

# **MAPPING THE GLOBAL GREEN TRANSITION: 2009-2020**

## **FINANCE, COMPANIES, TECHNOLOGIES.**

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By Hazel Henderson  
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Forward

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Forward

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**Introduction:** Evolving 21<sup>st</sup> Century Green Economies: 2000-2050  
(Hazel Henderson, forthcoming)

**Chapter 1:** Tracking Private investments: \$ 1.2 trillion in 2009

**Chapter 2:** Private Investments Rise to \$ 1.64 trillion in 2010

**Chapter 3:** Private Investments Top \$2.4 trillion in 2011

**Chapter 4:** Emerging Trends in Biomimicry Expanding Cleantech in 2012

**Chapter 5:** Green Transition Inflection Point: \$5.2 trillion in 2013  
Green Bonds Growing Green Infrastructure

**Chapter 6:** Plenty of Water: 97% Saltwater and Uses, 2014

**Chapter 7:** Breakdowns Driving Breakthroughs: \$6.2 trillion in 2015  
Batteries and Storage Charging the Green Transition

**Chapter 8:** Ending Externalities: Full-Spectrum Accounting for Transition 2016

**Chapter 9:** Deepening Green Finance, \$8.1 trillion in 2017

**Chapter 10:** Capturing CO2 While Improving Human Nutrition & Health,  
\$9.3 trillion in 2018

**Chapter 11:** Transitioning to Science-Based Investing, 2019-2020  
\$10.387 trillion in 2019

**Conclusion:** Entering the Solar Age  
(Hazel Henderson, forthcoming)

Note: All Chapters are complete in electronic form, will be edited  
Introduction and Conclusion will be written by Henderson, lead author.

## Foreword

### **Context and Strengths of the Ethical Markets Decade Long Mappings of the Global Green Transition**

by Dennis M. Bushnell, FAIAA, FASME, FRAeS, MNAE  
Chief Scientist NASA  
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Humanity and the planet we inhabit are beset by a number of concomitant and serious-to-existential issues. Those caused by humans include Climate/ Energy, a crashing Ecosystem/Population Growth/Water/ Food nexus, Employment/Wealth Distribution/AI and potential Biohacking impacts. Added to these are “natural” threats such as solar storms and asteroid impacts.

Overall, the current societal situation appears to be the following:

Population increases, previous-to-current technologies and increasing standards of living have resulted in placing climate, the ecosystem and wealth distribution on an unsatisfactory to in some cases existential path.

These are additive to concomitant natural threats, mentioned above: asteroid impacts and major solar storms.

Current solution spaces, when considered, are primarily tactical, inadequate, and largely protective of the economic status quo.

Solution spaces for these very serious and deepening issues require broader, systemic definition of the panoply of issues, as in defining the problem set.

Furthermore, since these issues are playing out longer term, such problem definition and subsequent formulation of solution spaces needs to evaluate the potential effects and feedbacks of taking various actions going forward.

We have learned, are learning a not very surprising lesson regarding successfully addressing these issues as we are working through climate and energy.

For decades there have been serious, well-based scientific studies calling for less fossil carbon fuels and a shift to renewable energy sources, which have massive capacity. Until technology enabled renewables which were at or below cost parity with fossil fuels not much progress was made. Once the costs of renewables, which had long been falling, became financially advantageous, their adoption accelerated.

Rapid progress in decarbonization is projected, catalyzed by the plummeting costs of storage for wind and solar, falling by some 15% per year since 2012.

The takeaway is that, to seriously address the major societal issues expeditiously it is efficacious to develop approaches that are financially advantageous.

Enter Ethical Markets and their mapping of the global Green Transition Scoreboard. This effort over a decade mapped year on year since 2009 and uniquely the financial and some technical aspects of primarily the “Green” Climate/ Energy related aspects of sustainability with excellent consideration along the way of other sustainability and societal issues. This mapping of the absolutely critical financial world aspects has documented and become a catalyst for commercial, industrial, government and financial “affirmative action” regarding climate/ energy and other societal issues.

This summary of the decade long mappings includes courageous content concerning frontier climate/ ecosystem issues, solution spaces such as halophytes/ salt plants grown on wastelands/ deserts using saline/ seawater irrigation to quickly and affordably solve land, water, food, energy and climate. The summary also includes documentation of and advocacy for advanced financial approaches to sustainability/ climate. The volume also calls for attention to and calls to action to address the massive worldwide scientific studies/ efforts that, if anything, are proving conservative concerning the actual observed effects of human activities upon the ecosystem and climate.

Going forward, major adverse effects are developing across a broad spectrum and will require, from the learnings of addressing climate/ energy, beneficial financial approaches to accelerate solution spaces. This is exactly what the Ethical Markets mapping of the Global Green Transition addresses, along with advocacy / cogent arguments for taking the requisite longer term view.

As we shift from creating wealth via natural resources as we did in the Industrial Age, to creating wealth via inventing things in the Information Technology (IT) Age, and now shifting rapidly into the Virtual Age, sustainability-related inventions include:

- Ever less expensive energy storage
- All electric land/sea/air transportation
- Energy- generating buildings
- Far more efficient electric motors
- Tele-everything society; tele-commuting, work, travel, education, medicine, commerce, politics, socialization and with at- home printing tele-manufacturing.
- Distributed energy generation
- Halophytes, seawater/saline irrigation to replace the 70% of the fresh water now used for agriculture, and produce massive amounts of food and biomass/ petrochemical feedstock, as well as capturing ambient CO<sub>2</sub>.

However, the shifts to these and other technologies, approaches going forward will have massive impacts on current industries. This is why advantageous financial aspects are necessary. A shift to electric transportation with electricity from renewables and a shift to halophytes for petrochemical feedstock have major impacts upon petroleum. The ongoing shift to renewable energy is having major impacts on such as coal and nuclear and going forward as storage improves, natural gas. Distributed energy generation is altering the power company business case ..... as a few examples.

The solution spaces for the many serious societal issues, as we try to mitigate their major downsides involves change, including change in many major industries. These shifts will have to

be handled very carefully and favorable overall financial benefits will be a tremendous catalyst, hence this book.

Dennis Bushnell, FAIAA, FASME, FRAeS, MNAE  
Chief Scientist NASA Langley Research Center  
Hampton, Virginia USA  
June 2019

## **Forward Forthcoming**

by KoAnn Vikoren Skrzyniarz  
Founder/CEO  
Sustainable Brands Worldwide

### **A Personal Note from Hazel Henderson**

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The global economy is now at a tipping point, as documented in our annual Green Transition Scoreboard® reports since 2009, culminating in our 2018 and 2019 reports showing over \$10.387 trillion now privately invested in green sectors worldwide. We are emerging from the 300-year fossil-fueled Industrial Era to the cleaner, greener knowledge-rich renewable energy societies which I predicted in my *The Politics of the Solar Age* in 1981, reviewed in the *New York Times*, *New Scientist* and now in 800 libraries around the world over in over 20 languages; my focus on the global green transition is based on my six years of service on the Technology Assessment Advisory Council of the US Office of Technology Assessment, the National Science Foundation and the National Academy of Engineering. Technology assessment research deepened my understanding of the scientific realities now entering public awareness: our planet Earth is awash in energy – that free daily photon shower from the sun. Our Green Transition Scoreboard ® has reported the progress of efficient capture and use of this gift of Nature which green plants innovated in the first technology: photosynthesis – providing food for humanity. [Ethical Markets 3 minute video](#)

This confirmed my view that GDP gives a [Grossly Distorted Picture](#) of a country's progress. By 2000, I and Calvert launched our Calvert-Henderson Quality of Life Indicators as an unbundled dashboard of 12 systemic trends in national progress, now part of Ethical Markets. Both public and private finance can play leadership roles: public investments created satellite communications, the internet, the inter-state highway system and many civilian spinoffs of military budgets, while

the private sector innovated in chemistry, biotech, the worldwide web-based economy and a whole range of efficient, renewable energy and materials technologies. These scientific breakthroughs and innovations are still often ignored by Wall Street, and have led to the new risks in science-denial, as we show in our 2019 report due to those anthropocentric fallacies in economic textbooks and underlying most financial models: CAPMs, Value at Risk, Black-Scholes-Merton Options Pricing as well as security analysts' asset allocation "buckets", all encoded in algorithms, which still lack a sustainability sector. Solar, wind, geothermal, whose annual potential exceeds total reserves of fossil fuels, are lost in their models, formulas and many ETFs still dominated by fossilized assets. Energy efficiency was often lost to investors' view until Bloomberg and FTSE began noticing their rapid paybacks of 12-24 months, obscured by textbook economics ignoring the "externalities".

Calvert, Pax World, Domini, and other SRI-ESG, green funds pioneered, along with Alice Tepper Marlin's Council on Economic Priorities, the new metrics of ESG company valuation. At the UN, Dr. Elizabeth Dowdswell, the first head of UNEP, pioneered UNEP-FI, bringing global financial groups into awareness of how economies are dependent on nature's ecosystems. Thoughtful financiers pondering their persistent crises are learning from ecologists how to correct financial models while recognizing that finance is a part of our global commons ([www.transforming-finance.net](http://www.transforming-finance.net)).

Out of UNEP-FI, led by pioneer asset manager Tessa Tennant and others, many initiatives have now joined the global Green Transition: UN-PRI with assets under management of \$60 trillion; the UN Global Compact with its 10 Principles of Global Corporate Citizenship, the UNEP Inquiry on Sustainable Finance ([www.unepinquiry.org](http://www.unepinquiry.org)). Accounting models shifted to IIRC's 6 forms of capital: financial, built, intellectual, social, human and natural forms. TEEB analyses revealed the value of ecosystems and biodiversity as material to asset valuation. In the private sector, SwissRE, CERES, the GRI, REN 21 and WWF joined in pioneering new metrics, while new stock indices and market letters covered the emerging green sectors, companies, and investors. Public opinion surveys in 12 countries revealed in our "Beyond GDP" research with Globescan showed the growing public awareness of the value of environmental considerations to overall wellbeing. Pew surveys in 2019 confirm that the public in 27 countries rate climate change the top risk, as we cite in our 2019 report.

Thus, I created the Green Transition Scoreboard® and selected only those technologies and companies I knew would meet the long-term criteria of sustainability. Thus we deliberately omit many investments in many areas that are not based on good science, technology, and competent management, as part of the new often hidden threat to financial markets: science-denial. It's time to end fossil fuel subsidies which would cut deficits and return billions annually to taxpayers and allow the green sectors to compete on a level playing field [www.globalsubsidies.org](http://www.globalsubsidies.org). Today, 70% of all US federal subsidies still go to oil, natural gas and coal and another 15% to ethanol – not to mention the hidden subsidies to nuclear.

As James Fletcher, former NASA Administrator told our Technology Assessment Advisory Council in 1976, if all these subsidies over past decades had instead gone toward solar, wind, all renewables and efficient energy, the US economy would have been 100% powered by these

renewable sources by the mid-1970s! Our Green Transition Scoreboard® tracks this technological evolution through these investments, shifting from the past to the future. The Green Transition Scoreboard® details this new 21st-century economy and how we are moving toward this cleaner, greener sustainable future, as envisioned in the Green New Deal Resolution backed by over 100 members of the 116th U.S. Congress in 2019.

**Hazel Henderson**

**Creator, Green Transition Scoreboard®**

**President, Ethical Markets Media (USA and Brazil)**

**Author, Ethical Markets: Growing the Green Economy (2006); and other books**

## **Praise for the Green Transition Scoreboard®**

“The Global Green Transition” e book is a true treasure chest. It shows how finance can act as a catalyst to accelerate the much needed transformation towards a clean and safe future“.

-Georg Kell

Chairman Arabesque, Founding Director UN Global Compact

“Great work. Most impressive!”

-Fritjof Capra, Author of the Tao of Physics and The Systems View of Life

“The Green Transition Scoreboard is a wonderful idea, and I hope that it continues for the decades ahead—still a long way to go, but we’re getting there!”

-Michael Marien, Senior Principal, *The Security & Sustainability Guide* ([www.securesustain.org](http://www.securesustain.org))

“Over twenty years ago, Hazel Henderson talked of a most implausible goal: to both encourage Green investing and to track its growth worldwide. The remarkable \$5.3

trillion [2014] now invested in Green still challenges the imagination. The world needs to know of this triumph and its significance to all our futures.”

– Carson E. Beadle, former Director, Mercer; Executive Committee Chairman, Security Mutual Life Insurance of NY.

“No leader, from the CEO of the smallest of corporations to the president of the largest of nations, could do better than internalizing the principles of Ethical Markets and always keeping a sharp eye on the Green Transition Scoreboard.”

– Ashok Khosla, Chairman, Development Alternatives and pioneer social entrepreneur.

“The GTS adopts a much more comprehensive and therefore effective working definition of a green economy than is usually the case, and provides a robust and consistent framework for measuring our progress towards it.”

– Matthew Kiernan, founder, Innovest; CEO, Inflection Point Capital Management; author of *Investing in a Sustainable World*

“We usually do manage what we measure; so the GTS is an important contribution from Ethical Markets Media in getting to the future our polling suggests people intend for their children.”

– Doug Miller, Chairman, GlobeScan Inc.; President, GlobeScan Foundation

“Wonderful initiative. Finally, an overview of the amount of private money invested and committed to Impact Investing.”

– Robert Rubinstein, CEO, TBLI GROUP™

“Because it enables tracking of the global macro-shift from the Industrial Era to the emerging sustainable economies of the 21st century the GREEN TRANSITION SCOREBOARD® is an important innovation. Check it out!”

– Don Tapscott, author of the bestsellers *Wikinomics and Macrowikinomics*

“Since 1987, we have guided our investors towards companies leading the growing green economy: the Sustainability Sector. The GTS is an important milestone in measuring the increasing economic viability of this CleanTech universe.”

– Stuart Valentine, Founder, Centered Wealth, Fairfield, Iowa



# 2019



## [“Transitioning To Science-Based Investing”](#)

Full Report

May 2019 [Press Release](#)

## Previous Years

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### 2018

April 2018 [“Capturing CO2 While Improving Human Nutrition & Health”](#)

April 2018 [Press Release](#)

### 2017

April 2017 [“Deepening Green Finance”](#)

April 2017 [Press Release](#)

### 2016

April 2016 [“Ending Externalities: Full -Spectrum Accounting Clarifies Transition Management”](#)

April 2016 [Press Release](#)

## **2015**

April 2015 Report: [“Breakdowns Driving Breakthroughs”](#)  
[April 2015 Press Release](#)

September 2015 Update [“Batteries and Storage Charging the Green Transition”](#)  
[September 2015 Press Release](#)

## **2014**

March 2014 Report [“Plenty of Water!”](#)  
[March 2014 Press Release](#)

August 2014 Report [“Green Bonds Growing Green Infrastructure”](#)  
[August 2014 Press Release](#)

## **2013**

March 2013 Report, [“Green Transition Inflection Point”](#)  
[March 2013 Press Release](#)

August 2013 Report-**Update**  
[August 2013 Press Release](#)

## **2012**

February 2012 Report [“From Expanding cleantech sectors to emerging trends in biomimicry”](#)  
link

August 2012 Report: **Update**

## **2011**

February 2011 Report:  
[“A Primer For Pension Funds, Endowments, Institutionals, Foundations, VCs”](#)

[February 2011 Press Release](#)

## **2010**

[August 2010 Report](#)

[August 2010 Press Release](#)

## **2009**

[December 2009 Report Introduction to Investors](#)