoming environmentally aware
- May be willing to pay?
- Most want “painless green”?
- **Drives a new focus on product and service strategy**

Significant need to innovate in all areas of product design, sourcing, manufacturing, supply chain and execution



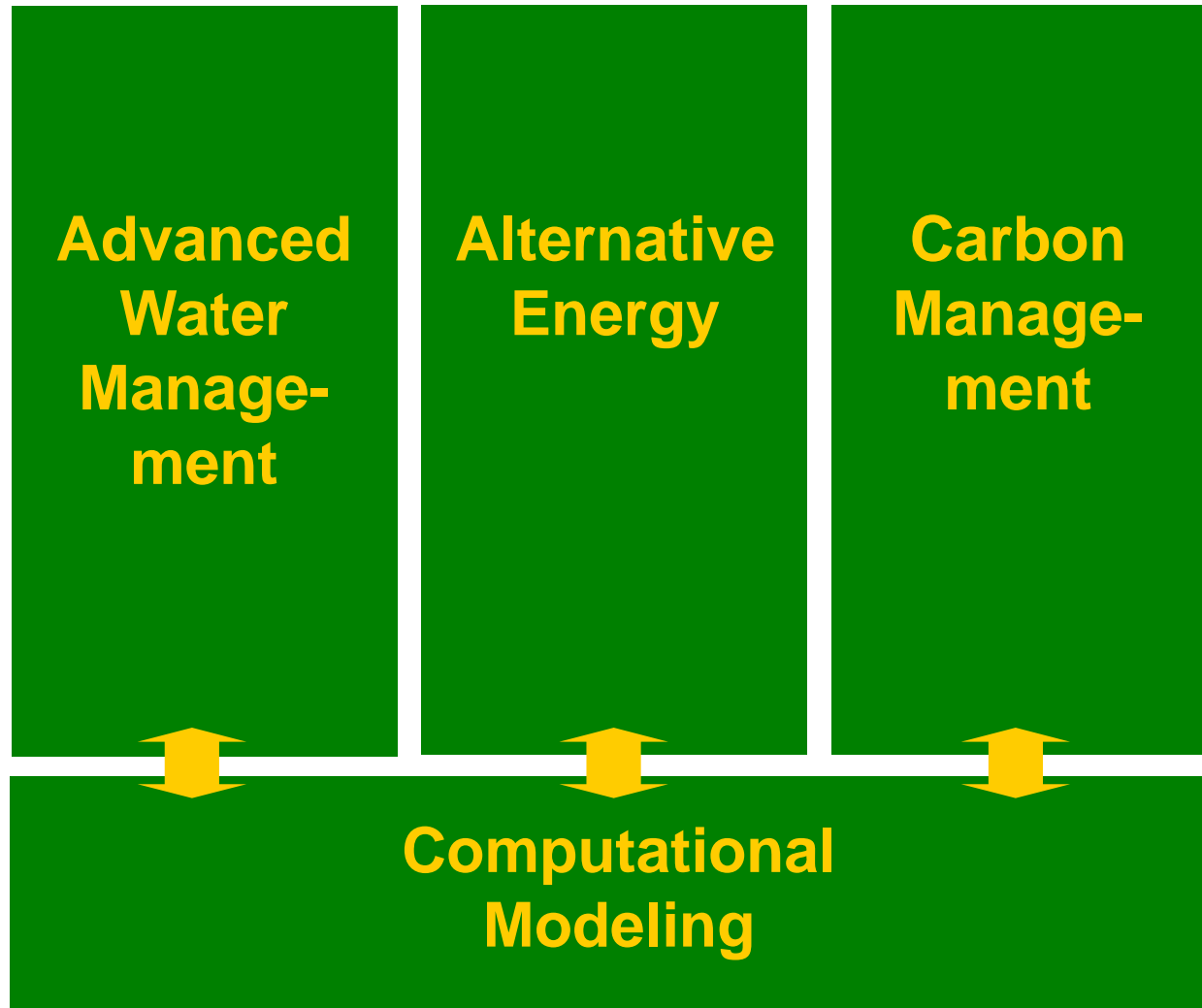
Catalyst - the “Innovation Jam”

- Late 2006 - “Strategy 2.0” - moderated web-based discussion
- IBM committed \$100m, in advance, to explore the outcomes further
- >140,000 IBMers, their families and some clients took part
- >40,000 separate contributions and ideas - moderated into 10 themes
 - Big Green Innovations was born from one of these themes

***“What are the innovations that matter for IBM
and for the world?”***

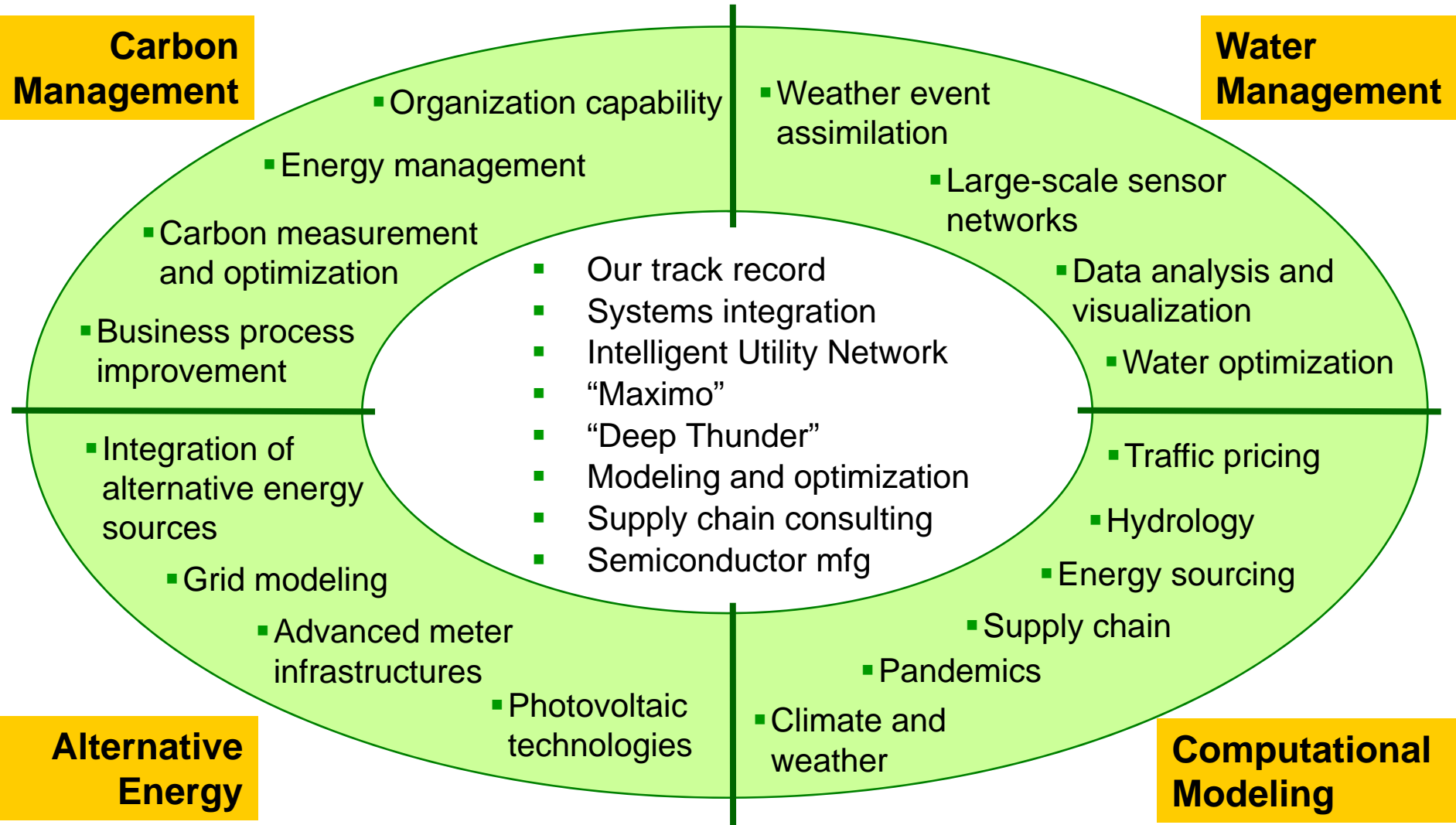


Big Green Innovations' portfolio has four core areas





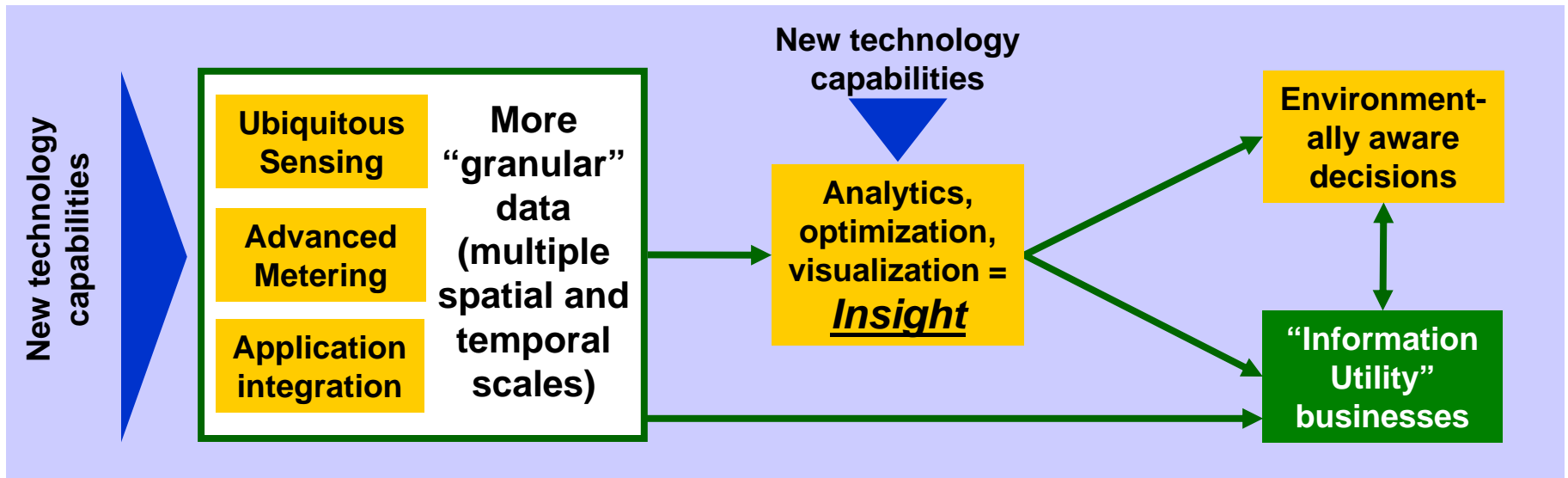
Innovation from a known base - we are building the portfolio from an existing core





The ultimate opportunity - “instrumenting the planet”, and creating information utilities

- Much of Big Green Innovations is based on enhanced understanding of planetary & human systems, and their interactions



- Sensing and metering will be in ever greater detail and ever closer to real time/ continuous.
- Modeling & optimization will be “whole business, real-world, operational”, no longer “function-based, off-line, advisory”
- Green “Information utilities” will emerge that make use of the data that will be available.



Evaluating Cleantech Options (ECO)

“ECO is an investment in making society smarter in how it assesses Green Innovation”



Problem statement



- It is very difficult to evaluate what technologies or proposals are the best, and best rounded, when looking at the full ecosystem.



- Most “reports” are self promoting or limited



- We do not have the resources or time to waste on missteps.



How ECO works...

- Open-sourced evaluation model used by inventors, VCs, the public to evaluate the environmental value and economic feasibility of specific “green” innovations - their own or others’
- Model evaluation criteria and benchmarks are reviewed and improved over time in the light of results achieved
- The model serves as a repository of “social wisdom” relating to each technology
- Updates to the ECO model are moderated by a panel of subject matter experts - per the Linux management model
- ECO will operate from a collaboration portal - a web site controlled by volunteer administrators





ECO: Evaluating CleanTech Options

Welcome

This is a Beta site for tapping the collective expertise of thousands of the Scientists, Engineers and Entrepreneurs world wide and applying it toward addressing sustainability issues, climate disruption and our over-dependance on fossil fuels.

This is an open community where you can get an Objective and fact based evaluation and discussion of CleanTech proposals and technologies.

At this site you can explore and Evaluate CleanTech Options in three dimintions: from broad energy proposals to the performance of the newest research. Between technology segments as to what is best use of resources. And from the latest battery technology to the best enzymes for making Cellulosic Ethanol. Come and join the debate.

Develop evaluation plans

Subject Matter Experts enter here to develop clean technology evaluation criteria.
➔Example Questionnaire form

Technology evaluation

Inventors/Entrepreneurs enter your performance information for a "Blind" evaluation of your technology
➔Tech eval form ➔Learn more about how we protect your Identity and Intellectual Property

Forums

The public discussion area of the site. You do not need to regiester or login to browse this. However in order to comment, registration and login are required.

[Register](#)

[Sign in](#)

About us

Have your Clean Technology safely evaluated by unbiased experts

Are you an expert in an Energy segment? Lend your expertise to help find the gems

Look for solutions that really work, are cost effective, scale and reduce GHGs

Learn what questions to ask about new CleanTech ideas.



Microsoft Excel - mock criteria and assessment with graph v2.xls

File Edit View Insert Format Tools Data Window Help

K20 =J21*M21

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
3	Question Group/ Question	Current	Target	Comment on response or Deviations from prescribed measurement methodology	What is gating factor for getting from current to target in any of these questions	Best of Breed	Units	Valid input range	Detail on what is being asked, how to measure (methodology) and what assumptions to make	Score 0-10 for Q in Group	Group score	Logic of Score in words	Weighting within Grouping	Weighting between Grouping
4	Versatility										10			0.15
5	1 Does the Enzyme work on C5 Sugars?	y	y			y		y or n		10		a yes =10 a no=0	0.5	
6	2 Does the Enzyme work on C6 Sugars?	y	y			y		y or n		10		a yes =10 a no=0	0.5	
7	Robustness										1.78			0.3
8	3 Require Sterilization?	y	y			n		y or n		0		a yes =0 a no=10	0.2	
9	4 Percent tolerance of Ethanol	10	20			45 %		.1-100		2.22		Linear on bob as reference	0.8	
10	Reaction Properties										5.25			0.15
11	5 Time scale of reaction in seconds	240	200			120 min		.0001- 4000		5		Inverse Linear with bob as ref	0.9	
12	6 Pressure	3	2			1 Atm		1		5		Inverse Linear with bob as ref	0.05	
13	7 Temperature	45	40			30 C		30		10		3 Range values with delta from	0.05	
14	Selection										8.00			0.3
15	8 Contol/Selection – Ability to direct to ethanol and avoid unwanted	y	y											
16	a) % Ethanol	80	98				%	.1-100		8			1	
17	b) % useful other	15	1				%	.1-100		0.75		partial credit		
18	c) % not useful other	5	1				%	.1-100		0		no credit for		
19	Cost													0.1
20		150	100			100 \$/ton of ethanol				6.67	6.67		1	
21	General Info													
22	9 Engineered micro-organism?	y	y					Text						
23	10 What is name of micro-organism?							Text						
24	Environmental impact Qs							Text						
25	Economic Scaling Qs							Text						

Sheet1 / Sheet2 / Sheet3





Possible segmentation of ECO model

Transportation

- Air powered cars
- Electric cars
 - All electric
 - Hybrid with generation
 - Plug-in Hybrid with generation
 - On-board generation options: gas/ICE, biofuel, fuel cell...
- Fuel production, distribution, storage
 - Ethanol – based on food sugars (like corn)
 - Cellulosic Ethanol
 - Pre-treatment
 - Hydrolysis
 - Fermentation
 - [Microbial Catalysts](#)
 - Combined Hydrolysis & Fermentation
 - Distillation/separation
 - Thermal processing and Chemical Catalysts for Cellulosic based fuels
 - Butanol
 - Waste to Biofuel
 - waste plastic/tires to fuel (diesel like)
 - biowaste to fuel
 - H2 Storage
 - Algae based Biofuels
 - Conservation/Efficiency

Buildings

- Residential Conservation (appliances, phantom loads, bulbs)
- Commercial Conservation
- Domestic Hot water
- Commercial hot water
- Residential HVAC (Geothermal grounded heat-pumps)
- Commercial HVAC solutions (windows, phase change material in walls...)

Energy Storage

- Batteries
- Ultracapacitors
- Combined Batteries and ultracapacitor systems
- Efficient portable generators for PHEVs
- H2 via Electrolysis

Electricity Generation

- Distributed solar
- Distributed waste heat generation
- Large Scale Solar
 - PV
 - Thermal concentrating
- Coal Gasification
- Wave
- Hydro
- Efficiency for conventional Gen
 - Oil
 - Natural gas -
- Wind
 - Ground based turbines
 - Tethered high or low altitude
- Nuclear
- Geothermal
- Enabling technologies
 - Carbon Capture and sequestering,
 - DC Grid for distribution
 - Smart Grid

Hydrogen Generation

- Distributed
 - Water Electrolysis
 - Microbial electrolysis cell process (ie Bruce Logan)
- Large scale



Everyone benefits...

Society: Easier to understand competing options – fosters educated discussion and better public awareness.

VC firms: Allows them to more easily screen and evaluate start-ups - fewer turkeys, more gems.

Government: Helps to focus limited resources on areas that will have most beneficial impact. Help gain consensus around options

Industry: Can get assessment results that have credibility – smaller innovators can more easily promote their ideas.

Universities: Can get assessment results that have credibility – can more easily promote their technology and leadership. Can build “green” resume by contributing to, or becoming subject matter experts for ECO



... including IBM

- Use ECO to promote ongoing awareness of our "Smarter Planet" offerings, just as our support of Linux drove awareness of our Linux offerings over several years.
- Demonstrates IBM's green credentials and corporate citizenship
 - Helps build our brand - currently 2nd most valuable in the world



let's build a smarter planet



Status and possible role for UCB

- ECO is a wholly voluntary effort supported to date with:
 - Time, materials and resources from IBM
 - Funding from the Kauffman foundation to support Academic links with entrepreneurs
- To date it is just a concept - it needs to be “made real”
- How could UC Berkeley participate?
 - Provide subject matter experts for energy segments
 - ID and introduce to other potential partners and SMEs
 - Help with development and hosting
 - Participate in launch
 - Help define appropriate governance approach



Thank you!

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