



DAY 1: Wednesday 25 Feb Aula 7 (ex Clinica Aresu)

9 am	Welcome & Introduction by Professor Fabrizio Pilo
9:10 am	Overview, schedule, format, expectations & class participation Plus brief introduction of the guest speakers
9:45 am	Lecture 1: The Fundamentals of electric power market Main takeaway: Understanding the basics & how/why they are changing What is electric utilities' main business? How did the traditional regulated utility business model evolve over time? How did we get to where we are? What has changed or is changing & why? Why the "traditional" model needs adjustment? Proposals on Electricity Market Reform: Topic for guest lecture #1
10:45 am	Break
11:00 am	Guest speaker #1 (virtual) 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.
12:00 pm	Lunch break
1:00 pm	Lecture 2: Transformational change along the utility value chain Main takeaway: How/why utility business is undergoing <i>transformational change</i> 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
2:00 pm	Break
2:15 pm	Lecture 3: Decarbonization, decentralization, digitalization, AI Main takeaway: Understanding the significance of <i>digitalization</i> & the potential of AI for <i>aggregation & demand flexibility</i> 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

3:15 pm

Break

3:30 pm

Guest Speaker #2 (Virtual)

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

4:45 pm

Break

5:00 pm

Late session to coincide with California time

5:00 pm Italy = 8:00 am CA

Guest Speaker #3 (Virtual)

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**

6:00 pm

End of day 1



DAY 2: Thursday 26 Feb Aula 7 (ex Clinica Aresu)

9 am

Guest speaker #4

Neil Lessem, Regulatory Assistance Project (RAP)

Sydney, Australia

9 am Italy time = 7 pm Sydney time on prior day

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

Guest lecture #5

Daniel Eghbal

Energy QLD

10:15 am Italy time = 7:15 pm Brisbane time on prior day

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

11:15 am

Break

11:30 am

Lecture 4: Innovation & disruption leading consumers to become *prosumers* & *prosumagers*

Main takeaway: Explore how new technological advancements and falling costs allow customers to become *prosumers*, *prosumagers*, *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

12:30 pm

Lunch Break

1:30 pm

Lecture 5: Distributed energy resources (DERs), aggregation & virtual power plants (VPPs)

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)

Aggregation & virtual power plants (VPPS)

Lotte Lehbruck, 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

5:00 pm Italy = 8:00 am CA

Ahmad Faruqui

The advantages & challenges of variable electricity pricing

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 27 Feb Aula 8 (ex Clinica Aresu)

- 9:00 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
- 10:00 am Break
- 10:15 am **“Pragmatic Energy Transition: recorded video**
Michael Leibreich
 A YouTube presentation on the challenges of the energy transition
 Class discussion
- 11:15 am Break
- 11:30 am **Guest Lecture #8**
Luca La Schiavo
Regulating European utilities & markets
Main takeaway: The guest speaker will present an overview of some of the main challenges facing the power sector in the EU given the underlying changes and how the regulators and regulations are trying to adjust and cope with the rapid pace of change
- 12:30 pm Lunch Break
- 1:30 pm **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

2:30 pm

Break

2:45 pm

8:45 am Boston time

Guest speaker #9 (virtual)

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

End