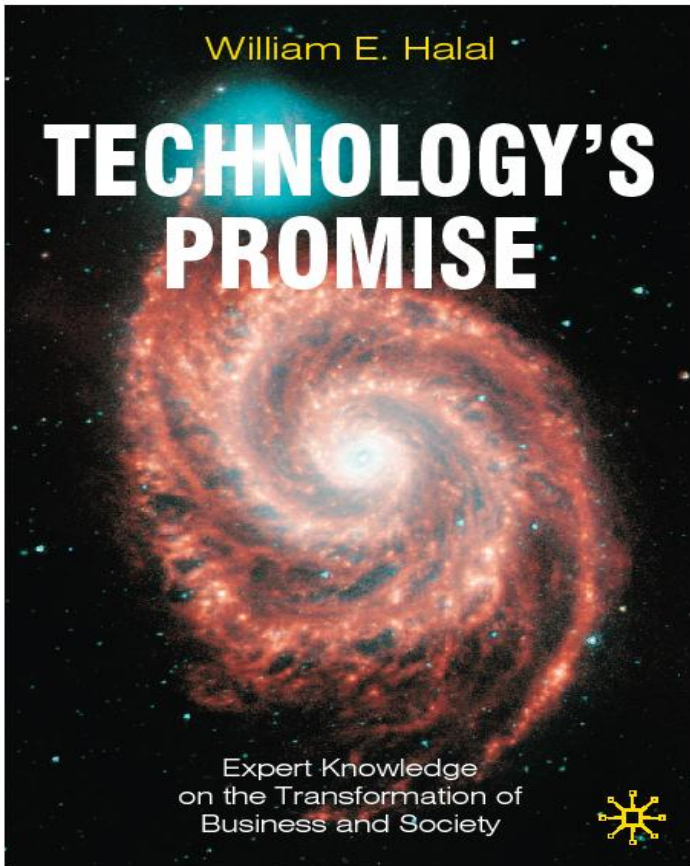


Forecasting the Technology Revolution

William E. Halal
George Washington University and TechCast LLC



Agenda

- The TechCast Project
- Forecast Highlights
- Scenarios by Decade

TechCast Online Research System

“Best Possible Answers to Tough Questions”

Status Quo Defined as
100 % Uncertainty

30 - 40 % Decrease
In Uncertainty

30 - 40 % Decrease
In Uncertainty

Uncertainty about 30%
+/- 3 years

Scanning

- Internet
- Media
- Science
- Interviews
- Conferences

Analysis

- Event/
Issues
- Data
Points
- Trends

Expert Survey

- Expert
Knowledge
- Integration
- Estimates

Results

- Forecasts/
Tracking/
Arrivals
- Data
Analysis
- Comments

Iterations

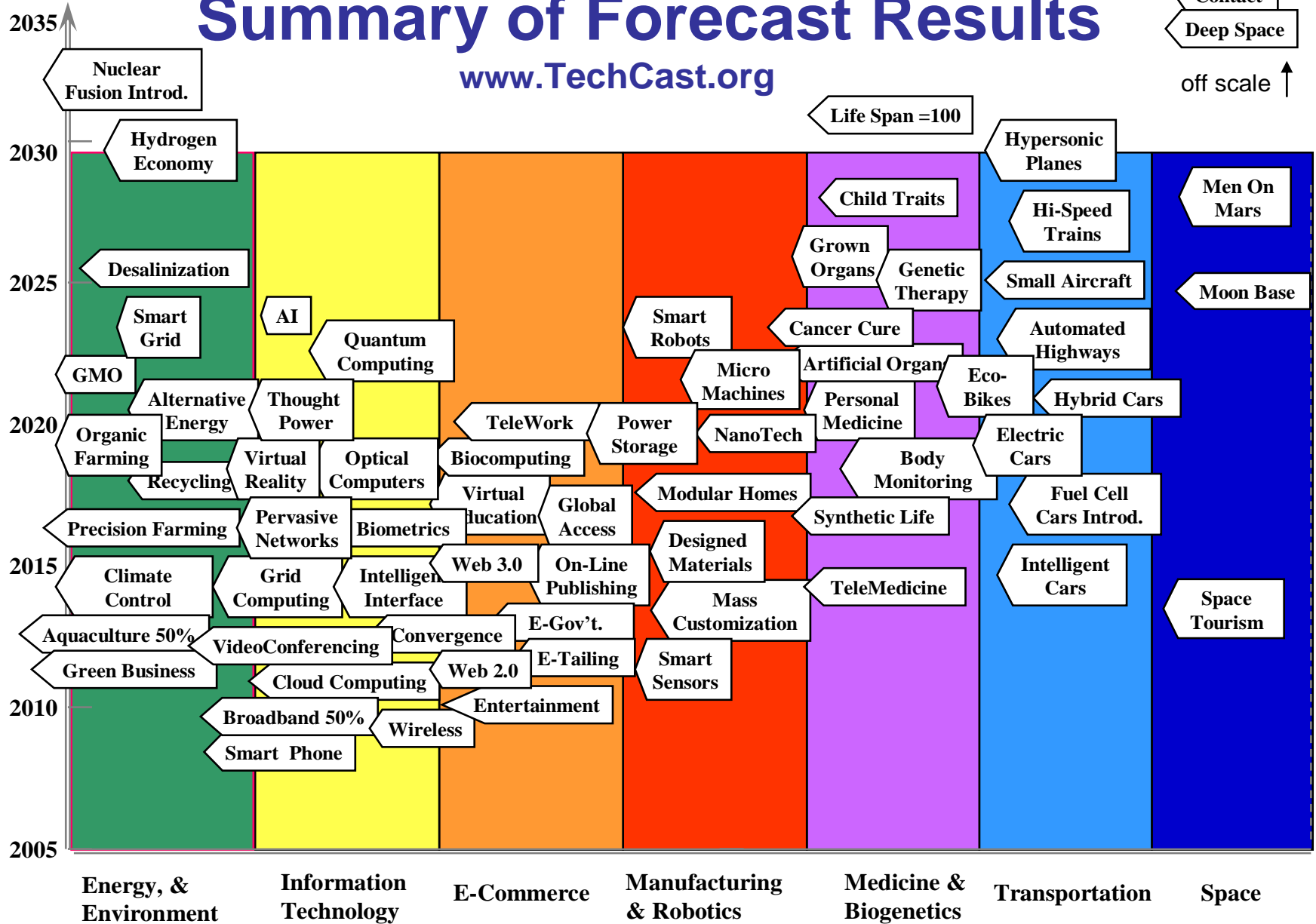
Summary of Forecast Results

www.TechCast.org

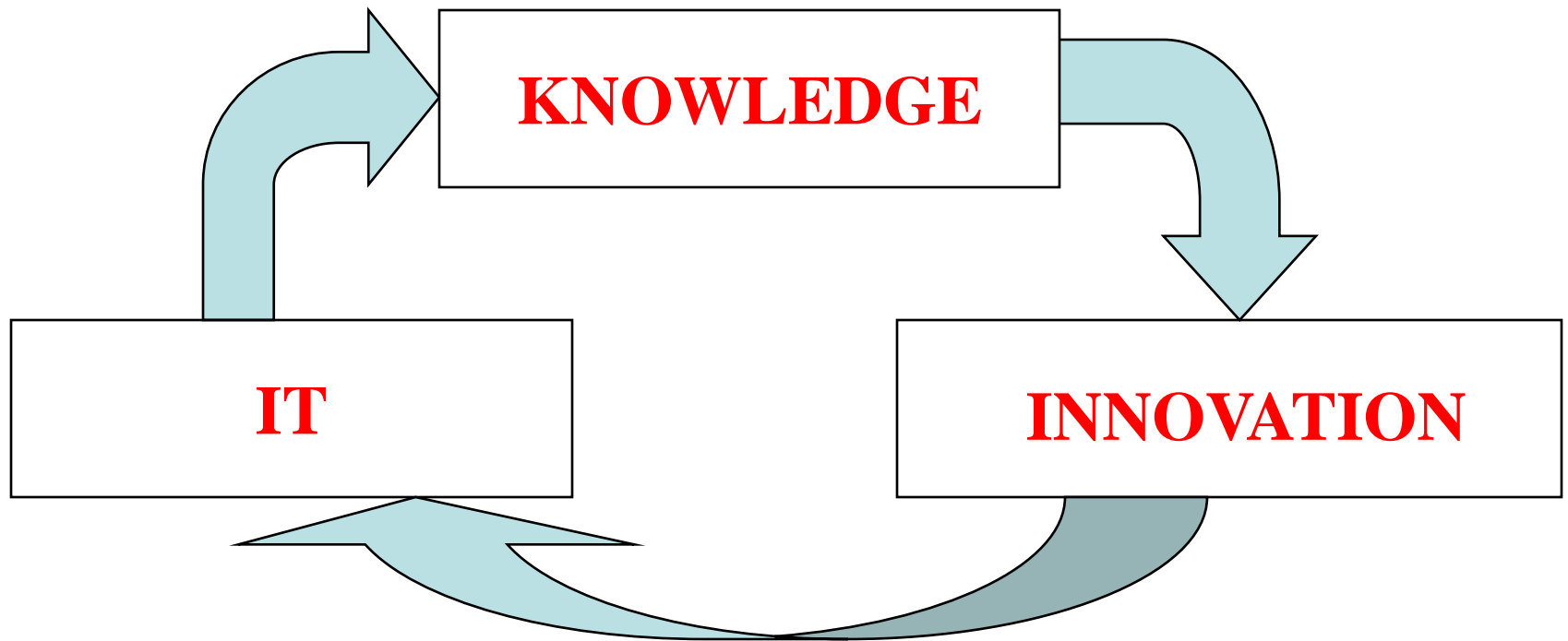
Contact
Deep Space
off scale ↑

Most Likely Year to Enter Mainstream

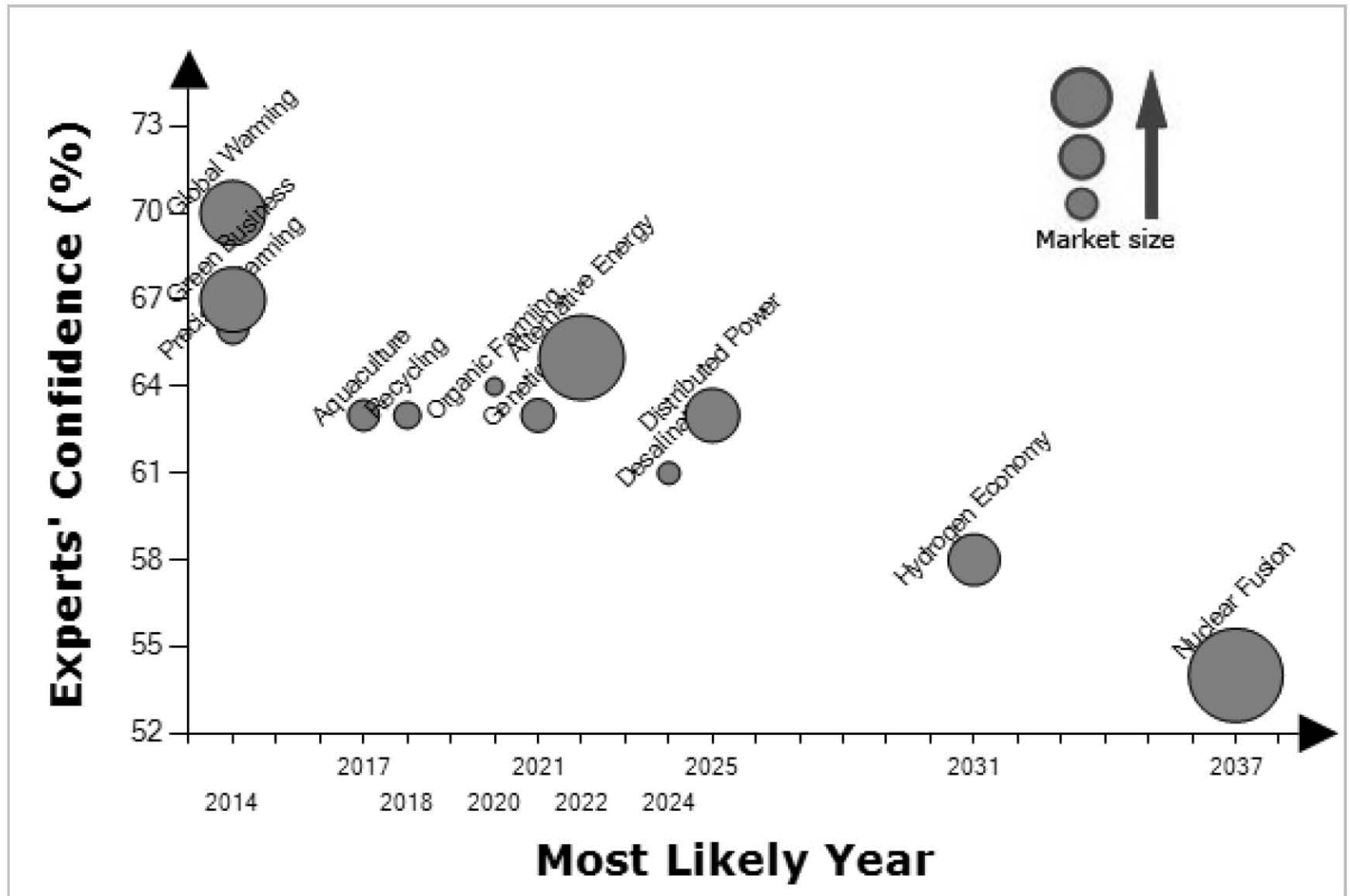
(Usually defined as 30% adoption level)



THE VIRTUOUS CYCLE OF KNOWLEDGE



Energy & Environment

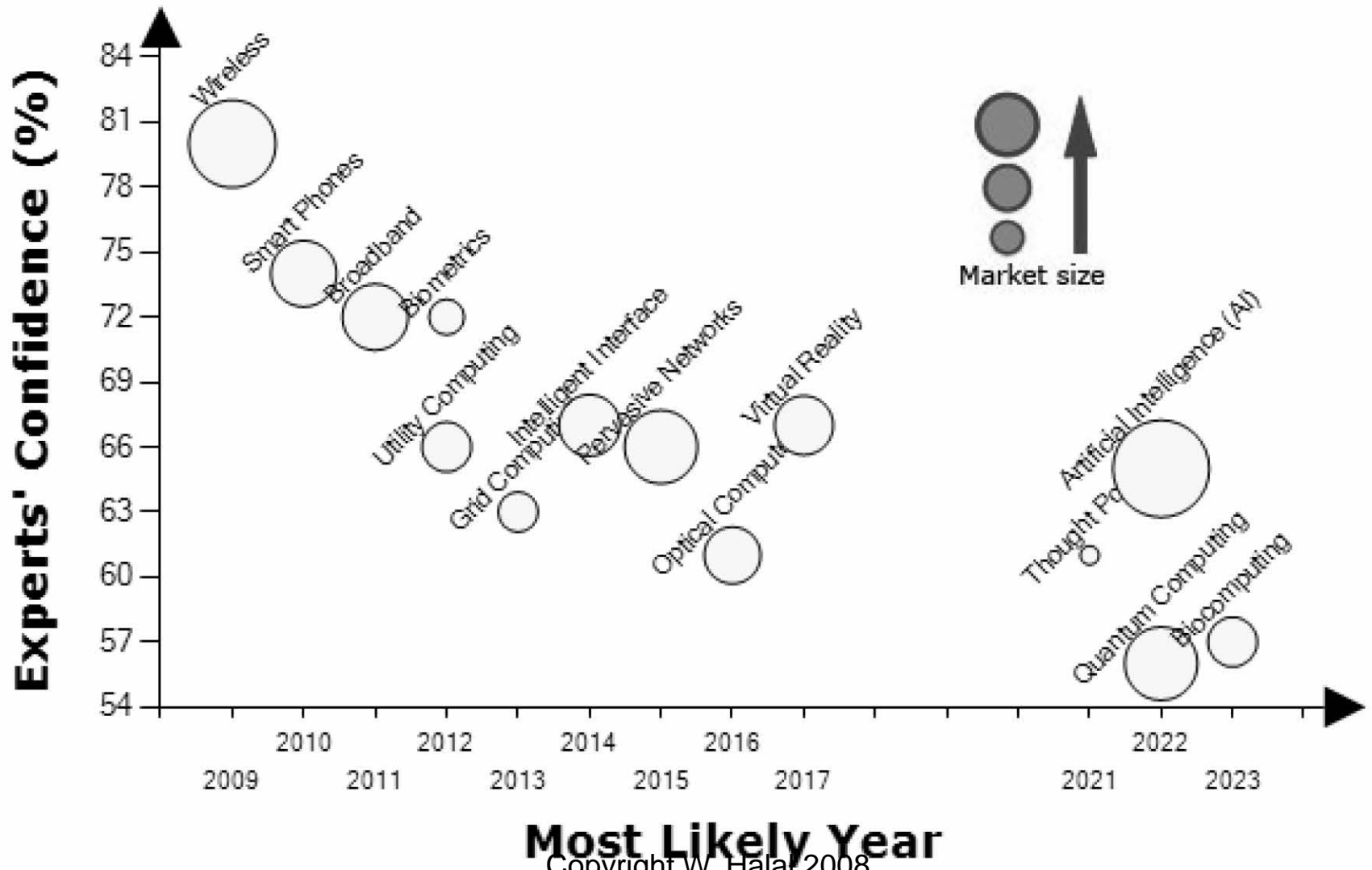


Alternative Energy

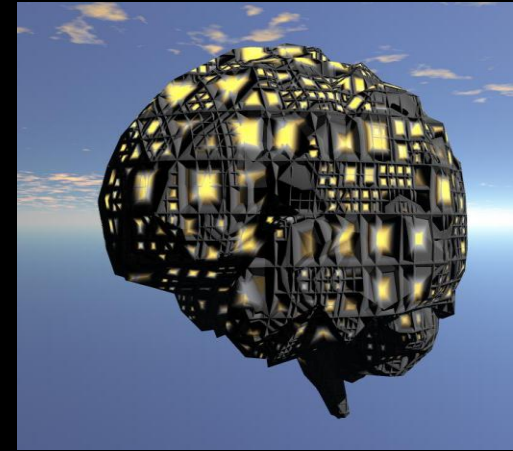
- Geothermal, wind, biomass competitive now
- Clean coal technologies/sequester CO₂ in mines
- Concentrated solar/photovoltaic in 2012-14
- Biggest source is conservation (Lovins)
- Nuclear favored - 440 plants to 500-600 by 2010
- Deregulation/distributed energy sources
- Growth rates of 30-50%/year similar to Moore's Law
- **TechCast: From 16 to 30% of energy use by 2020**
(hydro - 6%, bio - 3 to 6%, nuclear - 6 to 9%, wind - .5 to 3%, solar - .5 to 6%, plus conservation, clean coal, etc.)



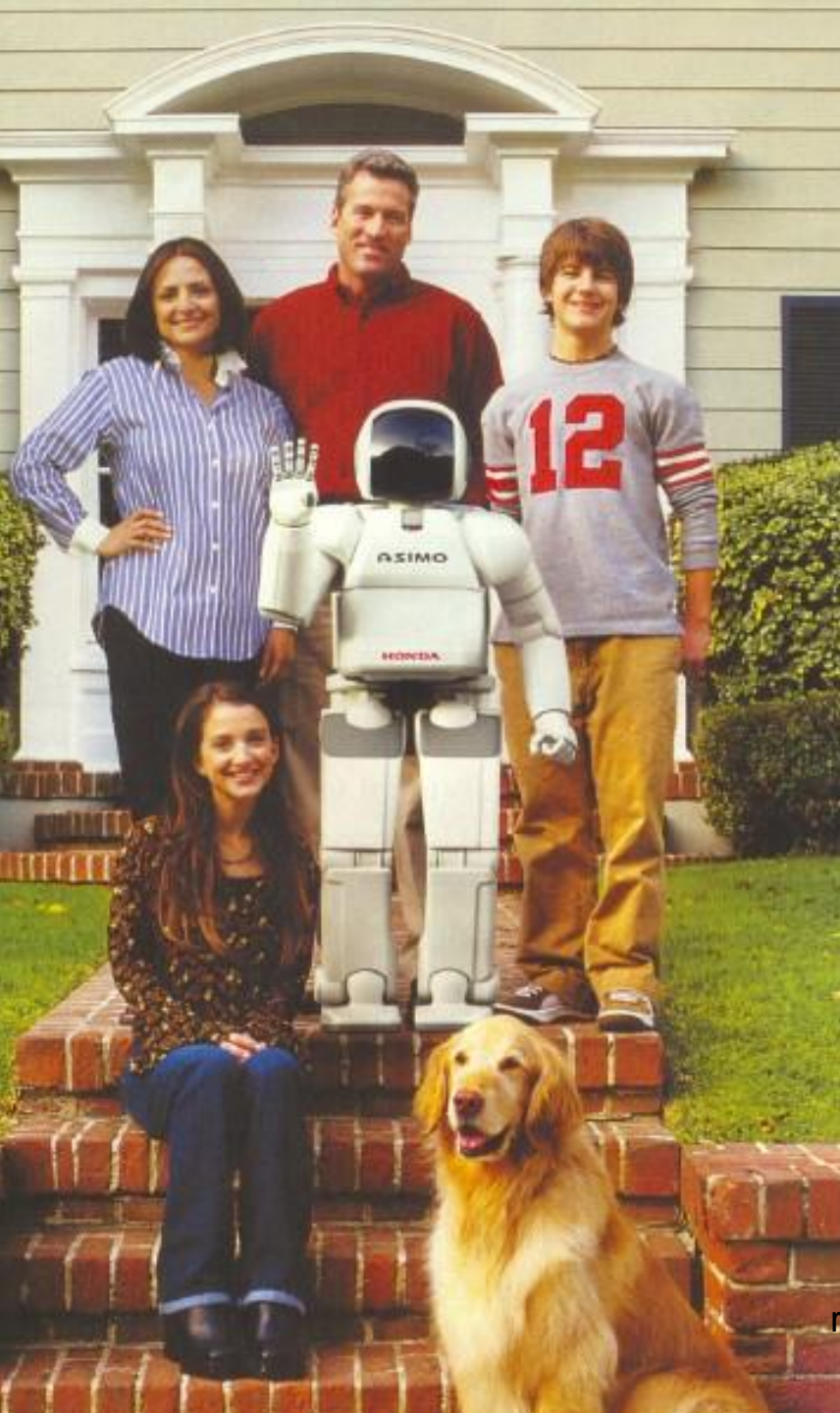
Information Technology



Artificial Intelligence



- \$1 B in '93, \$12 B in '02, \$21 B in '07
- Models: Cyc, Kismet, Jabberwocky, Asimo, etc
- Speech recognition, robots, computer games, GPS nav.
- IBM's autonomic computing program
- DARPA, DOE smart computer research
- 5 robotic vehicles completed DARPA urban competition
- IBM simulating the human brain (8,000 neurons)
- Kurzweil: \$1000 PC with power of the brain about 2020
- **TechCast: AI replaces routine mental work ("weak AI") about 2021**



Robotics

State-of-the-Art (Sony, Honda, Toyota)

- 60K vocabulary, speech recognition
- 30 motor joints, walks, runs, stairs
- Learn faces, surroundings
- Security guards, receptionists, aides, serving tea, other simple tasks

Coming

- Emotional interactions – Kismet (MIT)
- Improved AI, speech, consciousness?
- Care givers, servants, warriors, etc.
- Rodney Brooks (MIT): “Like PCs in '75”
- **TechCast – 30% of homes by 2020**

Intelligent Cars

- Annual costs of U.S. congestion - \$50 B lost productivity, 40K deaths/\$150B
- Traffic to double by 2020
- Self-driving, GPS navigation, OnStar, cruise control, collision-avoidance, electronic tolls, connected to driver's "info-cloud," etc.
- Infrastructure required
- Taiwan: Next \$ trillion industry
- **TechCast - 30% of cars by 2014**

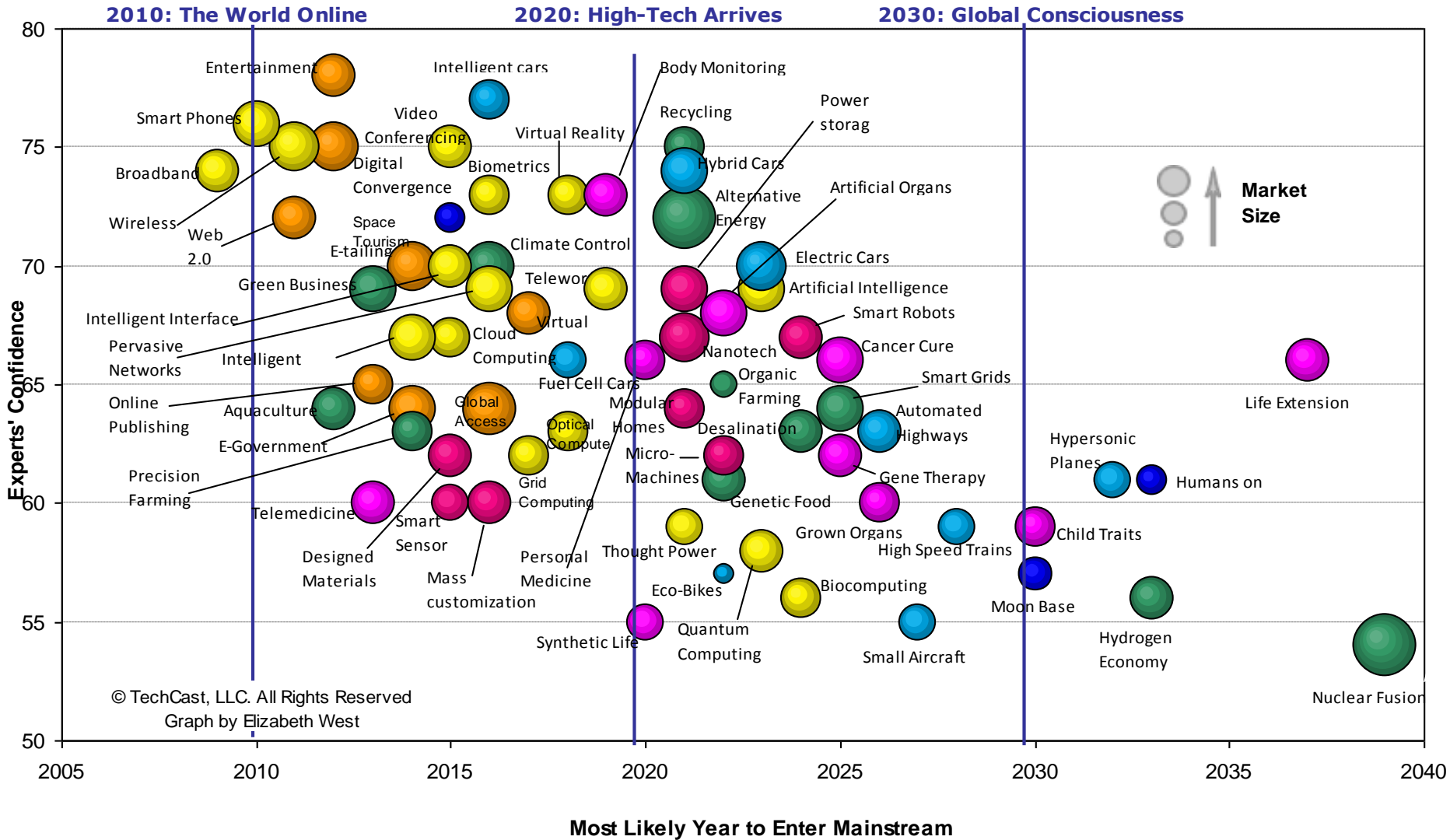
Space Tourism



Space Tourism

- Space Ship One (Virgin Galactic) – about 2010
- Like commercial air travel
- Space Adventure Co. has 1000 clients interested in going to the Int'l. Space Station for \$20 M and around the moon for \$100 M
- Robert Bigelow – Building \$500 M cruiseship and hotel
- Market surveys (10,000 people @ \$1 M)
- NASA: 2010 -12
- **TechCast: Spaceship carries tourists in high orbit – 2014**

Longitudinal Summary of Forecasts - www.TechCast.org



Energy & Environment Information Technology E-Commerce Manufacturing & Robotics Medicine and Biogenetics Transportation Space

2010-2015

The World Goes Online

Devices: Smart phones, \$100 PCs, Web 2.0/3.0, wall monitors/TVs, digital convergence

Infrastructure: Faster BB and wireless, utility/cloud computing, intelligent networks, GPS, language translation, speech recognition, etc.

E-Commerce E-businesses reaches 30% take-off adoption levels

Global Brain: Half the world joins the Internet

Next 35 yr Upcycle: About 2015 -2050



2020 High-Tech Arrives

Crisis of Maturity

Global GDP doubles, along with energy needs, climate change, environment load, economic disorders, conflict, and other failures of obsolete global system

Sustainability

Green business, alternative energy, climate control, recycling, distributed power

Mastery Over Life

Artificial organs, DNA testing, grown organs, cancer cure, life extension

Knowledge, Intelligence, and Beyond

2nd generation computing, good AI, robotics, virtual reality

Evolution of Global Consciousness

Automation of routine thought and spreading of knowledge and intelligence raise awareness and capability. Move beyond knowledge to consciousness

Marien-Halal Survey on the Global Megacrisis

(Results as of Feb 25, 2010 Sample = 51)

4 Scenarios on the Passage to Maturity

Decline to Disaster - 25% prob. World fails to react. Global warming, sea level rise, energy shortages, economic depression, conflict, etc. Loss of civilization in many parts of the globe.

Muddling Down - 35% prob. World reacts partially. High-tech dark age, some ecological damage, increased poverty and conflict.

Muddling Up - 28% prob. World reacts out of need and the help of IT/AI. Disaster avoided but some increased disorder

Rise to Maturity - 12% prob. Ideal transition to a responsible global order.

Next Field in TechCast

Technologies of Consciousness

Neurotech – Prostheses for Parkinson's, adding memory, etc.

Biofeedback – Use of EEG for focused attention, stress, control, etc.

Machine-Brain interface/Thought Power – Brain waves controlling machines, comm.

Virtual Reality – Simulating environments to live in fully.

Media – Consumerism, sex, violence, hype, etc. - the over connected society

The Experience Economy – Travel, dining, sports, the arts, etc

Drugs – Medicinal (Prozac, etc), professional (Modafinil), recreational (marijuana, etc)

Vision & Strategy – Purpose, vision, forecasting, strategy, etc.

Institutional Change – Collaborative enterprise in business & government

Collaboration – Politics, diplomacy, labor-mgt coop., joint problem-solving

Servant Leadership – GM Saturn, Good to Great Studies, Japanese, etc.

Conflict Resolution – Peace Studies, arbitration, mediation, etc.

Physical Practice – Yoga, dance, athletics, art, etc.

Religion – Synthesis of world's religious values?

Science - Study of spiritual energy?

Meditation & Prayer

Sexuality

Other ways to shape awareness?

Thank you

Questions?