

STOCKHOLM ENVIRONMENT INSTITUTE U.S.

ANNUAL REPORT
2014





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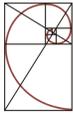
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INTRODUCTION

The Stockholm Environment Institute is an international not-for-profit research organization that has been engaged in environment and development issues at local, national, regional and global policy levels for more than 20 years. Our goal is to bring about change for sustainable development by bridging science and policy. We do this by conducting integrated analysis that supports decision-makers.

SEI's work is interdisciplinary in nature, drawing upon engineering, economics, ecology, ethics, operations research, international relations and software design. We work all around the world building capacity for integrated sustainability planning through training and collaboration on projects.

SEI is headquartered in Stockholm, Sweden, and has six additional centers around the world. SEI's U.S. Center (SEI-US), an independent 501c-(3) nonprofit corporation, is a research affiliate of Tufts University in Massachusetts and also has offices in Davis, California, and Seattle, Washington.

2014 OVERVIEW

SEI-US had a productive 2014 in continuing to strengthen its core research efforts in water and energy resource management, climate mitigation policy, climate equity, and general sustainability issues. We took significant strides in further developing and applying our "robust decision support" framework, which underpins several new activities in the water area, and provides the basis for a number of exciting new efforts in the coming year. Our work on climate-resilient infrastructure in Africa led to accolades and further work in the region. SEI-US researchers co-led the establishment of three new SEI initiatives: on the water-energy-food nexus, on fossil fuel supply and climate change mitigation, and on short-lived climate pollutants (SLCPs) and low-emission development strategies (LEDS).

Through partnerships with key initiatives and institutions, from the New Climate Economy to the UN Special Envoy on Cities, we firmly established a work program on cities and climate change. Our LEAP work and collaborations continued to expand in extent and influence, including support for countries as they prepare their Intended Nationally Determined Contributions for the Paris COP in December, 2015. Our climate equity work, leveraging the newly released Climate Equity Reference Calculator and key contributions to the IPCC Fifth Assessment Report, advanced the conversation regarding "fair shares" through a number of widely-read publications. We describe these and other key activities further herein.

Institutionally, the principal development at SEI-US was the transition to a new Director chosen through a competitive process. Charlie Heaps, the founding Director, closed out an eight-year tenure. Charlie shepherded us from a collection of nine relatively independent researchers in 2006 to the well-organized, highly collaborative organization of twenty-four that we are today, with thriving offices in three locations. Michael Lazarus will take over as Center Director on Jan. 1, 2015.

Other important SEI-US developments and activities of note in 2014 include launching a Gender and Diversity Committee. The Gender and Diversity Committee is expected to complete work in 2015 that is intended to enhance our institutional understanding of how the different dimensions of diversity and gender play a role in our success, efficiency, and interactions with others. We hope translate these findings into our internal, hiring, and related policies in the coming year.

SEI-US STAFFING AND FINANCES IN 2014

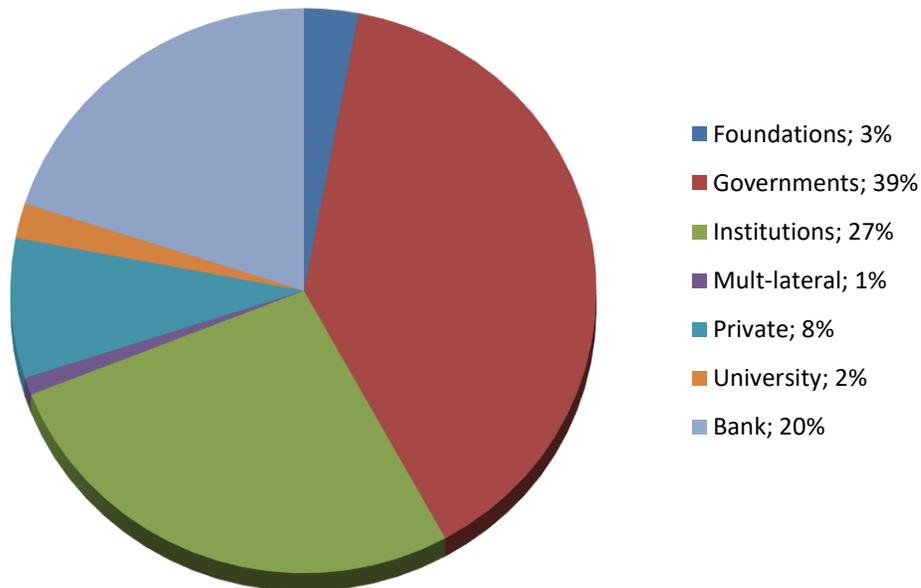
2014 was remarkably stable from an organizational standpoint. For perhaps the first year ever, there were no staff changes – we began and ended the year with 24 staff - 14 were Senior Scientists, 8 scientists and analysts, and 2 in administration.

The Water Group remains the largest research area in SEI US with 14 staff, and operates as a relatively tightly organized and integrated unit. Another 8 staff work on energy and climate, spread across a number of thematic focus areas, from equity to modelling to policy.

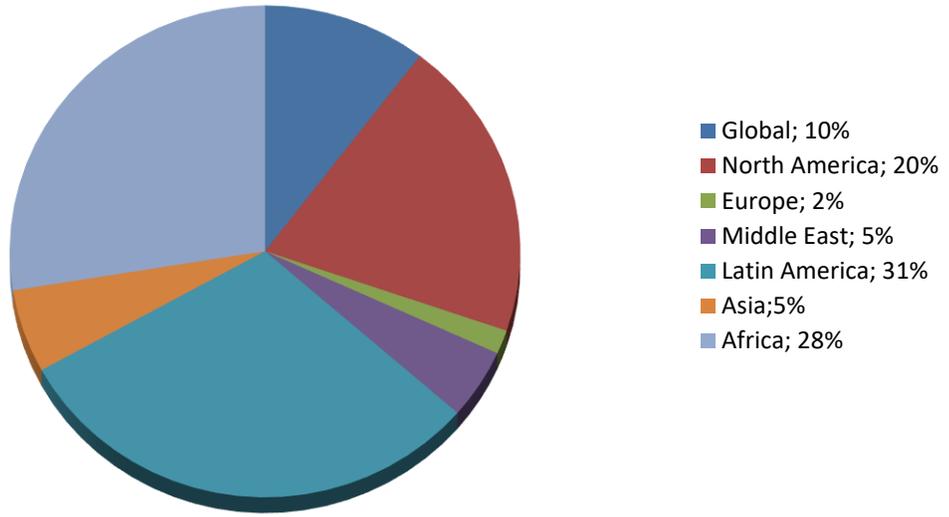
We continue to occupy three office spaces - in Seattle, WA (in a building shared with numerous social and environmental NGOs); Davis, CA, and Somerville, MA (on the Tufts University campus). We are close to capacity at the Somerville office, and are reinitiating a search for space that offers improved staff interaction and greater room for growth, while maintaining proximity and connection to Tufts. As past efforts have shown, these are not easy criteria to fulfil in the Somerville office space market.

SEI US' financial situation remains strong. In 2014, we had \$4.87 million in revenue, a roughly 10% increase over 2013. As shown below, SEI-US researchers continued to procure substantial contract and grant awards through local, regional, and national governments, representing approximately half of Center revenue (inclusive of subcontracts). SEI-US researchers continued to procure substantial (\$988,554) contract and grant awards through U.S. federal funding mechanisms, a 25% increase over 2013. With regard to federal compliance and fiduciary responsibility, SEI-US successfully completed its sixth A-133 single audit as a component of its overall annual financial reporting. Projects with a Latin American and African focus contributed the largest fractions of revenue at 31% and 28%, respectively, while US-focused projects provided another 20% of revenue.

Sources of Revenue



Geographic Foci



RESEARCH PROGRAMS

Water Resources

Contact: David R. Purkey, david.purkey@sei-us.org
<http://sei-us.org/WaterResources>

In recent years, the issue of the long-range adequacy of fresh water resources has moved to center stage in international discussions of sustainable development. The call for the adoption of sustainable water strategies has become urgent as conflicts over the allocation of increasingly scarce water resources loom. Sustainable water management requires a systemic perspective that links water resources to requirements for irrigation, industry, human needs and ecosystems.



SEI-US has actively sought to heighten awareness of freshwater problems and to develop appropriate strategies for living within water budgets in a sustainable manner. The SEI-US Water Resources team advances integrated approaches to freshwater assessment and policy. The team works throughout the US, Central and South America and the Caribbean, the Middle East, Africa and Asia.

We work in five main areas:

- **Methods for Integrated Water Analysis:** SEI's WEAP (Water Evaluation And Planning) system, a transparent and user-friendly decision-support tool for engaging stakeholders, provides a unique framework for water assessment and planning.
- **Capacity Building:** WEAP is widely disseminated to water analysts throughout the world in both governmental and NGO settings, and SEI-US runs workshops on integrated water planning with WEAP as a conceptual framework and practical approach.
- **Modeling Climate Change Impacts on Water Resources:** SEI-US uses WEAP to quantify climate-change driven impacts to water resource allocation.
- **River Basin Assessments:** Working with local counterparts, SEI-US provides comprehensive assessments of water and environment in watersheds around the globe.
- **Global Water Futures:** SEI-US has been at the forefront of analyzing global freshwater conditions, preparing alternative water scenarios including developing and modeling agricultural adaptation strategies to climate change, and setting priorities for action.

Selected Projects in 2014

Enhancing the Resilience of Africa's Infrastructure

Staff: Huber-Lee, A.; Joyce, B.; Galaitsi, S.; Purkey, D.; RAND; University of Cape Town, Rhodes University; University of York; University of Massachusetts Amherst; 2iE; KTH; Nile Basin Initiative; Industrial Economics

Date: 2013-ongoing

Client/Funder: World Bank

Research Area(s): Water Resources; Energy Modeling

Description: This study seeks to address the implications of changes in future climate on the planned infrastructure investments in Africa. In particular, the study seeks to assess the vulnerability of water-related infrastructure (i.e. hydropower, water storage, and irrigation) to climate and to estimate the costs of

adaptation options designed to maximize the performance of this infrastructure in the face of climate uncertainty. The project focuses on the seven major river basins that have the greatest strategic significance for the continent in terms of hydropower and irrigation potential – i.e. Congo, Orange, Niger, Nile, Senegal, Volta, and Zambezi rivers – which account for the bulk of the region’s development potential, including some 200 GW of hydropower generation capacity. For each basin, a WEAP application is being developed that integrates climate-driven routines for estimating streamflow and agricultural water demands into a systems model that allows for the exploration of different management strategies and investments under a range of uncertainties. The Open Source Energy Modeling System (OSeMOSYS) will simulate the energy generation of the four power pools that overlap the seven river basins. The tool is being used to estimate the power generation from various sources given assumptions about future energy demands and hydropower capacity under different climate scenarios. While a rigorous water-energy nexus approach, which fully integrates the water and energy models, will not be feasible for this study, some linkages have been made between the water and energy tools. Specifically, water data from the seven basin WEAP analyses were fed into the OSeMOSYS energy models to describe (a) water availabilities for hydropower, (b) water pumping requirements for storage management, and (c) water available for irrigation related pumping requirements. With these initial constraints, the energy model runs and informs subsequent evaluation of adaptation options such that the analyses can achieve a first round robust scenario description and analysis.

The West Bank Water Security Project

Staff: Galaitsi, S.

Date: 2013-ongoing

Client/Funder: Tufts University

Research Area(s): Water Resources

Description: The West Bank Water Security project has investigated issues related to domestic water access in different communities in the West Bank. In collaboration with Tufts University researchers, SEI-US has investigated funding sources for a larger project to compare and contrast water interventions for domestic water scarcity under different socio-economic and political circumstances. The project also included a review of the literature of discontinuous domestic water supply, which is to be submitted for publication in a peer-reviewed journal.

Development of the Sacramento River Water Allocation Model (SacWAM)

Staff: Young, C.; Joyce, B.; Sieber, J.; Hereford, A.

Date: 2013-ongoing

Client/Funder: California State Water Resources Control Board

Research Area(s): Water Resources

Description: This project continues the development of a water resources model for the Sacramento River Basin. The model has been designed to study potential flow requirements at the confluences of Sacramento River tributaries and in the Sacramento – San Joaquin Delta. The model represents all major reservoirs, diversions, and operations for the Central Valley and State Water Projects as well as smaller non-project operations on tributaries.

Partnering for Adaptation and Resilience – Agua Project (PARA-Agua) in LAC**Staff:** Purkey, D.; Escobar, M.; Forni, L.; Depsky, N.**Date:** 2013-ongoing**Client/Funder:** USAID**Research Area(s):** Water Resources

In coordination with USAID bilateral programs and priorities, PARA-Agua will work in target watersheds to undertake the following: 1) Create platforms for sustained dialogue and information sharing between the research community, policy makers, watershed stakeholders and the private sector to help mainstream the use of relevant scientific data; 2) Conduct stakeholder mapping for each watershed to determine key actors and relations, and facilitate participation women and disadvantaged groups; 3) Employ the Water Evaluation and Planning (WEAP) model to enable integrated assessment of climate change impacts on watershed dynamics within a single decision support framework; 4) Identify structural and non-structural adaptation options and facilitate access to finance to support implementation; and, 5) Replicate best practices and build capacity across the region through improved data sharing tools, twinning partnerships and other tools. SEI's role is focused on strengthening planning systems that optimize water use over the whole length of watersheds in the context of climate change adaptation. In the 2nd year of the project we advanced adaptation strategies identification and adaptation funding strategies support for the Chira-Piura watershed in Perú, and in the Chinchiná watershed in Colombia. We also started activities in the Quilca-Chili watershed in Peru achieving a vulnerability analysis, and in the creation of a WEAP model for the Guatapurí watershed in Colombia. The project was subject to a mid-term evaluation, which led to the extension of the project until 2017.

Integrating economics into water planning in Jordan**Staff:** Huber-Lee, A.; Joyce, B.; Galaitsi, S.**Date:** 2013-ongoing**Client/Funder:** Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)**Research Area(s):** Water Resources

Description: SEI US is working with the Jordanian Ministry of Water and Irrigation (MWI) to develop an economic analysis tool that provides a comprehensive way to evaluate alternative infrastructure and water policies under a range of scenarios of climate, political change and economic development. The tool (MYWAS) optimizes the benefits to be achieved from water subject to various water policy and management regimes and demonstrates the potential benefits of regional cooperation in managing water resources by reporting the differences in social welfare under different scenarios.

Vulnerability and Adaptation to Climate Variability in the Rio Maipo basin, Central Chile**Staff:** Young, C.; Sieber, J.; Escobar, M.; Purkey, D.; Flores-Lopez, F.**Date:** 2013-ongoing**Client/Funder:** Pontificia Universidad Catolica de Chile/IDRC**Research Area(s):** Water Resources

Description: In this project, SEI has provided expert assistance on a range of topics. These include: groundwater modeling, plant growth modeling, glacier modeling, and participatory governance for irrigation systems. The SEI team has provided expertise to Chilean researchers through periodic site visits and remote meetings.

Assessing both National and Regional Water and Energy Dynamics in the UAE and Arabian Gulf**Staff:** Flores, F.; Yates, D.; Young, C.; Galaitsi, S.**Date:** 2014-ongoing**Client/Funder:** Environmental Agency of Abu Dhabi**Research Area(s):** Water Resources and Energy

The Arabian Gulf countries have relied on fossil groundwater resources and increasingly on desalination to meet rapidly increasing demands due to rapid population growth, regional prosperity and other factors. In this transboundary region, there is an inherent connection between water and energy, as considerable energy is expended pumping water from groundwater sources and converting saline water to freshwater for municipal, industrial, and even agricultural and ecosystem uses. The water sector also consumes a great deal of energy, typically in the form of electricity, as it treats and moves water along the supply chain from various sources, through treatment processes, and ultimately to the end-user. As water demand grows, so does energy demand. Energy production also places demands on water resources that may compete with other users. Since population growth drives demand for both resources, water and energy demands tend to grow together. This project focuses on the various dimensions of transboundary groundwater management, including the water-energy nexus. Broadly speaking, these dimensions encompass two major areas, namely the impact of increasing ambient temperatures and changing precipitation, i) their effects on the transboundary of both water and energy demands; and ii) sea-level rise and its attending effects due to saltwater intrusion into the aquifers. These issues are being explored through an integrated analysis of a large portion of the Arabian Gulf Region relative to climatic changes and socioeconomic development factors under a scenario approach.

Water-Energy-Food Nexus**Staff:** Huber-Lee, A.; Galaitsi, S.; SEI-International**Date:** 2013-ongoing**Client/Funder:** SEI-International**Research Area(s):** Water Resources

Description: The Water-Energy-Food nexus is a framework under which natural resource scarcity and decisions about trade-offs are carefully evaluated and negotiated in order to make human development thrive, not just survive. Four connected but relatively distinct challenges relate to the governance of the Nexus: policy coherence, institutional coordination, integration, and planning. The starting point for the research questions related to governing the nexus is not that some super water-energy-food governance institution is needed, but rather that the optimal level of governance and jurisdictional fragmentation must be established in order to identify improved resource management strategies. This can be developed without compromising current functional governance components of individual sectors, but that will encourage cross-sectoral cooperation. We to find innovative ways for structuring and supporting decision making processes and explore ways to provide incentives and visualization techniques to compel managers across sectors to include broader considerations and information in their sectoral decisions. Building on SEI legacy tools (WEAP and LEAP), past Nexus projects and emerging opportunities in Africa, Asia, the Middle East and Latin America the Nexus initiative aims to develop a **Nexus toolkit** which enables a joint assessment of water supply, energy production and agricultural production and related environmental impacts. The toolkit allows regional, power pool, national and basin level planning exercises to identify and quantify externalities, understand risks and trade-offs and optimization of solutions. The Nexus toolkit is designed to follow a **joint learning** approach to tool and scenario development building on iterative interactions between stakeholders, SEI researchers and research partners. Expanding on a growing area of research on **robust decision making** we aim to guide decision makers towards “robust” options amid uncertainty.

Water-Energy implications under climate change for the Comahue Region in the Patagonia, Argentina

Staff: Forni, L.; Purkey, D.; Escobar, M.; Young, C.

Date: 2013-ongoing

Client/Funder: International Development Research Centre (IDRC) funded to Fundación Bariloche - Argentina

Description: SEI is collaborating with Fundación Bariloche in exploring the water and energy nexus components for future planning under climate and non-climate uncertainties for the Comahue region. Future climate change scenarios emerging from the IPCC indicate a potential increase in water stress in Comahue region in the Argentinean Patagonia. This region extends across multiple political jurisdictions and includes several water uses, such as: hydropower generation, water supply to support subsistence economies, large fruit production for local and export markets, residential water use, the oil industry (including conventional and unconventional reservoirs), and mining. While policy makers increasingly recognize the need for integrated water-energy-climate analyses, they lack the tools and capacity. This study aims to support policy makers via integrated tools for water-energy planning under climate and non-climate uncertainties. The methodology is based on the dynamic exploration of the water-energy-climate linkages under future socio-economic and climate scenarios using the WEAP (Water Evaluation and Planning) and LEAP (Long-range Energy Alternatives Planning) models for long term policy support. Until now, a lack of suitable modeling tools has hindered efforts to explore the water energy nexus. In the context of climate change, the combination climate and non-climate related uncertainties such as population growth, socio-economic development and planning for energy access requires integrated analytical tools. The integration of WEAP and LEAP provides a technical view of resource use linkages and tradeoffs. Policy makers and stakeholders from both the water and energy sectors need to weigh the pros and cons, try to minimize negative outcomes, and formalize a decision based on those outcomes. The value of the integrated model and visualization tool is that it can help these actors understand the many implications and the exploration of the tradeoff landscape under a changing climate: 1) water availability to meet future growing demand for irrigated areas; 2) water supply for hydropower production; 3) increasing demand of water for mining and extraction of unconventional oil; 4) potential resource use conflicts and impacts on vulnerable populations.

Water Resource Planning through Climate Change Capacity Building in Colombia

Staff: Purkey, D.; Escobar, M.; Flores-Lopez, F.; Forni, L.; Sieber, J.; Universidad Tecnológica de Pereira; Universidad del Quindío; Fundacion CINARA

Date: 2012-ongoing

Client/Funder: USAID

Research Area(s): Water Resources

Description: This project seeks to develop capacity to achieve water management adaptation to climate change in the Eje Cafetero region of Colombia, in particular the Rio La Vieja watershed. Here, sensitive paramo ecosystems provide hydrologic services and functions by regulating the timing and supply of water to the demands of agriculture (coffee predominantly) and urban (mid-size) cities. Implementation of climate adaptation measures is confounded by an administrative structure requiring coordination at regional and national levels. Our research efforts will aim to complement current regional efforts to provide climate adaptation guidance, and will benefit substantially from local collaboration with the Universidad Tecnológica de Pereira, the Universidad del Quindío, and Fundacion CINARA.

Greening Flood Risk Management: A guide to natural and nature based approaches**Staff:** Wickel, A.J.; World Wildlife Fund**Date:** 2013-ongoing**Client/Funder:** USAID-OFDA**Research Area(s):** Water Resources; Disaster Risk Reduction**Description:** Technical co-author hydrological processes, spatial assessments and climate change adaptation of a manual aimed at practitioners for the development and implementation of natural resource management based approaches before and after flood disasters. The manual is currently under review and a set of training modules is being developed based on the technical modules.**Urban Metabolic Mapping: Securing the Biophysical Foundation of Indian Cities****Staff:** Mehta, V.; Indian Institute of Management; Indian Institute of Science**Date:** 2011-ongoing**Client/Funder:** SEI-International, Cities Alliance Catalytic Fund**Research Area(s):** Water Resources; Sustainable Futures**Description:** Bangalore Urban Metabolism Project is a joint initiative of the Stockholm Environment Institute and the Centre for Public Policy at the Indian Institute of Management, Bangalore. It is conceived as a long term program. Funding from 2011-2014 was provided by SIDA, and India's Ministry of Urban Development, and in 2014-2016, by a Cities Alliance Catalytic Fund grant. Rapid population growth and economic activity in Indian cities have overwhelmed their ecological support base, leading to chronic shortages in electricity, water and road space while polluting the physical environment. We seek a systems understanding of problems that cuts across myriad aspects of the urban sustainability conundrum in order to inform better urban governance. The key policy tool that we will develop is a deliberative modeling framework - the metabolism framework - that will treat cities as living entities, that use energy and resources to generate useful products and waste. What are the material and energy inputs that keep the city running? What are the waste products of the city? A pedagogical computer model will be built for Bangalore city – India's burgeoning software capital that serves as a poster-child of these problems - that will integrate diverse aspects of the urban environmental problem, and the diverse actors involved in crafting solutions. We bring together a strong, multidisciplinary team of ecological economists and environmental scientists from SEI and the Indian Institute of Management (IIM). Consumption data will be compared with social, economic and demographic information. Current and future development scenarios will be gauged against dimensions of economic efficiency, social equity and environmental sustainability. We are using the following tools in implementing the framework:

1. **Treating cities as tightly coupled social ecological systems:** using coupled human-natural models to truly understand the city at system level.
2. **Information geoportals:** that transparently communicates and delivers data on the spatial distribution of resource use across the city.
3. **Social science tools:** including household surveys and other citizen science initiatives to fill in severe data gaps.
4. **Online scenario explorers:** provide an online interface to users for interacting with different aspects of the city to create and explore their own future scenarios.
5. **Participatory planning:** exposing the establishment to **formal** methods for participatory planning under uncertain futures.

Outputs have included workshops, presentations, publications, information geoportals and models. All of these are available on a dedicated website: <http://bangalore.urbanmetabolism.asia/>

Decision support for the Yuba Integrated Regional Water Management (IRWM) Plan Update: Discovering innovation through the deployment of an integrated water resources model

Staff: Mehta, V.; Depsky, N.; Hereford, A.; Purkey, D.,

Date: 2013-ongoing

Client/Funder: Yuba County Water Agency

Research Area(s): Water Resources; Sustainable Futures

SEI has been involved in California water resources planning and policy since 2006, working at local, watershed, regional and state levels, with municipalities, irrigation districts, Integrated Regional Water Management (IRWM) groups, universities, and the state. SEI's WEAP water resources decision support system has been a mainstay in all these contexts; it is being used by the State Department of Water Resources (DWR) and the State Water Resources Control Board (SWRCB). We have also developed policy briefs on the energy-water nexus in California, combining two SEI tools, WEAP and LEAP.

California's Integrated Regional Water Management (IRWM) program is a collaborative effort to identify and implement water management solutions on a regional scale that increase regional self-reliance, reduce conflict, and manage water to concurrently achieve social, environmental, and economic objectives (<http://www.water.ca.gov/irwm/>). The California Department of Water Resources' (DWR) support of IRWM has been implemented through grants, technical, and facilitation services since 2002. In support of IRWM, DWR is developing a Strategic Plan for the Future of IRWM, soliciting feedback from local-level agencies and stakeholders as to the past effectiveness of the IRWM as a regional planning framework. One such local agency is the Yuba County Water Agency (YCWA), whose experience with IRWM in the Yuba River basin suggests that IRWM is indeed a valuable planning process, but could be vastly improved by integrating a formal decision-making framework centered around a comprehensive, integrated analytical platform.

To this end, the California Water Foundation's (CWF) supported SEI in implementing a Robust Decision Making (RDM) process that will bring about this coupling of the Yuba IRWM Plan Update with enhanced water resources modeling capabilities. In the Yuba study, SEI worked with a stakeholder group representing multiple interests in 2013-2015. Over two years, our RDM approach formally elicited, via the XLRM framework, the uncertainties, objectives and management strategies across multiple interests. Our quantitative analysis, using a WEAP model of the complex Yuba basin, showed that the Yuba system is most vulnerable to climate change and new environmental regulations concerning possible mandatory water releases to the Delta. Trade-offs and co-benefits of future impacts across multiple interests have been quantified and explored visually. Our recent analysis of strategies, drawn from the IRWM plan, showed that most of the individual strategies being considered do not improve the regional vulnerabilities of the system. In particular, urban conservation projects, while helping local constituencies, would not significantly decrease vulnerabilities, because of the very small proportion of total water used by the non-agricultural sector. A combination of multiple strategies – a portfolio- would be needed for cross-sectoral regional impact (see Figure 1). Our approach painstakingly built a shared mental model of the system over several workshops and innovative visualizations. These approaches have proved valuable in finding solutions amongst diverse stakeholders, especially the traditionally opposing interests of farmers and environmentalists. Innovative visualization of complex trade-offs was a key component of the work. These have also been made publicly available: https://public.tableau.com/shared/TGF729373?:display_count=yes

Operational and infrastructure planning using WEAP-DSSAT, the Water Evaluation and Planning DSS for Agrotechnology Transfer model.

Staff: Mehta, V.; Young, C.

Date: 2013-ongoing

Client/Funder: NASA via subaward from Colombia University

Research Area(s): Water Resources; Sustainable Futures

In Yolo county, California, SEI's work with an irrigation district, the Yolo County Flood Control and Water Conservation District (YCFCWCD, www.ycfcwcd.org) is supported by NASA and focuses on conjunctive use of surface and groundwater, in the face of water shortages. YCFCWCD is particularly vulnerable to drought. In 2014, the third consecutive year of drought in California, YCFCWCD had no surface water supply whatsoever. Hence, it is exploring investing in groundwater infrastructure to improve water service and financial stability. SEI, building on previous collaborations with YCFCWCD that were supported by the California Energy Commission, used Robust Decision Making (RDM) to elicit concerns and objectives, and to evaluate the performance of various strategies they are considering. In this study, we included investment costs and financial analysis, along with a simulation of groundwater depth, and the use of climate projections derived from paleoclimate reconstructions. Climate, landuse change and new regulations (SGMA) were of concern. Seven different management strategies have been analyzed and the most promising one identified was a conjunctive strategy involving winter recharge, periphery pond storage and a moderate amount of groundwater supply by YCFCWCD . One of the important contributions of this study is the testing of different rules that might be formed in response to California's new Sustainable Groundwater Management Act (SGMA), and what implications they might have for all three dimensions of sustainability.

Energy Modeling

Contact: Charlie Heaps, charlie.heaps@sei-us.org
<http://sei-us.org/EnergyModeling>

SEI's energy modeling activities are focused on the development, support and application of LEAP: the Long range Energy Alternatives Planning System, a software tool for energy policy analysis and climate change mitigation assessment used by thousands of organizations in more than 190 countries.

We work in three main areas:

- **LEAP Development and Support:** LEAP has been used at many different scales – from cities and states to national, regional, even global applications – for integrated resource planning and greenhouse gas mitigation assessments.
- **Scenario Studies:** In addition to developing LEAP and supporting LEAP users, we also apply LEAP in a wide variety of energy scenario studies – most recently in a global energy assessment.
- **Capacity and Community Building:** SEI is the founder and manager of COMMEND (COMMunity for ENergy environment & Development) an international initiative designed to foster a community among energy analysts working on energy for sustainable development.



Selected Projects in 2014

Mexico Low Emissions Development Program: Update of Mexico's Emissions Baselines and Mitigation Portfolio 2009 – 2030

Staff: Veysey, J.

Date: 2013-2014

Client/Funder: National Institute for Ecology and Climate Change, Mexico (INECC); World Wildlife Fund Mexico; United Nations Environment Programme

Research Area(s): Energy Modeling; Climate Mitigation Policy

Description: Working with INECC and the National Autonomous University of Mexico, SEI developed a LEAP model of Mexico's energy system and GHG emissions. The model covers the period 2000-2030, includes baseline and climate mitigation scenarios, and provides an important evidence base for INECC's contributions to Mexican climate policy and inter-ministerial discussions. The project team selected mitigation options for the scenarios from a previously existing set of marginal abatement cost curves. A significant finding from the project is that by 2030, identified mitigation measures could yield a 38% reduction in Mexican GHG emissions when compared to business-as-usual conditions. As this reduction potential is not sufficient to meet the target Mexico adopted at the 15th UNFCCC Conference of Parties, the model provides a foundation for exploring additional mitigation proposals and their relationship to existing plans. A second phase of work in 2014 included the development of Monte Carlo-based sensitivity analyses of baseline projections and training of INECC staff to use these new techniques.

Economics of Climate Change in Central and West Asia**Staff:** Veysey, J.; Binnington, T.; Heaps, C.**Date:** 2013-2015**Client/Funder:** Asian Development Bank**Research Area(s):** Energy Modeling; Economic Analysis of Climate Mitigation

Description: For this project, SEI led a study of the costs and benefits of climate mitigation in Azerbaijan, Kazakhstan, and Uzbekistan, focusing especially on the energy and transport sectors. The analysis was based on national LEAP models we developed, including long-range scenarios exploring emissions, financial, and co-benefits implications of mitigation. Together with national partners, we conducted significant data collection activities in each country to identify and define mitigation measures for the models. For Azerbaijan and Kazakhstan, national energy supply and demand were both modeled to depend in part on fuel prices, allowing endogenous assessment of carbon tax, subsidy removal, and other price-based mitigation scenarios. The findings of the study are now being used in the formulation of each country's Intended Nationally Determined Contribution to the next international climate agreement. The study models are also being transferred to government and academic institutions in the countries for further application in policy making, a process supported by several training workshops we delivered.

Integrated Climate Modeling and Capacity Building in Latin America (CLIMACAP)**Staff:** Veysey, J.; Heaps, C.**Date:** 2013-ongoing**Client/Funder:** European Commission, DG CLIMA**Research Area(s):** Energy and Climate Modeling; Capacity Building

Description: CLIMACAP is a regional capacity building program that seeks to improve the quality and timeliness of modeling inputs to energy and climate policy making in Latin America. Under this project, SEI is providing technical support to and coordinating the efforts of national energy and climate modeling teams in Argentina, Brazil, Colombia, and Mexico. We are assisting the teams with methodology, research, model construction and calibration, and results reporting. We have also conducted an in-depth, cross-model study of mitigation pathways in Mexico and communicated the results to Mexican decision makers. This study and several others from the project are being published in a special issue of the journal *Energy Economics*.

Food/Energy/Environment Nexus in Ethiopia's Lake Tana Basin**Staff:** Binnington, T.; Heaps, C.**Date:** 2013-2014**Client/Funder:** SIDA/Stockholm Environment Institute**Research Area(s):** Energy Modeling; Water Resource Modeling

Description: Ethiopia's Climate Resilient Green Economy (CRGE) plan lays the foundation for Ethiopia's green development through 2030. As part of ongoing work to develop and strengthen SEI's food/energy/environment nexus toolkit, we constructed a regional LEAP model to examine the energy implications of the CRGE, as well as different water and land management practices modeled by WEAP. In particular, household fuel switching scenarios were explored to highlight the interplay among different agricultural management strategies and biomass production.

Climate Change Assessment of the Energy-Water Nexus in the Zambezi River Basin

Staff: Heaps, C.; Binnington, T.; Seiber, J.; University of Cape Town; Carbon Limits; Centre for Energy, Environment, Engineering Zambia; OneWorld Sustainable Investments; University of Zambia; University of Eduardo Mondlane

Date: 2014-2015

Client/Funder: World Bank

Research Area(s): Electricity Modeling, Water Resource Modeling

Description: Led by the University of Cape Town, this project aims to develop a set of climate futures for the Southern Africa region and to use them to inform electricity scenarios covering the Southern Africa Power Pool (SAPP). Emphasis is placed on hydropower prospects in the Zambezi River basin, for which integrated water-energy scenario analysis is underway to evaluate system-wide impacts. This analysis is being conducted using SEI's software tools LEAP and WEAP. As part of the work, SEI is tasked with providing ongoing technical support, modeling expertise, and software development to improve the application of the tools under the project. Further, together with other project partners, we are responsible for institutional capacity building components including delivering a LEAP training course, participating in workshops to engage key stakeholders (SAPP, SADC and others), and delivering final modeling outputs.

Capacity Building in Energy Planning and LEAP Training

Staff: Binnington, T.; Veysey, J.; Heaps, C.

Date: Ongoing

Client/Funder: Various, including GIZ, UNDP, UNECA

Research Area(s): Energy Modeling, Capacity Building

Description: SEI continues to support capacity development for energy systems planning worldwide. These opportunities arise bilaterally between SEI and partner institutions, as well as through ongoing project activities. Excluding those workshops and trainings held through projects described elsewhere in this document, in 2014 we conducted trainings in Senegal and Mexico, as well as regional workshops for the Middle East and North Africa (held in Italy) and East Africa (held in Rwanda). These workshops sought to prepare analysts to undertake their own national energy planning exercises, as well as to cultivate a worldwide network of LEAP experts.

Climate Mitigation Policy

Contact: Michael Lazarus, mlaz@sei-us.org
<http://sei-us.org/ClimateMitigation>

Avoiding dangerous climate change requires ambitious actions to deeply reduce greenhouse gas emissions at the international, national, and local community levels. At each of these levels, SEI-US informs, supports and advises decision-makers and civil society on possible pathways to an equitable, low-carbon future.

In addition to activities specifically related to energy modeling, climate economics, emissions trading, and equity, SEI-US:



- Provides analytical support and facilitation to regional and local policymakers and stakeholders in the development of climate action plans, in the design of emission trading systems, and in the establishment of technical capacity. For example, SEI-US has provided technical support to several U.S. states, including Washington and Massachusetts; to numerous developing countries, and to regional programs such as the Western Climate Initiative.
- Conducts low-carbon scenario studies that outline pathways to deep emission reductions, such as the recent Carbon Neutral Seattle and Europe's Share of the Climate Challenge studies.
- Develops methods for emissions accounting and assesses policies and measures such as domestic and international offset protocols (e.g. the Clean Development Mechanism), emissions benchmarking, and comprehensive emissions tracking frameworks that take both consumption and production into account.
- Develops tools to better assess the life cycle impact of energy projects (e.g. woody biomass energy).

Selected Projects in 2014

C40 Cities

Staff: Erickson, P.; Tempest, K.

Date: 2012-ongoing

Client/Funder: C40 Cities Climate Leadership Group

Research Areas: Climate Mitigation Policy

Description: SEI has an ongoing partnership with C40 to develop frameworks for estimating the GHG abatement potential of urban areas and urban policy. In 2012, we developed estimates of the greenhouse gas emissions reduction potential of C40 cities in the years 2020 and 2030; In 2013, we developed a typology of urban-scale GHG abatement policies and measures, and conducted an initial quantification of the global potential (this work was published a peer-reviewed journal article). In 2014 we developed a global data set to support analysis for individual cities.

Strategies for Development of Green Energy Systems in Mongolia**Staff:** von Hippel, D. (Senior Associate); Erickson, P.; Lazarus, M.; Tempest, K.**Date:** 2013-ongoing**Client/Funder:** Global Green Growth Institute (GGGI)**Research Areas:** Climate Mitigation Policy; Energy Modelling**Description:** This project evaluates and describes scenarios for the evolution of Mongolia's energy sector. The focus is on green energy systems that can lead to lower emissions of greenhouse gases in Mongolia, in addition to improving air quality, employment, and energy security. Four scenarios of energy supply and demand through 2035 are presented: *Reference*, *Recent Plans*, *Expanded Green Energy*, and *Shift in Energy Exports*. These scenarios were developed with the input of, and with data collected by, an Advisory Committee from the Ministry of Energy and several other organization in Mongolia, as well as with inputs from a local consultant team. A bottom-up techno-economic analysis of energy and GHG-reduction scenarios was assembled using the Long-range Energy Alternatives Planning (LEAP) software.**Low carbon cities****Staff:** Erickson, P.; Tempest, K.**Date:** 2013-ongoing**Client/Funder:** SEI-International**Research Areas:** Climate Mitigation Policy**Description:** SEI is developing a model for cities around the world to use in assessing alternative scenarios of development and GHG emissions. Work involves developing a set of region-specific default data for cities to apply, developing a city-focused interface for SEI's LEAP software, and conducting pilot analyses with individual cities.**New fossil fuel economy - Risks of and responses to the new fossil fuel economy****Staff:** Lazarus, M.; Erickson, P.; Kartha, S.; Tempest, K.; SEI-International**Date:** 2013-ongoing**Client/Funder:** SEI-International**Research Areas:** Climate Mitigation Policy**Description:** This project provides analysis on the climate and other social and environmental risks of developing new fossil fuel supply and delivery infrastructure. Key objectives include: cataloging and assessing risks of unconventional gas and oil development, as well as new coal trade infrastructure, with respect to greenhouse emissions and local livelihoods in developing countries; identifying "hot spots" or "convergence zones" where countries pursuing green growth initiatives may also face decisions on whether or how to develop sizeable new fossil fuel resources; exploring potential policy and other responses that various stakeholders, including policy-makers, NGOs, and multilateral/bilateral institutions can take to minimize these risks associated with potential fossil resource development, and provide resources for stakeholders to respond to these risks. Possible case studies include oil shale developments in North Africa, North America (a Keystone XL Pipeline analysis has been published), and the risks and the risks of developing new coal resources and transportation routes in the Pacific and North Asia region.

Towards a Common Accounting Framework for pledges under the UNFCCC**Staff:** Lazarus, M.; Kollmuss, A.; Schneider, L.**Date:** 2013-ongoing**Client/Funder:** Swiss Federal Office for the Environment**Research Areas:** Climate Mitigation Policy; Climate Economics**Description:** Under the UNFCCC, many countries have pledged mitigation objectives for the year 2020, ranging from quantified economy-wide targets to single mitigation actions to be implemented, across reduction targets compared to a baseline or sectoral targets. While this can be viewed as a positive development emerging from COP15 (Copenhagen), Parties have yet to agree on common accounting rules or to establish a process sufficient to demonstrate that these pledges have been met. For this project, we researched, published, and presented a number of reports – on achieving a net mitigation benefit, on avoiding double counting, and on accounting rules generally -- that could assist in the development of a common accounting framework (CAF) that would apply across all pledges, especially with relation to the treatment of market-based units.**New climate economy****Staff:** Lazarus, M.; Erickson, P; Tempest, K.; Lee, C.**Date:** 2013-ongoing**Client/Funder:** The New Climate Economy: The Global Commission on the Economy and Climate**Research Areas:** Climate Mitigation Policy; Climate Economics**Description:** Served as research partners for a major New Climate Economy project that seeks to address economic decision-maker and address how economic and social goals can be met in concert with reducing the risk of dangerous climate change. As research partners, engaged on analysis of natural gas as a bridge, the potential for emissions reductions from global cities, and the resource potential and cost projections of renewable power.**Additionality of CDM****Staff:** Lazarus, M., P. Erickson, C.M. Lee**Date:** 2013-ongoing**Client/Funder:** DG Clima**Research Areas:** Climate Mitigation Policy**Description:** In collaboration with colleagues at the Öko-Institut and INFRAS, SEI is contributing to an evaluation of current tools and alternatives for additionality assessment under the CDM. The study employs a variety of approaches to evaluate to what extent the CDM meet its objective to deliver “real, measurable and additional” emission reductions. The research evaluates three main areas: general CDM rules, specific project types, and innovative approaches towards baseline setting and additionality assessment.**Technical Working Paper on GHG Emissions, Scenarios and Mitigation Potentials in the Energy and Transport Sectors****Staff:** von Hippel, D. (Senior Associate); Tempest, K.; Erickson, P.**Date:** 2013-ongoing**Client/Funder:** Asian Development Bank (through NIRAS A/S and D. von Hippel)**Research Areas:** Climate Mitigation Policy**Description:** This project included the preparation of a LEAP (Long-range Energy Alternatives Planning) energy/environment/economic model for the country of Vietnam and for three provinces in Vietnam. Each

model included a business-as-usual scenario (2012 through 2030) of energy supply and demand development, plus a mitigation scenario modeling the implementation of over 30 greenhouse gas emissions mitigation options throughout the Vietnamese economy. The two scenarios, and their greenhouse gas emissions and cost implications were described in a Final Report that is complete and is expected to be released soon. The Final Report also includes a description of suggested actions that Vietnam and its provinces might undertake to reduce national and provincial greenhouse gas emissions, while advancing development and building a "greener" economy.

Emissions Trading & Offsets

Contact: Michael Lazarus, mlaz@sei-us.org

<http://sei-us.org/EmissionsTrading>

Avoiding dangerous climate change requires ambitious actions to deeply reduce greenhouse gas emissions at the international, national, and local community levels. At each of these levels, SEI-US informs, supports and advises decision-makers and civil society on possible pathways to an equitable, low-carbon future.

In addition to climate mitigation activities specifically related to energy modeling, climate economics, emissions trading, and equity, SEI-US:



- Provides analytical support and facilitation to regional and local policymakers and stakeholders in the development of climate action plans, in the design of emission trading systems, and in the establishment of technical capacity. For example, SEI-US has provided technical support to several U.S. states, including Washington and Massachusetts; to numerous developing countries, and to regional programs such as the Western Climate Initiative.
- Conducts low-carbon scenario studies that outline pathways to deep emission reductions, such as the recent Carbon Neutral Seattle and Europe's Share of the Climate Challenge studies.
- Develops methods for emissions accounting and assesses policies and measures such as domestic and international offset protocols (e.g. the Clean Development Mechanism), emissions benchmarking, and comprehensive emissions tracking frameworks that take both consumption and production into account.
- Develops tools to better assess the life cycle impact of energy projects (e.g. woody biomass energy).

Selected Projects in 2014

UNFCCC NAMA Registry

Staff: Lazarus, M., Lee, C.M., van Asselt, H.

Date: 2014

Client/Funder: European Commission (DG Clima)

Research Areas: Climate Mitigation Policy

Description: As part of a broader set of deliverables for the European Commissions examining opportunities for scaling up carbon finance. SEI worked with Ricardo AEA to analyze the NAMA Registry

and its entries, with the dual objectives of increasing understanding of the quality and associated financial investments of individual NAMA entries, and identifying options for improving the Registry's design and functioning. In doing so, we considered how well the NAMA Registry has fulfilled expectations, and could be improved going forward.

Options and Guidance for the Development of Baselines

Staff: Lazarus, M.

Date: 2012-ongoing

Client/Funder: World Bank / Partnership for Market Readiness

Research Areas: Climate Mitigation Policy; Climate Economics

Description: Emissions baselines are fundamental to market-based climate policy instruments, as well as to non-market-based ones such as results-based payments. For this project, SEI worked with various stakeholders and country representatives to co-author a technical document that offers options and guidance for the development of these baselines. Developed under the Partnership for Market Readiness (PMR), it is designed to support PMR Implementing Countries that are considering the establishment of new mechanisms. It may also assist other policy makers and policy analysts involved in mechanism design or review, practitioners developing baseline methodologies, and actors implementing mitigation initiatives whose impact needs to be quantified.

Support for the Washington Carbon Emissions Reduction Taskforce

Staff: Lazarus, M., Lee, C.M., Erickson, P.

Date: 2014

Client/Funder: Washington State Governors Office

Research Areas: Climate Mitigation Policy

Description: SEI served as policy advisors and technical facilitators supporting the Carbon Emissions Reduction Taskforce established by the Washington Governor's Office to provide recommendations on the design and implementation of a market mechanism for Washington. SEI prepared briefing papers and presentations to support taskforce deliberations and the development of recommendations.

Can carbon revenues help transform household energy markets? A scoping study with cookstove programs in India and Kenya

Staff: Lee, C.M.; SEI-International

Date: 2013-2014

Client/Funder: GIZ

Research Areas: Climate Mitigation Policy; Climate Economics

Description: Carbon finance has emerged as an attractive option to help scale-up cookstove projects, but little research has been done on how well it meets the needs of these projects. To address this gap, SEI conducted a scoping study in India and Kenya to examine the growing role of carbon finance in cookstove projects, with a focus on how it might support market transformation. The authors conducted an in-depth review of the project design documents (PDDs) for 75 carbon-financed cookstove projects in India and Kenya. They also interviewed 49 stakeholders along the value chain, including cookstove project implementers (both carbon-financed and not), households, NGOs and cookstove and carbon market experts. The analysis presented in this report focuses on how carbon finance might help or hinder projects in meeting those challenges.

New climate economy

Staff: Lazarus, M.; Erickson, P; Tempest, K.; Lee, C.

Date: 2013-ongoing

Client/Funder: The New Climate Economy: The Global Commission on the Economy and Climate

Research Areas: Climate Mitigation Policy; Climate Economics

Description: Served as research partners for a major New Climate Economy project that seeks to address economic decision-maker and address how economic and social goals can be met in concert with reducing the risk of dangerous climate change. As research partners, engaged on analysis of natural gas as a bridge, the potential for emissions reductions from global cities, and the resource potential and cost projections of renewable power.

Climate Equity

Contact: Sivan Kartha, skartha@sei-us.org

<http://sei-us.org/ClimateEquity>

The emerging climate crisis must be seen against the backdrop of an ongoing development crisis. The scientific imperative of climate change requires extensive emissions reductions in all countries, but it is politically unrealistic and ethically unacceptable to expect those struggling against poverty to focus their limited resources on averting climate change. Developing countries must still transition toward a low-GHG development path, but the global consuming class – the industrialized world and elites within developing countries – must provide the financial and technological resources that will enable this transition.



A centerpiece of SEI's work in this field is the Greenhouse Development Rights (GDRs) Framework, developed by SEI and Ecoequity, which presents a burden-sharing framework based on a straightforward accounting of national responsibility and capacity that requires those who consume and emit more than a specified "development threshold" to carry the global cost of an emergency climate program. The GDRs framework could provide the basis of a solution to the burden-sharing problem at the heart of the climate negotiating impasse. It could enable a climate regime that ensures ambitious mitigation globally to avert a climate disaster, while safeguarding the right to development in the South.

In addition, SEI contributes to the global climate policy dialogue through research, analysis, and on-the-ground engagement with Parties and non-governmental organizations involved in the United Nations Framework Convention on Climate Change process.

*Selected Projects in 2014***Developmental equity in an international climate regime: Analysis, practical paths and engagement****Staff:** Kartha, S.; Kemp-Benedict, E.**Date:** 2011-ongoing**Client/Funder:** Sida

Description: This project is built on the notion that an equitable framework is a precondition for an effective climate regime. Without developmental justice, it will not be possible to win the earnest engagement of the developing world, which is necessary for a successful global response to the climate problem. This project will continue and extend the work of the ongoing Greenhouse Development Rights project. It aims to instill a perspective of developmental equity into the climate discourse and negotiations, by providing an appropriate framing and the necessary technical, analytical and political substantiation.

Contributions to the Intergovernmental Panel on Climate Change**Staff:** Kartha, S.**Date:** 2014**Client/Funder:** IPCC**Research Area(s):** Climate Equity, Adaptation & Vulnerability

Description: This project is part of SEI's larger contribution to the *Fifth Assessment Report (AR5)* of the IPCC. Sivan Kartha served as Coordinating Lead Author of Chapter 4, "Sustainable Development and Equity", of Working Group III. He was also a coordinator of the Least Developed Country and Developing Country Contact Group, which was newly constituted at the spring 2012 Lead Authors Meeting, to help ensure that the AR5 is policy-relevant to developing country decision-makers. The drafting of the AR5 began in spring 2011, and the report was approved and issued at the end of 2014.

Greenhouse Developments Rights (GDRs)**Staff:** Kartha, S.; Kemp-Benedict, E.; Athanasiou, T. (EcoEquity); Baer, P. (Georgia Institute of Technology)**Date:** 2006-ongoing**Client/Funder:** IPS (Sida), Mistra Foundation, Rockefeller Brothers Fund, International Center for Human Rights Policy

Description: The Greenhouse Development Rights (GDRs) Framework, developed by SEI and Ecoequity, presents a burden-sharing framework based on a straightforward accounting of national responsibility and capacity that requires those who consume and emit more to carry a larger share of the global cost of an emergency climate program. Relatively wealthy people who have produced higher levels of emissions can thereby protect the right to development of the world's poor. The GDRs framework could potentially be used to design a solution to the burden-sharing problem at the heart of the climate negotiating impasse. It could provide the basis for ambitious mitigation globally to avert a climate disaster, while safeguarding the right to development in the global South.

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