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Energizing the US Resource Innovation Ecosystem

The Case for an Aligned Intermediary to Accelerate GHG Emissions Reduction

Ashby Monk Executive and Research Director of the Stanford Global Projects Center

Sarah Kearney Executive Director, PRIME Coalition & Visiting Researcher, MIT Sloan School of Management

Alicia Seiger Deputy Director, Stanford Steyer-Taylor Center for Energy Policy & Finance

Elliott Donnelley General Partner of the White Sand Investor Group, LP



Stanford | Global Projects Center

Stanford | Steyer-Taylor Center for
Energy Policy and Finance

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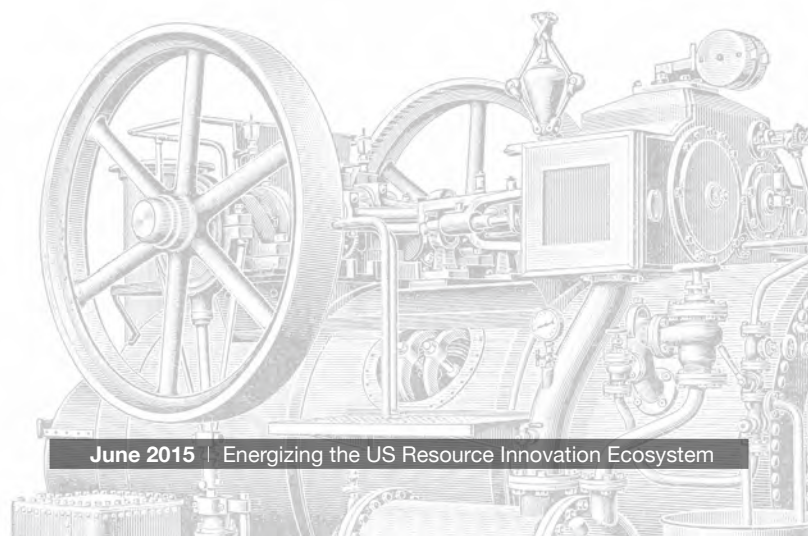
By 2050,
the world population is forecasted
to reach 10 billion people, and
consumption of natural resources is expected to increase
four-fold above current rates. Radical resource innovation
– across energy, agriculture, water, and waste – is required
to prepare the world for this future. Without it, we risk
irreversible climate change, military conflict over resource
access, and deepening inequity in the developing world.





Paradoxically,

there are no shortages of breakthrough technologies being developed in universities, national labs, and garages that could be as transformative today as the steam turbine in the 19th century or the solar cell in the 20th.





What there is a shortage of, however, is patient, early-stage capital to support the transformation of these projects into lasting, profitable companies. Even growth-stage companies in this space sometimes lack access to project capital to execute first-of-a-kind demonstrations and deployments, and to achieve price competitiveness at commercial scale. In short, preventing a climate catastrophe demands that we create a new investment toolkit that can help bridge the “valleys of death” faced by these companies.



We thus believe that the resource innovation ecosystem could benefit from the creation of a new aligned intermediary (“AI”). The AI, detailed below, is designed to be a uniquely aligned financial services organization whose mission would be to specifically help Long-Term Investors (“LTIs”) – such as pensions, endowments, sovereign funds, family offices, and foundations – identify, screen, assess, and invest in high-potential companies that are producing the most impactful, and indeed profitable, solutions to climate change.

The AI’s primary goal will be to help LTIs generate attractive market risk-adjusted returns from investments in companies and projects that can help avoid the catastrophic effects of climate change. The high performance of such investments will, in turn, unlock billions and potentially trillions of dollars from within the LTI community for resource innovation ventures and projects. In this regard, the AI will help companies bridge the innovation and commercialization valleys of death and accelerate the commercial deployment of technologies that reduce global greenhouse gas emissions.

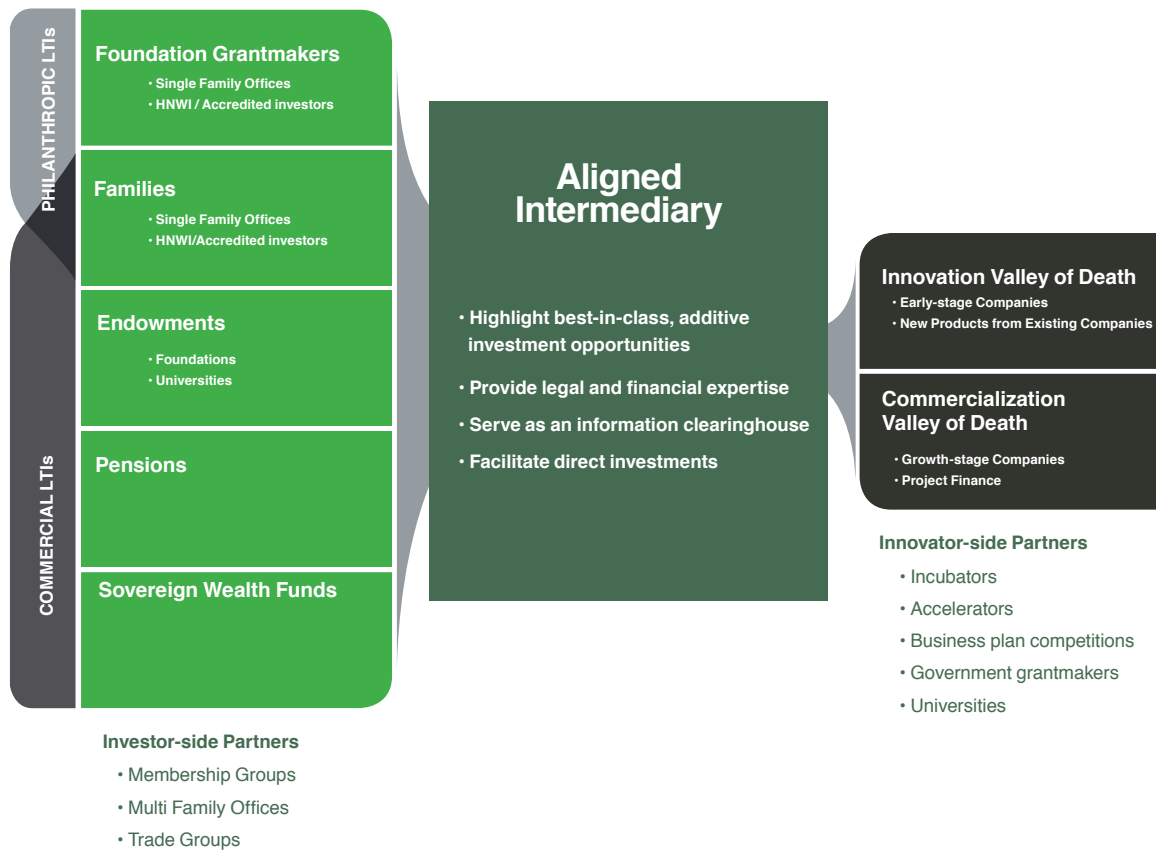
In order to achieve its mission, the AI will reduce information asymmetries and transaction costs for LTIs that are (or might one day be) interested to invest directly in the resource innovation ecosystem. It will also serve as a bridge for entrepreneurs and project developers to connect to an otherwise difficult-to-access set of investors. The AI will not, itself, provide financing to resource innovation companies or projects, at least in its initial incarnation. Instead, it will serve as a mechanism for unlocking direct investment capital from LTIs via proactive and deliberate collaboration and cooperation. To be clear, there are a variety of organizations actively seeking to catalyze investments in resource innovation. The AI does not seek to replace or displace any aligned parties but, rather, to bolster and bind the ecosystem in a more deliberate manner, focusing in particular on supporting LTIs, whose capital remains largely untapped in the current financial marketplace. Our assumption is that the scale of the climate crisis warrants an “all of the above” approach to catalyzing the resource innovation investment ecosystem.

For detail descriptions of the different types of Long-term Investors served by the AI, please see page Appendix A.

The purpose of this document is to propose the AI as an independent and aligned intermediary that will help LTIs identify the most promising companies and projects in the resource innovation ecosystem. The AI's initial target will be to identify companies that can create large-scale greenhouse gas emissions reductions and that are of commercial interest to LTIs. This will include identification, measurement, assessment, and screening of opportunities that are specifically

tailored to the needs of each LTI participating in the AI. In addition, the AI may facilitate due diligence, coordinate syndicates, and act as a trusted information source to help helpful LTI clients invest in resource innovation companies meeting their criteria. This document lays out the rationale for creating the AI, the proposed role of the AI in the context of existing players and key stakeholders, as well as success factors based on experience in the field.

The AI is a two-sided marketplace of Innovators and Investors





Introduction

Defining “Resource Innovation” Companies and Projects

Global climate change is caused by greenhouse gas emissions – Carbon Dioxide, Methane, Nitrous Oxide, etc – emitted by a large number of manmade industrial processes. A partial list of the supply chains that emit a large portion include transportation, electricity and heat for commercial and residential buildings, production of chemicals and cement, oil and gas extraction, refining and processing, land use change such as deforestation, agricultural practices such as livestock and soil management, and waste management at landfills and beyond. In the past, investors have used the terms “cleantech” and “clean energy” to include a subset of the sectors we will include in our definition of “resource innovation” – we find these terms limiting because they exclude some of the supply chains that emit the most, such as agriculture and traditional baseload power generation. The AI will not exclude any company or project from our definition that holds promise for reducing greenhouse gas emissions at scale. Of course, innovation of unproven technologies as well as deployment of proven technologies in many of the “resource innovation” subsectors could affect social outcomes above and beyond climate change mitigation – economic development, advancement of science, direct environmental preservation, poverty alleviation, advancement of human health, energy security, and lessening the burdens of government to name a few. While the mission of the AI will be to connect LTIs to investment opportunities that have been selected for their potential to reduce GHG emissions, our due diligence packages will always include additional impact metrics projections as well.

We believe that a small set of new ventures related to resource innovation – energy, agriculture, waste, and water – will scale to become the most profitable companies for generations to come. Importantly, a subset of those will also play a catalytic role in driving large-scale reductions in global greenhouse emissions. Many long-term investors (“LTIs”) share this view and indeed believe that competitive, risk-adjusted, long-term investment returns can be generated by catalyzing solutions to the climate crisis.²

While many resource innovation ventures (e.g. software, new service models, financing innovations, and capital-efficient hardware, among others) currently enjoy alignment with traditional venture capital – and some projects like commercial-scale solar photovoltaic arrays enjoy alignment with traditional project finance – a large set of viable and attractive new ventures and growth-stage companies are being left behind due to a “misalignment” with traditional asset classes. More specifically, the capital-intensive, long-technology-development-timeline ventures and first-of-a-kind infrastructure projects – the investment opportunities that are often in lockstep with reducing greenhouse gas emissions at scale – are insufficiently supported by the private sector today and represent a market failure – an incomplete capital market. In fact, investors that sought to create an investment ecosystem in this domain over the past decade, traditional venture capital firms, have retreated from the space almost entirely. “Cleantech” investments dropped 67% between 2011 and 2013, and appetite among these mainstream investors continues to decline.³

Despite the drop in capital allocated, many LTIs are still motivated to invest in resource innovation companies and projects, even those that fall into the innovation and commercialization ‘valleys of death.’

Our Take on “Concessionary” Capital

Across many sectors – resource innovation and beyond – finance scholars have used the term “concessionary” to describe investments that would not be done by traditional investors under normal circumstances,²² whether the “concession” in question pertains to outsized technology, market, regulatory or financial risk, longer-than-acceptable timelines to return on investment (“ROI”), or smaller-than-desired amount of financial returns. We have chosen to use the word “philanthropic” in lieu of “concessionary,” primarily because we see philanthropic opportunities as high-risk, high-reward, and not necessarily making a “concession” on climate impact. The AI will aim to build a coalition of philanthropic investors that create large-scale impact by collaborating closely with traditional asset managers and other LTIs.

For the purposes of this document, we define two types of philanthropic investments:

(1) Foundations – private, corporate, or public – can make such investments through a mechanism called a program-related investment (PRI). With a PRI, a foundation channels grant funds (that is, money that comes from the “5 percent” side of its operations) to a for-profit company that does “program-related” work. The US tax code requires a PRI to meet a two-part test: The investment must “significantly further” the charitable goals of a foundation, and it must be such that the foundation would not have made it “except for [its] relationship” to those goals. PRIs may be made directly to qualifying for-profit companies or projects, or to the AI as a nonprofit intermediary.

(2) Any donor – accredited or unaccredited households, individuals, foundations, corporations, etc – can make a philanthropic investment by writing a tax-deductible grant to the AI. The donor would have the option to recover the grant plus inflation if and when the for-profit company or project the grant supported achieves financial success.

However, LTIs find it increasingly difficult to access these opportunities in cost-effective ways that align with their own long-term objectives. As such, LTIs are ignoring the opportunity set altogether – not because of a distaste for the underlying assets but because of a lack of aligned access points to invest in those assets. This in turn creates a negative feedback loop whereby the opportunity set shrinks due to a lack of capital, and makes the opportunities even more difficult for willing LTIs to access. Experience from other sectors, such as the dramatic rise of infrastructure as an asset class, would suggest that unlocking capital for resource innovation demands reevaluation of existing access points. For example, the infrastructure asset class only matured when large public pension funds began developing in-house teams of professionals and paired those professionals, via strategic investments, with external “platform companies” that offered efficiency and scale. Today, hundreds of billions of dollars are flowing into infrastructure assets, and some estimates suggest this could pass \$1 trillion. Remarkably, infrastructure was not even an investable asset class thirty years ago, but the simple act of re-conceptualizing the way in which LTIs accessed the infrastructure ecosystem transformed the entire asset class. This is precisely what we hope to facilitate in the resource innovation sector via the AI.

A proposed reevaluation of access for investors raises an important set of questions about the resource innovation ecosystem: Can the experience of LTIs investing in infrastructure ecosystem translate into the resource innovation ecosystem? Should LTIs interested in resource innovation look beyond traditional intermediaries like venture capital and private equity firms to deploy capital? Can LTIs look to foster a new class of intermediaries that can better align with their own goals as well as the unique needs of many clean technology entrepreneurs and project developers? To answer this, we begin by examining LTIs more closely.

Understanding The Needs of LTIs

LTIs have inter-generational time horizons and deep pockets (albeit to varying depths), which make them valuable partners for capital-intensive and long-gestation companies. In fact, LTIs supported many of the well-known success stories in “cleantech” over the past twenty

years with little public fanfare. One striking example is the story of First Solar, founded in 1990 as “Solar Cells Inc.” First Solar is a go-to success story in the history of US-based energy innovation. However, it took twelve years for First Solar to ship its first product and the company did not return capital to its investors until year sixteen – well beyond the ten-year threshold for any traditional venture capital fund. Luckily, First Solar was supported exclusively by a single-family office with long-term financial goals that outlast traditional investors. Alas, this innovator-LTI dyad has not been replicated frequently in the marketplace since First Solar was founded, despite interest from family offices in later-stage opportunities.⁴

Looking Back: Unlocking LTI Capital in the Field

Thirty years ago, “infrastructure” was not considered an investable asset class by most institutional investors. But with the strong support of international governments and a handful of pioneering commercial banks that structured and packaged real assets, the capital markets opened their arms to infrastructure. Today there are several hundred billion dollars specifically targeting infrastructure assets, and LTIs are interested in raising that commitment. Similarly, sovereign development funds in places like Singapore (Temasek), South Africa (PIC), Malaysia (Khazanah) and the Palestine Investment Fund (PIF) have been successful at channeling capital into their own domestic markets by facilitating access to funds and delivering competitive financial returns. All four of the organizations listed above have generated double-digit Internal Rate of Return (IRR) over the last decade.²³ We believe these historical examples from the field offer useful insights for the US resource innovation ecosystem today. achieves financial success.

Unfortunately, it is increasingly apparent that the success of long-horizon ventures is contingent on attracting long-horizon investors, which may mean asking some LTIs to move beyond short-term, third party funds and invest directly (as was the case with infrastructure assets). But making direct investments in resource innovation companies places most LTIs far outside their traditional comfort zones;⁵ LTIs need sophisticated organizational and human resources to invest at the scale required for sufficient diversification. Indeed, the organizational and human resources required are challenging even for the largest LTIs to secure, which is why many families, pensions and sovereign funds have started working together in loose alliances over the past ten years. They recognize that third party funds are not the best way to access these assets, but they also recognize that they cannot go it entirely alone. As a result, many LTIs have developed peer relationships in the hope of creating “virtual” funds made up of aligned peers. While useful, these loose alliances often fail to bring dedicated and reliable support, which means the capital that might otherwise flow into the sector is flowing elsewhere.

The fact that many LTIs lack internal resources to execute direct investments on their own remains underappreciated in the marketplace. We find that when people see large pools of assets under management at LTIs, they assume that these assets can be used for internal resources. This is often not the case for LTIs, as boards at endowments, sovereign funds or pensions often fail to properly appropriate support to their own organizations in order to recruit the

people and build the systems necessary to become effective direct investors. The irony is that building internal resources is often more cost effective than buying those same resources from Wall Street; and new research shows unequivocally that in-house teams outperform.⁶ Notwithstanding, this internal capacity gap has been the cause of many LTIs accessing long-term assets via short-term (though well-resourced) intermediaries. In our view, this is problematic, difficult to remedy, but an addressable challenge. As such, it is critically important for the resource innovation investment ecosystem to bolster the resources of LTIs so they can deploy capital more efficiently into those long-term assets that would be left behind by traditional intermediaries, but hold promise for reducing greenhouse gas emissions at scale. We believe helping LTIs develop their own capabilities internally (and providing considerable capabilities externally) will help to unlock capital for the very companies and projects that may reduce the threat of climate change. This is where a new, independent, completely aligned intermediary can play an important role.

The AI could help to bring stakeholders together to develop the nurturing commercial environment required, coordinating among the various groups and organizations that already are operating in the space. Moreover, the AI could work for the LTIs directly, helping to put (rather bluntly) a greater number of bodies on a greater number of deals – providing expert advice and services to those that are interested in resource innovation opportunities. If done correctly, the AI will help LTIs connect with some of the most promising resource innovation companies in the world.

Modus Operandi - the Aligned Intermediary

The AI will not, itself, provide financing to resource innovation companies or projects, but will instead serve as a mechanism for helping LTIs invest in the most promising resource innovation ventures. (Note: Many individuals have asked if the AI could include some sort of delegated capital to a discretionary vehicle. A future phase of the AI may include such a structure, but seeking to set that up now would over-complicate what we are trying to achieve. The first phase of the AI is specifically designed to demonstrate that LTIs can generate high returns in this space by acting as direct investors.)

Specifically, the AI will be purpose-built to play the following roles:

Facilitator: The AI will reduce transaction costs and syndicate risk for LTIs by sourcing, measuring, screening, assessing and introducing companies whose activities employ resource innovations that result in large-scale greenhouse gas reductions to LTIs. It may also facilitate diligence, structuring, and monitoring.

Buy-side Advisor: LTIs inevitably have highly idiosyncratic wants and desires when it comes to investing. As such, catalyzing the ecosystem will require the AI professionals to understand their client LTIs intimately, bringing them only the deals that match their unique needs – thereby minimizing the internal resources required by those LTIs to actually deploy capital.

Collaborator: The AI will serve as the hub to a series of stakeholder spokes, made up of key players in the resource innovation investment ecosystem.

Finance Expert: The AI will have to include credible and seasoned investment experts (or engaged advisors) that understand seed- and growth-stage resource innovation investing.

Syndicator: The AI will work to create and structure deal flow with the highest potential for greenhouse gas reduction and financial returns, and package these deals (i.e., through the use of philanthropic capital or creating different tranches of risk) so that those deals become attractive to institutional investors.

Standardizer: The AI will attempt to bring standards, norms and benchmarks to the resource innovation financial markets for LTIs, including standardized legal forms and structures for philanthropic investors that may be novice to resource innovation investment practices.

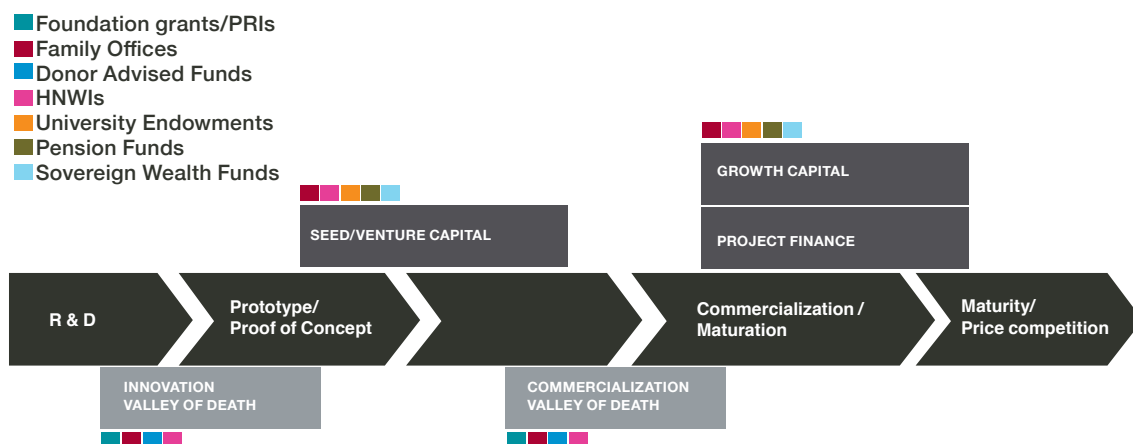
Anonymizer: The AI will collect and maintain anonymous data on capital flows and returns from its stakeholders to contribute to a better understanding of investment activity in the sector.

The AI will seek to collaborate and act as a bridge with existing, aligned intermediary players in the ecosystem, on both the investor side (philanthropic and commercial capital), as well as the innovator side (entrepreneurs, project developers, and the organizations that support them – incubators, accelerators, business plan competitions, etc). In sum, AI will be a hub at the center of an ecosystem, pulling together various actors and capital types to support high-potential companies and projects on the basis of both commercial and social objectives.

Key Stakeholders

The AI will serve LTIs interested in resource innovation investments – LTIs are the primary clients. Notwithstanding, it is important to note that there are a variety of different types of LTIs that will come together under the umbrella of the AI. Indeed, each of the following groups needs to be taken into consideration in the design of the AI. For the purpose of this list, we define an investor alliance as “a loose affiliation of like-minded investors around an investment theme to share deals and resources.”⁷ By creating a series of these “alliances,” we believe we could seamlessly bring together distinct actors with variable objectives into an overarching mission.

LTIs along the resource innovation & deployment pipeline



Commercial Capital - Seed: We need a vibrant community of seed investors that are willing to back companies that have been sufficiently de-risked through Federal R&D dollars, university-based research grants, and/or PRI investment into early-stage, for-profit companies. Operating outside of a traditional venture capital fund structure, AI will provide seed investors – family offices and high net worth households – a constant stream of high-risk, high-reward investment opportunities that are truly investable. AI will assess the companies and screen only those that have the highest potential for seed capital, recognizing the unique appetites of specific AI clients and customers (LTIs). Moreover, AI will work closely with providers of philanthropic capital to further de-risk the opportunity set (see below). In turn, the deal flow making its way to the seed investors will be of high quality. A seed alliance could then work together to assess the companies and invest where they see fit on a case-by-case basis. Since AI's ecosystem will include growth-stage investors as well, early-stage investors will be able to see a pathway to commercial funding for their top prospects. Groups such as CREO, the Cleantech Syndicate, and the Clean Energy Venture Group may be able to help bring this together, and we anticipate investment sizes would be in the \$500K to \$10M range.

Commercial Capital - Growth: If the venture-backed, cleantech investment experience over the past decade taught us anything, it was that venture firms under-appreciated the capital required to bring most resource innovation companies to commercial scale. With this in mind, and by working with large institutional investors, AI will have in its ecosystem a group of economic agents that has the size and time horizon to take the most promising companies forward. In fact, one of the key differentiators of the AI will be its ability to facilitate access to the community of Giants – top sovereign wealth funds, development/multi-lateral banks, and pension funds – and enable the direct deployment of their capital into resource innovation opportunities. AI will seek to work closely with these LTIs to identify and scale investment opportunities that promise outsized financial returns over the long run, while at the same time delivering catalytic and scalable impact. The \$91B University of California Regents will commit to working with the AI to deploy a significant portion of its \$1B green energy commitment and, should it be deemed desirable, help curate an alliance of like-minded investors. We anticipate the investment size for these investors would range from \$10M to \$300M.

Philanthropic Capital - R&D / First Loss: Philanthropists – private foundations, community foundations, corporate foundations, donor advised funds, family offices and high net worth households – are key LTI players that can invest in – and even de-risk – early-stage ventures and/or project deployments for commercialization. By working closely with providers of philanthropic capital, AI will enable high-risk, high-reward ventures and projects to reach the stage where they are more appropriate for follow-on, commercial investors and scale much faster than if they were simply left to traditional market mechanisms. The use of philanthropic capital for direct, for-profit climate investing happens infrequently today,⁸ but the AI will play an important role in advocating among the philanthropy community in order to ramp up their involvement in the financial ecosystem. Armed with access to philanthropic capital, AI could fill gaps in

markets, remove points of market friction or blockages, and incubate and support disruptive technologies until they can be validated by the market and are ready to be taken to scale.⁹ PRIME Coalition, a registered 501c3 public charity launched in late 2014, has already laid much of the groundwork for curating appropriate investments and managing an alliance of philanthropists. AI would be valuable to PRIME's effort because it would accelerate and scale the alliance of participating philanthropists. We anticipate philanthropic deal sizes to range between \$50k and \$5M.

Strategic / Corporate Partners: In addition to the LTI community, AI would seek to build an alliance of strategic capital providers to enhance the ecosystem. While this group has different and likely more competitive characteristics than the LTI alliances, they are a critical and active source of capital and must be considered collaboratively in AI's activities. We believe many corporations will be threatened by new developments in the resource innovation sector and see participation in the AI as a natural hedge.

Government Agencies: We aim to collaborate with a number of government agencies in line with the Clean Energy Investment Initiative launched by the Obama Administration in February 2015. For example, the U.S. Department of Energy has the potential to be an important partner for the AI, given its capacity to provide technical insights, impact assessments, and information about emerging technology roadmaps.

Innovators - Entrepreneurs, Researchers, and Supporting Organizations: The entrepreneurs and researchers that start new ventures will be critical stakeholders for the AI. Luckily, there is already a robust ecosystem of innovator-facing incubators, accelerators, business plan competitions, and university programs with whom the AI can partner to build out its pipeline of investment opportunities.

In addition to serving LTIs (and helping to coordinate alliances of LTIs), the AI will also manage relationships with important co-investor and stakeholder communities, including:

Partial Lists of Support Organizations

Innovator-side Support Organizations

1776
 Ag Innovation Development Group
 Artemis Project
 Austin Technology Incubator
 CalCharge
 Clean Energy Trust
 Cleantech Group i3 Database
 Cleantech Navigate Northeast by NECEC Institute
 Cleantech Open Northeast
 Cyclotron Road
 E2Tech - Environmental & Energy
 Technology Council of Maine
 Energy Excelsior
 First Look Out West
 Fraunhofer TechBridge
 Greentown Labs
 I2CAN
 iCLEAN E2TAC/CNSE
 Idea Foundry
 Innosphere
 Los Angeles Cleantech Incubator
 Massachusetts Clean Energy Center
 MassChallenge

MIT Clean Energy Prize
 NextEnergy
 NEXUS-NY
 NYC ACRE
 OregonBEST
 PowerBridgeNY
 Propeller: A Force for Social Innovation
 Prospect Silicon Valley
 RIT's Clean Energy Incubator
 SfunCube
 SURGE Accelerator
 The Cleantech Open West
 the Energy Foundry
 the Louisiana Tech Proof of Concept Center
 the Maryland Clean Energy Technology Incubator
 the Mid-West Energy Research Consortium
 the Rice Business Plan Competition
 the Rocky Mountain Innosphere
 the San Antonio Clean Energy Incubator
 the Tech Belt Energy Innovation Center
 Third Way
 Tumml
 VillageCapital

Investor-side Support Organizations

Ceres Working Group for
 Families & Foundations
 Confluence Philanthropy
 Clean Energy Venture Group
 CREO
 Divest-Invest Philanthropy
 Family Office Exchange
 Global Philanthropy Forum
 Jewish Funders Network
 Mission Investors Exchange
 Nexus Global Youth Summit
 The Giving Pledge
 The ImPact
 Toniic

Success Factors for the AI

Based on our own experiences building investment alliances in the past, we propose the following characteristics as imperative to the AI's success:

Intermediation: The success of any co-investment initiative will require a pro-active, independent, aligned party to lead, manage and provide infrastructure for and services to the primary constituents in a highly transparent manner. This is the guiding lesson that drives the idea that a new aligned intermediary is required to help LTIs invest in the US resource innovation ecosystem.

Trust: The AI must be a facilitator of trust between the diverse stakeholders involved, which means transparency and accountability will be critical.

Clear Mandate: In order to be successful, the AI must have a clearly defined mandate from its funders and primary constituents. As such, AI will have a clearly defined mission of its own and, in turn, it will work with each stakeholder group and investor alliance to clearly articulate each group's mandate and how it fits into the broader mission.

Quality People: The success of any complex program rests on the shoulders of the people building it. The staff of the AI must be of the highest caliber and earn competitive compensation tied to the long-term objectives of the AI.

LTI Commitment: The LTIs working with the AI must demonstrate some level of commitment to the AI. Commitments may take the form of operating (grant) capital or letters of intent for investment capital (grants, PRIs or commercial).

Measurement and Enforcement: Given that being a client of the AI will come with certain commitments, the AI will hold participating organizations accountable for these commitments and help investors report on impact metrics.

Momentum: AI will work to establish a critical mass before launch so that there is no doubt to its viability.

Evolution: AI may opt to sunset a subset of its activities should the market develop to the point where they are no longer necessary.

Design Elements for Legitimacy

In addition to these lessons, here are our suggestions for building AI to have sufficient legitimacy in the marketplace to ensure success

Legal organization: With the AI's mandate to highlight investment opportunities, conduct research, serve as an information clearinghouse, and coordinate investor alliances, we envision it could be structured as a non-profit, non-stock corporation organized and operated exclusively for charitable, educational, and scientific purposes within the meaning of Internal Revenue Code ("Code") Section 501(c)(3) or some type of nonprofit / for profit hybrid organization. We are currently seeking legal counsel to weigh the strengths and weaknesses of structural options.

Organizational architecture and governance: The AI would be governed by a board of directors, managed by a lean, full-time staff, and include participation from volunteers for purpose-built Investment Committees, one for each investment type – R&D, seed, growth, and project finance.

Conclusion

LTIs in most cases lack the internal resources to execute direct investments in resource innovation companies and projects. And yet, direct investments by LTIs in long-term assets is precisely what's required to catalyze this ecosystem and mitigate climate change at scale. Helping LTIs develop their own capabilities internally (as well as providing considerable capabilities externally) will help to unlock capital for the very companies and projects that may reduce global greenhouse gas emissions at scale on a timeline that mitigates catastrophic climate change. This is where a new, independent, completely aligned intermediary can play an important role. This is why we're making a case for the "Aligned Intermediary," which we hope will reduce information asymmetries and transaction costs for LTIs that are (or might one day be) interested to invest directly in the resource innovation ecosystem.



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Author Bios



Ashby Monk

Dr. Monk is the Executive and Research Director of the Stanford Global Projects Center. He is also a Senior Research Associate at the University of Oxford and a Senior Advisor to the Chief Investment Officer of the University of California. Dr. Monk has a strong track record of academic and industry publications. He was named by aiCIO magazine as one of the most influential academics in the institutional investing world. His research and writing has been featured in *The Economist*, *New York Times*, *Wall Street Journal*, *Financial Times*, *Institutional Investor*, *Reuters*, *Forbes*, and on National Public Radio among a variety of other media. His current research focus is on the design and governance of institutional investors, with particular specialization on pension and sovereign wealth funds. He received his Doctorate in Economic Geography at Oxford University and holds a Master's in International Economics from the Universite de Paris I - Pantheon Sorbonne and a Bachelor's in Economics from Princeton University.



Sarah Kearney

Sarah serves as Executive Director of PRIME Coalition, a nonprofit organization whose mission is to empower foundations and families with the critical tools they need to invest in market-based solutions to climate change. Before PRIME, Sarah served as Executive Director and Trustee of the Chesonis Family Foundation, a grantmaking organization that supports transformational energy innovation. Based on her work, Sarah has been inducted into the Raven Society at the University of Virginia, and awarded the 2012 MIT Ronald Heller Entrepreneurship Award, 2014 Caltech Resonate Award, 2014 Echoing Green Fellowship, the MIT Technology Review's 35 Innovators Under 35, and the 2015 Forbes 30 Under 30 for Social Entrepreneurs. Sarah serves on the board of directors for Saha Global, and holds a B.S. in Commerce from the University of Virginia and an M.S. in Technology and Policy from MIT's Engineering Systems Division.



Alicia Seiger

Alicia serves as the Deputy Director of the Stanford Steyer-Taylor Center for Energy Policy & Finance and leads the center's work to identify opportunities for philanthropic and long-term investors to fill financing gaps to scale up clean energy. A serial entrepreneur and pioneer of new business models, Alicia was at the forefront of the web advertising and carbon offset industries before pursuing solutions in the rapidly evolving area of climate finance. Prior to joining the center, Alicia founded Climate Strategy Partners, a strategic advisory services provider that designed and executed climate and energy programs for foundations, investors and NGOs. She has served on the management teams of multiple startups, including at TerraPass, a pioneer of the US carbon offset market, and Flycast Communications, one of the first web advertising networks. She holds a MBA from the Stanford Graduate School of Business, where she also served as a case writer for the Center for Entrepreneurial Studies, and a BA in Environmental Policy and Cultural Anthropology from Duke University.



Elliott Donnelley

Elliott is a Founding General Partner of the White Sand Investor Group, LP, a fifth generation investment partnership of the Chicago-based RR Donnelley family. As an investor of both his personal and family's assets, Elliott has increasingly focused on innovative companies focused on developing next generation financial and investment technology as well as companies that are addressing pressing global problems in areas such as education, water, health and the environment. In addition to his role as an investor, Elliott serves on the board of Stanford's Global Project Center, the World Affairs Council of Northern California, the Philanthropy Workshop, Synergos, and the LGT Venture Philanthropy Foundation. He is also a member of the Global Philanthropist Circle, Toniic, and a member of the organizing committee of the China Philanthropy Forum. Now based in San Francisco, Elliott travels frequently to China and Europe. He lived and worked in Beijing from 1989-1991 and is a frequent speaker in China and Asia on family legacy, and new models in philanthropy and impact investing. Mr. Donnelley graduated from Yale University in 1988 with a B.A. in history.

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Appendix A.

Long-Term investors (“LTIs”) Served by the AI

Families | Investable assets by families represent a significant, and largely untapped, pool of capital for resource innovation. In 2011, individuals were the largest source of charitable giving in the U.S., donating \$218 billion to public charities and accounting for 73% of total charitable giving. In addition to donating to nonprofit organizations, households with assets over a specific threshold – accredited investors – can make for-profit investments that may or may not be inspired by social impact. In 2013, angel investments from accredited investors into companies across all sectors in the U.S. totaled \$24.8 billion, which came from 298,800 separate households primarily focused on consumer-facing software and media investments.¹⁰ With the advent of crowdfunding websites that facilitate donations from unaccredited investors (e.g., Kickstarter) and angel investments from accredited investors (e.g., AngelList), the crowdfunding industry grew to over \$2.7 billion in 2012.

One particular structure that has emerged as a popular resource for high-net-worth households is the single or multi-family office – a private company that manages investments and trusts for one or many families. Generally speaking, a family needs at least \$250 million in assets to justify the expenses associated with operating a single-family office. In 2014, there were an estimated 5,000 single-family offices in the United States.¹¹ The world’s wealthiest families are estimated to have more than \$152 trillion in net worth, while the average North American family office has approximately \$1.2 billion under management.¹² Meanwhile, multi-family offices vary widely in terms of assets under management, number of families served, and services provided. Most offer investment and philanthropy advisory, estate planning, and accounting. Philanthropic services might include helping clients to establish a private foundation or providing strategic guidance for grantmaking and endowment management.

Foundation Grantmakers | In 2011, U.S. foundations’ endowments were estimated to be worth approximately \$600 billion and grant disbursements totaled \$47 billion.¹³ There are three types of foundations in the U.S.: private foundations – typically endowed by one individual or family (e.g., William and Flora Hewlett Foundation); corporate foundations – operated by a for-profit company (e.g., Newman’s Own Foundation); and public foundations (including community foundations) that are focused on defined geographic areas (e.g., the Boston Foundation) or constituents (e.g., women and girls). Ninety-eight percent of the more than 86,000 foundations in the U.S. have less than \$50 million in assets under management, and 60% of foundations have less than \$1 million.¹⁴ As of February 2014, the 100 largest U.S. foundations controlled approximately \$300 billion in assets¹⁵ – capturing 1% of those assets annually would eclipse total current U.S. public spending on energy R&D.¹⁶ The Internal Revenue Code (the Tax Code) mandates that private foundations spend 5% of total assets on charitable purposes annually.

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College and University Endowments | According to a recent survey of 851 public and private colleges and universities, US-based institutions' endowments total more than \$500 billion in assets.¹⁷ The distribution of wealth is highly concentrated, with the top 10% of endowments owning roughly 70% of the total assets. Unlike foundations, university endowments are not required to meet a specific annual payout level. Each university chooses payout rates based on current operating needs and the concept of intergenerational equity, which aims to strike a balance between meeting the needs of the present without compromising future generations of students and researchers. Whereas foundation endowments are trending towards increasing payouts to address society's intractable problems, almost all universities exist to continue providing high quality education and research in perpetuity. With no legal payout obligation, and with the goal of maximizing returns for the long haul, many endowments can afford to adopt an aggressive risk posture. However, the nature of being an institutional investor leads endowments to generally adopt more traditional investment strategies than family offices. Importantly, and similar to family offices, private universities are not required to disclose their investment holdings.

Pension Funds and Insurance Companies | According to the OECD, insurance companies currently manage \$26.1 trillion, and pension funds manage an additional \$24.7 trillion worldwide. Because this capital is most often being used to meet long-term liabilities, this pool of \$51 trillion can be characterized as "long-term investment capital." The long-term nature of these investment funds means they are often open to considering long-term risks, such as those presented by climate change. As such, these investors, which often have liabilities extending three decades or more, are increasingly keen to mitigate environmental risks in their portfolio – and do so proactively and creatively and derive strong, stable, uncorrelated inflation hedged, risk adjusted returns from investing in bankable renewables.¹⁸ While both insurance companies and pension funds are limited to investing in only profitable and commercial assets, most have flexibility over the time horizon of their investments. And this flexibility is valuable, as it opens up a whole host of different kinds of risky assets for investment. In fact, according to another OECD report,¹⁹ the largest pension funds in the world have more than 10% of their capital in "alternative" assets. This interest in risky assets and managing long-term risks makes pensions funds and insurance companies ideal partners for resource innovation projects and companies.

Sovereign Funds | According to recent estimates, sovereign wealth funds ("SWFs") have more than \$5 trillion dollars in assets under management.²⁰ The International Monetary Fund defines five sub-groups that combine to make up the community of SWFs: Stabilization funds, which seek to smooth commodity revenues for long-term budget planning; savings funds, which take sub-soil assets and convert them financial assets; reserve investment corporations, which take excess foreign exchange reserves and deploys them internationally in higher risk (and hopefully higher return) assets; pension reserve funds, which take excess funds from governments and earmarks it specifically for future social security or pension liabilities; and development funds, which invest government capital on a for-profit basis in domestic companies and projects. Except for stabilization funds, which are short-term and risk averse, these investment funds are generally able to bear long-term illiquidity risks. By definition, SWFs have no explicit liabilities outside of the government. In other words, sovereign funds have an ability to make inter-generational and accept illiquidity on sufficient scale as to be unique in the institutional investment landscape. As such, they are particularly well suited for the long gestation projects and companies in the resource innovation sphere.²¹