

# **Economics of Renewable Energy**

Module 3, 2018-2019 academic year

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## **Course information**

**Course Website:** [my.nes.ru](http://my.nes.ru)

**Instructor's Office Hours:** by appointment

**Class Time:** TBA

**Room Number:** TBA

**TAs:** Artyom Akselrod

## **Course description**

This course will familiarise the students with renewable energy resources and its economics. For decades renewable energy peacefully coexisted with traditional fossil fuel based energy. The former in the laboratories and the enthusiasts' backyards, the latter - on the energy market. More recently though the continued progress in technology has made certain renewable energy sources cost competitive with the incumbents. Such cost competitiveness has the potential to change the landscape of the energy industry, with further implications on the macro side (current account surpluses/deficits, FX), politics (rent economies and non-rent economies demand different politics), geopolitics, and economics (new international division of labour in the global economy). There are also second order effects related to a number of seemingly unrelated problems where energy availability and cost has been a bottleneck, but not any more (e.g. water desalination).

The student will get acquainted with the physical foundations of renewable energy, its economics, current competitive landscape in the energy industry, as well as the direction of possible changes.

## **Course requirements, grading, and attendance policies**

**Prerequisites:** School level physics, Microeconomics

**Attendance:** Voluntary

**Grading:** Research project (40%) / Final exam (60%). Failure on the project leads to failure on the course.

## **Course contents**

### Renewable energy sources

- Solar (physical foundations, economics)
- Wind (physical foundations, economics)
- Storage (physical foundations, economics)
- Other sources of renewable energy

### Energy usage

- Electricity (natural gas vs. solar/wind)
- Heat (natural gas/CHP vs. solar/wind)
- Transportation (oil vs. solar/wind)
- Renewable chemistry (oil-based top down chemistry vs. CO<sub>2</sub>/biomass-based bottom up chemistry)

### Macro/Micro/Political implications

- Corporate level (incumbents vs. new players)
- Macro level (current accounts, FX)
- Economics (Comparative advantage, Dutch disease)
- Politics (rent-economy politics vs. non-rent economy politics)
- Second order effects (water, food, construction)

## **Course materials**

### Books/Papers = physical foundations of renewable energy

- [Sustainable Energy – Without The Hot Air](#) (2008). *David JC MacKay*.  
(Free online book on physical foundations of renewable energy)
- [Fundamentals of Renewable Energy Processes](#) (2012). *Aldo V. da Rosa*.  
(Advanced book on physical foundations of renewable energy)

### Books/Papers = feasibility studies of renewable energy

- 100% Clean and Renewable Wind, Water, and Sunlight (WWS) AllSector Energy Roadmaps for 139 Countries of the World (2017). *Mark Jacobson et al.* ([graphics](#), [text](#))
- Low-cost solution to the grid reliability problem with 100% penetration of intermittent wind, water, and solar for all purposes. *Mark Jacobson et al.* ([text](#))
- [Clean Disruption of Energy and Transportation](#) (2014). *Tony Seba*.  
(watch Tony Seba's presentation below, to decide if you want to read this book)

### Books/Papers = economics of renewable energy

- [Lazard's levelized cost of energy analysis - Version 11.0](#) (2017)
- [Lazard's levelized cost of storage analysis - Version 3.0](#) (2017)

### Media/Think tanks

- [Cleantechnica](#) ([RSS feed](#))
- [Forbes - Energy](#) ([RSS feed](#))
- [Greentech Media](#) ([RSS feed](#))
- [Renew Economy](#) ([RSS feed](#))
- [Bloomberg New Energy Finance](#) (BNEF). Think tank.

- [The Solutions Project](#). Think tank / lobbyist for 100% renewable energy world.
- Vitaly Kazakov's [blog](#) on economics of renewable energy.

Presentations

- BNEF State of The Clean Energy Industry Keynote (2017). ([video](#), [slides](#))
- BNEF State of The Clean Energy Industry Keynote (2016). ([video](#), [slides](#))
- Tony Seba's presentation on Clean Disruption ([video](#))

People to follow

- [Elon Musk](#). Founder of Tesla Motors.
- [Mark Jacobson](#). Stanford university professor. Co-founder of The Solutions Project.
- [Michael Liebreich](#). Founder of BNEF.