UNIVERSITÀ DEGLI STUDI DI CAGLIARI

IEEE PES Power & Energy Society® Italy Chapter - PE31

DIPARTIMENTO DI INGEGNERIA ELETTRICA ED ELETTRONICA
DIPARTIMENTO DI ECCELLENZA MUR 2023-2027
DIEE
UNIVERSITÀ DEGLI STUDI DI CAGLIARI

Transformation of the electric power business

presented by Fereidoon Sioshansi, Ph.D.
Menlo Energy Economics

26, 27, 28 Febbraio 2025
Aula B0 (IAM_TA), Edificio M,
Facoltà di ingegneria e architettura
Dipartimento di Ingegneria elettrica ed elettronica
Via Marengo, 3 - 09123 Cagliari

The Master Class consists of 3-days of intensive, interactive lectures covering 8 topical areas in the electric power sector:

- The fundamentals of the electric power sector
- Transformational change along the utility value chain
- The 3Ds - Decarbonization, decentralization & digitalization
- Innovation & disruption enabling consumer stratification into *prosumer, prosumager* & more exotic versions
- Distributed energy resources, aggregation & virtual power plants
- Climate change: How bad is it & why is it such a difficult problem to solve
- Energy transitions of the past & why this one has to be different
- What future for utilities; emerging business models; how to apply the lessons learned & prepare for future job opportunities in the energy sector
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The lectures are supplemented by 9 virtual lectures presented by distinguished invited guest speakers from Italy, the UK, Australia, California, Spain, Germany, and Sweden with empirical applications and innovative business models directly relevant to the topics of the lectures.

The attendees shall get exposure to a wide range of issues on the economics, business, technology, environment and regulatory aspects of the rapidly evolving electric power sector.
A multiple-choice test at the end will evaluate how much of the delivered content was absorbed and retained by the attendees.

Link for registration: REGISTER NOW!

DAY 1: Wednesday 26 Feb

Aula B0 (IAM_TA)

9 am	**Welcome & Introduction by Professor Fabrizio Pilo**
9:10 am	**Overview, schedule, format, expectations & class participation** **Introduction of guest speakers**
9:45 am	**Lecture 1: The Fundamentals of electric power sector** **Main takeaway:** Understanding the basics & how/why they are changing What is the main business? How did the traditional regulated utility business model evolve over time How did we get to where we are? What has changed & is changing & why? Why the "traditional" model needs to adjust? Proposals on Electricity Market Reform: Topic for guest lecture #1
10:45 am	Break
11:15 am	**Lecture 2: Transformational change along the utility value chain** **Main takeaway:** How/why utility business is undergoing *transformational change* along its value chain What is the utility "value chain" Transformation of main segments Generation: Renewable & variable => Feast or famine Transmission: Caught between changing supply & demand Distribution: Two-way flows, localized congestion, stressed network Customers, demand, behind-the-meter, DERs, VPPs
12:15 pm	Lunch Break
1:15 pm	**Guest speaker #1 (virtual): Confirmed** **El. Mkt. Reform proposals in the EU/UK** **David Robinson, Oxford Institute for Energy Studies** **Main takeaway:** Understanding why the historical models are no longer fit for purpose and how they can/should be reformed Dr. Robinson will provide the context for **electricity market reform** (EMR) plus an overview of recent developments including the EU's adopted market design. He will explain what has been decided & its implications - namely a fair number of national systems that rely on government subsidies because spot market prices will be too low to justify adequate investment. This could lead to expensive electricity systems and a risk of stranded/underutilized assets as consumers self-generate/store and rely as little as possible on the system.
2:15 pm	Break
2:30 pm	**Lecture 3: Decarbonization, decentralization & digitalization** **Main takeaway:** Understanding the significance of *digitalization* & the potential of AI for *aggregation* & *demand flexibility* What is meant by decentralization & digitalization (Decarbonization covered later under climate change) Impact of decentralization on power flows, relationships & service needs

Impact of digitalization on devices & demand
Opportunities & obstacles are defined by
Technology: What is possible
Economics: What is commercially feasible/profitable
Regulations: What is permitted, encouraged, subsidized, etc.
Examples of the innovations & disruptions
AI, data, ubiquitous connectivity

3:30 pm Break

4:00 pm **Guest speaker #2 (virtual) To Be Confirmed (TBC)**
Overview of Terna's expansion plans
Giacomo Terenzi, Terna, Rome, Italy
Main takeaway: Overview of Terna's major expansion plans including observations on the Italian regulatory regime & address emerging issues

5:00 pm Break

5:15 pm Late session to coincide with California time
5:15 pm Italy = 8:15 am CA
Guest Speaker #3: Confirmed (TBC)
The transformation of utility business in California
Alva Svoboda
Pacific Gas & Electric Company, San Francisco, CA
Main takeaway: Guest speaker will explain how the business model has evolved for the **Pacific Gas & Electric Company** (PG&E), the largest utility in California, how it procures power from the **California Independent System Operator** (CAISO) to serve the needs of its 5+ million customers, how it interacts with **Customer Choice Aggregators** (CCAs) and other major opportunities and challenges as customers invest in **solar PV panels, batteries** and **electric vehicles**

6:15 pm End of day 1

DAY 2: Thursday 27 Feb

Aula B0 (IAM_TA)

9 am **Guest speaker #4: Confirmed**
Neil Lessem, Australian Energy Market Commission (AEMC)
Sydney, Australia
9 am Italy time = 7 pm Sydney time
Main takeaway: Guest speaker will describe the phenomenal rise of distributed generation in Australia, an overview of the market and some of the key issues facing retailers and customers specifically focusing on how AEMC, through regulation and new rules is encouraging the integration of DERs into VPPs, demand flexibility services, new products and retail service innovation

10:00 am Break

10:15 am **Lecture 4: Innovation & disruption; consumer migration into *prosumer, prosumager* & more exotic versions**
Main takeaway: Explore how new technological advancements and falling costs allow customers to become *prosumers*, p*rosumagers*, flexumers, *nonsumers*, etc. and what are the impact of such "stratification" on incumbent utilities & their revenues.
The fable of Rip Van Winkle
What is customer "stratification"
Consumer => *Prosumer*
Prosumer => *Prosumager*
Next: *Flexumer, nonsumer*
Why customers are migrating away from regulated bundled services
Who will pay for T&D networks of the future
Featured books:
The future of decentralized distribution networks
Behind & beyond the meter
Consumer, prosumer, prosumager

11:15 am Break

11:30 am **Guest speaker #5 (virtual): Confirmed**
Demand flexibility services & electronic trading platforms
Marco Giansoldati
Piclo Energy, based in Milan, Italy
Main takeaway: Guest speaker will describe the need for demand flexibility and the emergence of electronic platforms for trading demand flexibility services in the UK and beyond

12:30 pm Break

1:30 pm Lecture 5: Distributed energy resources, aggregation & virtual power plants
Main takeaway: Understanding the significance of "behind-the-meter" revolution at customers' premises and its implications
What is "the grid's edge?"

What is “behind-the-meter?”
What are distributed energy resources (DERs)
- Distributed generation (DG)
- Distributed storage including EVs
- Demand response (DR)
- Energy efficiency (EE)

Emerging trends in “smart” aggregation, optimization, AI
Emergence of “agents” & “intermediaries”
How customer service needs are changing
Emergence of “*nonsumers*”
Micro-grids & energy communities
How do VPPs work?
How big is the potential for VPPs
Regulatory & policy obstacles
Opportunities for “prices-to-devices”
Example: California’s MIDAS pricing scheme as a “game changer”
Example: Transactive energy & the role of “agents”
Example: Variable pricing

2:30 pm Break

2:45 pm **Guest speaker #6 (virtual): Confirmed**
Aggregation & Virtual power plants (VPPS)
Lotte Lehmbruck, Next Kraftwerke
Main takeaway: Guest speaker will provide an overview of NK’s business model, history, growth, future expansions including
- How does Next Kraftwerke aggregate loads & generation
- How does the VPP concept actually work?

3:45 pm Break

4:00 pm **Lecture 6: Climate change: How bad is it & why is it such a difficult problem to solve**
Main takeaway: Understanding the significance of *changing climate*, challenges to address it, the dynamics of *energy transition* and why the current one is different than the prior ones
Fundamentals of climate change
Why difficult to address?
Politics, economics, coordination, execution, monitoring & measurement

5:00 pm Break

5:15 pm **Guest lecture #7: Confirmed**
5:15 pm Italy = 8:15 am CA
Ahmad Faruqui
Main takeaway: Guest speaker will describe the advantages of variable electricity pricing, how they can be offered, what are the remaining regulatory, behavioral and technical challenges to their wide-spread acceptance & adoption

6:15 pm End of day 2

DAY 3: Friday 28 Feb

Aula B0 (IAM_TA)

9:00 am **Guest lecture #8 - Confirmed**
Daniel Eghbal
Energy QLD
9 am Italy time = 6 pm Brisbane time
Main takeaway: Guest speaker will explain the stunning rise of distributed self-generation in Australia, its impact on the grid, utility revenues and the emergence of new retail products and services
He will explain how the distribution utility is preparing for a future with high share of variable renewable generation and non-homogenous customers with divergent needs

10 am Break

10:15 am **Lecture 7: Energy Transitions of the past & why the current one has to be different**
Main Takeaway: For energy transition to succeed two interdependent goals must be coordinated and implemented simultaneously
First: Electrification of virtually everything
Second: Supplying the new and existing demand from low carbon resources
The deficiencies/inefficiencies of the existing fossil based system
Obstacles to overcome: Political, economic, scale, time
The dynamics of historic "energy transitions": Additional vs. substitutional
- Transition 1: Wood to coal
- Transition 2: Coal to oil
- Transition 3: Electricity, nuclear & natural gas
- Transition 4: Renewables substituting/displacing fossil fuels

How & why energy infrastructure/energy flows have to change
Speed & scale of "transition"
Bottlenecks & unintended consequences
Examples:
- Interconnection queues in US
- 260 GW of offshore wind in North Sea
- China's dominance in PVs, EVs, batteries, etc.
- Solving old problems, creating new ones

11:15 am **Break**

11:30 am **Lecture 8: What future for utilities, business models**
PLUS how to apply the lessons learned
And prepare for future job opportunities in the energy sector
Main takeaway: Capturing the lessons of the prior lectures
What are possible scenarios for utilities in the future and how will the industry evolve?
Scenarios of the evolution of utilities
Disaggregation & re-aggregation of services
Bifurcation of energy vs. delivery or energy services

What future customers need from energy service providers?
- Energy
- Energy delivery
- Aggregation, energy management & optimization
- Reliability & balancing services

How new services, new relationships & emerging business models are impacting the historical utility business model
The emergence of Distributed Energy Resources (DERs)
Micro-grids/community energy
Examples:
- Stanford University micro-grid
- Sunnova Energy's proposal

Featured books:
- Energy communities
- The future of decentralized distribution networks

12:30 pm Break

1:30 pm **7:30** am Boston time
Guest speaker #9 (virtual): Confirmed
Case study of innovative start-up's business model
Shwan Lamei, CEO, Emulate Energy
Main takeaway: Guest speaker will describe Emulate Energy's business model, how it works, how it has evolved, who are the current & potential future clients, how it generates & monetizes its services, how it plans to expand beyond its current markets, how it can scale up given the available technologies, AI, and addressable digitalized assets

2:30 pm Adjourn master class