INSTITUT POLYTECHNIQUE DE PARIS

RESEARCH DAY

Researcher Biographies and Project Abstracts

Symposium
“Models and Society”

December, 1st
4.00 pm to 6.00
Lecture Thévenin

Chaired by
Gauthier Vermandel, Researcher at CMAP, a laboratory of École Polytechnique

Peter Tankov is professor of quantitative finance at ENSAE Paris, Institut Polytechnique de Paris, having previously worked at Paris-Cite university and Ecole Polytechnique. He is a mathematician, specialist in applied probability and quantitative finance. He earned his PhD in applied mathematics from Ecole Polytechnique in 2004. His current research focuses on green and sustainable finance, where he aims to develop quantitative methodologies. Peter is the author of over 60 research articles on these and other topics and of the widely read book, Financial Modelling with Jump Processes. He is the recipient of the 2016 Best Young Researcher in Finance award of the Europlace Institute of Finance and the 2024 Louis Bachelier Prize of London Mathematical Society, SMAI, and Natixis Foundation. Professor Tankov is the scientific director of the Paris Agreement Research Commons foundation at Louis Bachelier Institute, where he leads data-oriented initiatives, and member of editorial boards of the main quantitative finance journals: Mathematical Finance and Finance and Stochastics.

Tipping points, climate risks and emission reduction

We develop a simple model of optimal emission reduction in the presence of climate tipping points, where the remaining carbon budget before reaching a tipping point is uncertain, and the detection of its occurrence is subject to measurement noise. Assuming that agents are reluctant to reduce emissions before the tipping point occurs, but are averse to the physical climate risks that will materialize afterward, we formulate the optimal emission reduction problem as an optimal switching problem under partial information. We then characterize the optimal strategies as a function of the remaining carbon budget and the perceived likelihood of crossing a tipping threshold. Our results show that the optimal emission reduction trajectory does not follow a smooth path, but instead consists of alternating periods of strong and weak climate policy, depending on the public perception of the catastrophic risks associated with tipping points.

Antoine Missemer is a researcher in economics at the French National Centre for Scientific Research (CNRS), and a member of CIRED – International Research Centre on Environment and Development (part of IP Paris, France). His research focuses primarily on the history of environmental and energy economics, i.e. how the discipline of economics has addressed environmental and energy issues since the 18th century, in resonance with contemporary ecological challenges (natural resource depletion, energy transition, climate change, biodiversity loss). In addition to many publications of books and articles in international journals, he is currently leading the ERC-funded ETRANHET project, which aims to examine how economists have addressed energy issues since the 19th century in five market economies around the world to draw lessons for today's global energy transition.

Economists, their models, and public policy on energy issues: a retrospective view

Throughout the 20th century, and especially since the 1970s, economists have proposed models that incorporate environmental and energy dimensions, ranging from natural resource management to pollution control and climate change mitigation. These models, often criticized, have been developed in response to political demand; they have also informed public decision-making. This presentation will use one historical example to illustrate the intertwining of economic research, modeling exercises, and public action on energy issues: the Dutch macroeconomic models (partly numerical) of the 1960s, which followed the discovery of gas fields in the Groningen region and legitimized expansionist policies that were retrospectively judged excessive after the oil crisis. This example shows that economists' models, for all their sophistication and heuristic power, are always caught up in a web of economic, social, and political contingencies. This observation remains highly relevant today.

Claire Le Renard is a research scientist at LATTS, Laboratoire Techniques, territoires, sociétés, at the École nationale des ponts et chaussées-IPP. Her research focuses on the analysis of processes that involve undoing, doing less, doing with less: how do actors work around the discontinuation of a project? How can we reverse the course of modern technologies that have become problematic in terms of our understanding of environmental limits? Until 2023, she was a researcher in sociology at EDF R&D, GRETS (Energy Technology Society Research Group), Palaiseau. The common thread of her research analyzes and questions the way in which socio-technical change takes place in the energy sector, under environmental constraints. In 2021, she defended her thesis in sociology, entitled "Unmaking a prototype. Superphénix, from a shifting technoscientific promise to the trials of 'technical democracy"". Claire Le Renard was originally trained as an environmental engineer at the ENGREF-AgroParisTech and Ecole Polytechnique (X93), where she later taught in a specialty course about Energy and the environment (2005-2007). She now teaches Sociology of Energy Transition at the Ecole des Ponts and Ecole Polytechnique, Analysis of Sociotechnical Controversies at the Ecole des Ponts, and History of Nuclear Energy at ENSTA.

Energy sufficiency in real life: domestic practices in a stratified society. Insights from winter 2022–2023

In the face of climate change, reducing energy consumption is a crucial part of the solution, as shown by the scenarios put forward by the IPCC and RTE (French electricity transmission system operator). Whereas 'energy demand management' or energy conservation tends to rely on 'behaviour' and energy efficiency focuses on technical measures, sufficiency policies are fundamentally socio-technical (Grandclément, 2023). Each of these paradigms assumes an implicit model of society – a theory, in the terms of the social sciences and humanities. What are the conditions for energy sufficiency? Sufficiency is defined as in the IPCC AR 6 : "Sufficiency policies are a set of measures and daily practices that avoid demand for energy, materials, land and water while delivering human well-being-for-all within planetary boundaries."

In households, most of environmentally significant consumption is rooted in routines and habits. To understand its determinants, we draw on practice theory: practices involve material devices, meanings and competencies (Shove et al., 2012). We combine this approach with recent research that sheds light on stratification within society with regard to environmental issues (Dubuisson-Quellier, 2022 ; Coulangeon et al., 2023 ; Comby, 2024). Based on an empirical survey of the public policy called 'sufficiency plan' during the winter of 2022-2023 in France (Desvallées, Le Renard & Haine, 2025), the paper aims to explain the multiple factors and causalities (beyond the price signal) that enabled domestic energy consumption to fall noticeably and remain at this lower level.

Ada Diaconescu holds a position of Associate Professor at Télécom Paris, Institut Polytechnique de Paris. Before joining Télécom Paris in 2009, she worked for Grenoble Alpes University, Orange Labs and INRIA, France; and completed a PhD in Electronic Engineering and Computing at Dublin City University, Ireland. She has been strongly involved with the Autonomic and Organic Computing communities, including a book on Autonomic Computing (2013) and the role of Steering Committee co-chair of the IEEE ACSOS conference, since its inception in 2019.
Her main research interests include design patterns for complex adaptive systems, multi-scale feedback systems and agent-based modelling, focusing on applications to large-scale socio-cyber-physical organisations.

Science beyond quantification - integrating objective and subjective views in unpredictable worlds

This presentation will stress the importance of extending model-driven research practices to deal more comprehensively with unpredictability in hyper-complex systems (e.g., large socio-cyber-physical systems and planetary eco-systems). This point becomes particularly critical when scientific results inform governance decisions with dire consequences for various stakeholders (e.g. managing pandemics, economic crisis or climate disturbance). Research areas more acquainted with hyper complexity (e.g. psycho-sociology, biology, business, defence) have proposed specific methods to deal with system unpredictability and management subjectivity. These include strategic prospective, dependability by design, action-research, precautionary principle and post-normal science. Research areas more accustomed to stability and objectivity (e.g. natural sciences and engineering) seem to resist such extensions and struggle with the consequences when operating in unstable, multi-faceted contexts. They may issue unreliable predictions and ill preparedness due to over-reliance on models that are unfit, obsolete or one-sided. The presentation aims to emphasise the importance of adopting more suitable methods for studying, describing and managing hyper-complex systems facing unpredictability and subjectivity; and highlighting how inter-disciplinary research in complex systems may contribute.

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