

Scenario for energiutsikter

Bibel eller blendverk?

Klaus Mohn, Professor
 University of Stavanger Business School
<http://www.uis.no/Mohn>
 Twitter: @Mohnitor



Presentasjon for Nysnø Klimainvesteringer AS
 Stavanger, 14. februar 2019

1

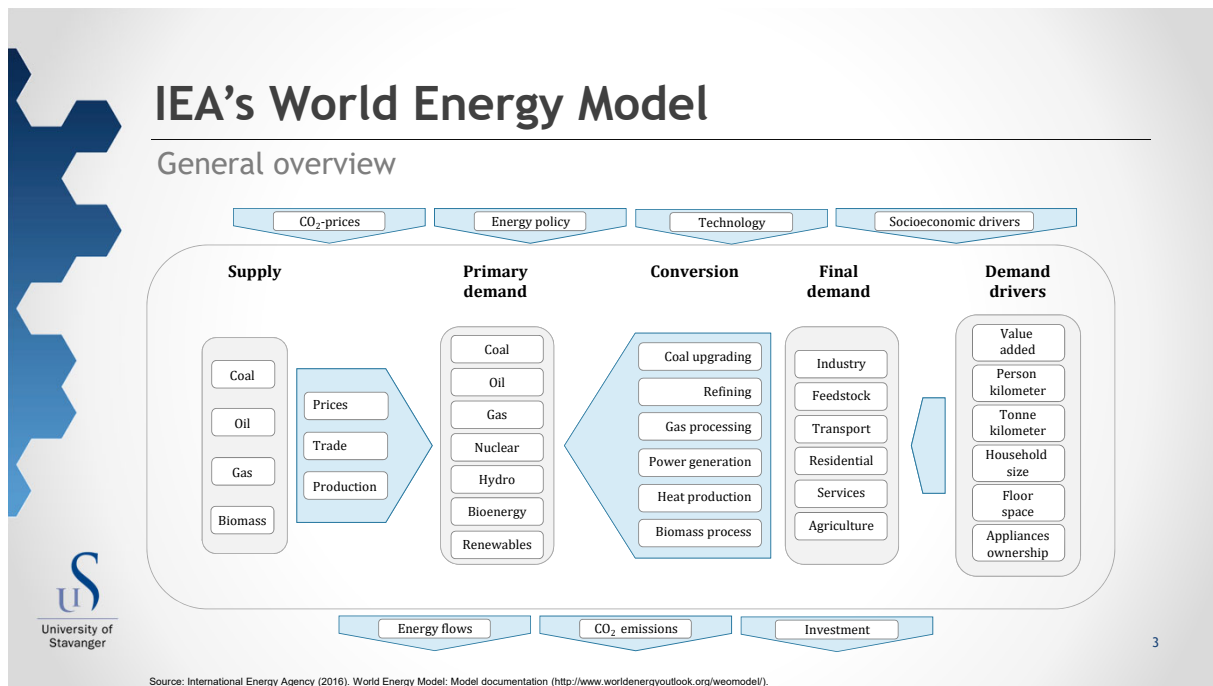
Introduction

Point of departure: IEA's World Energy Outlook

- Authoritative reference document
 - Van de Graaf (2012)
 - Heubaum and Bierman (2015)
- Scenario approach to energy
 - Nielsen and Karlsson (2007)
- Debate and dispute
 - Midttun and Baumgartner (1986)
 - Gaede and Meadowcraft (2016)
 - Metayer et al (2015)
- Methodology and model



2



IEA's World Energy Outlook 2018

Three main scenarios

- **New Policies Scenario**
 - Adopted policies and measures
 - Announced commitments
- **Current Policies Scenario**
 - “Business as usual” baseline
 - Only measures enacted by 2018
 - No further commitments
- **Sustainable Development Scenario**
 - Climate stabilization
 - Cleaner air
 - Energy access for all

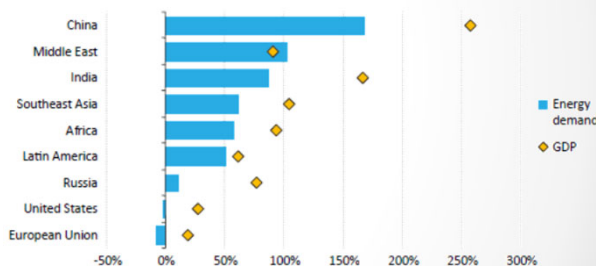
Source: International Energy Agency (2017). World Energy Outlook 2017. IEA, Paris.

Building blocks of the energy scenarios

A variety of exogenous assumptions

- Economic growth
 - No variation across scenarios
 - 3.4% (2016-2040 cagr, @PPP)
- Population and demographics
 - No variation across scenarios
 - United nations projections
 - World population: 9 bn by 2040
- Energy prices
 - Exogenous to the model
 - Variation across scenarios
 - Increase driven by scarcity/cost
- Climate policies
 - Variation across scenarios
 - Carbon markets evolve
 - Emission cost to increase

GDP and energy demand
Changes by region, 2000-2014



Source: International Energy Agency (2016). World Energy Outlook 2016. IEA. Paris.

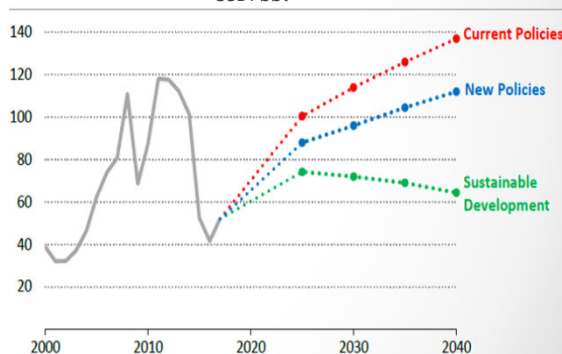
5

Key variables outside the model

Energy prices: Methodology

- Energy prices are exogenous
- Fossil-fuel prices derived through iterative process-...
 - ... based on demand-driven capacity requirement
- Energy prices vary across scenarios...
 - ... reflecting differences in technology and policies
- Gradual phase-out of fossil subsidies is assumed
- Oil price: 111 USD/bbl in 2040
 - SD scenario: 64 USD/bbl in 2040

Oil price by scenario
USD/bbl



Source: International Energy Agency (2018). World Energy Outlook 2018. IEA. Paris.

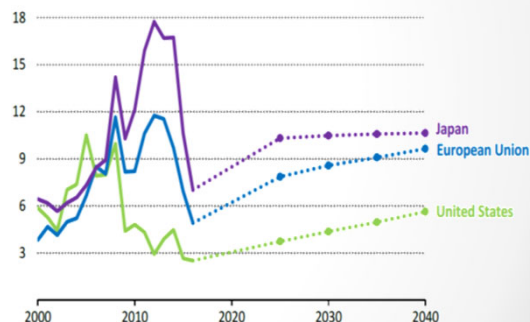
6

Key variables outside the model

Energy prices: Methodology

- Energy prices are exogenous
- Fossil-fuel prices derived through iterative process-...
 - ... based on demand-driven capacity requirement
- Energy prices vary across scenarios...
 - ... reflecting differences in technology and policies
- Gradual phase-out of fossil subsidies is assumed
- Oil price: 111 USD/bbl in 2040
 - SD scenario: 64 USD/bbl in 2040

Natural gas prices by region
New Policies Scenario (USD/MMBtu)



Source: International Energy Agency (2017). World Energy Outlook 2017. IEA. Paris.

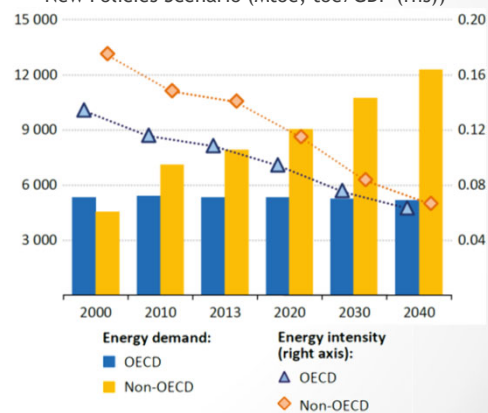
7

Technology development

“Black swan” - or “Slow train coming”

- No technology shocks implied
- Exogenous rate of innovation
 - Bottom-up approach
 - Extrapolation of recent trends
 - Some policy influence assumed
- Important to total energy demand...
 - ... and to the fuel mix
- Untapped efficiency gap assumed
 - Gradual closure of efficiency gap
 - Prices and policies at work
- Varying degree of credibility
 - Modesty on behalf of renewables
 - Heroic on behalf of CCS

Energy demand and energy intensity
New Policies Scenario (Mtoe; toe/GDP (rhs))



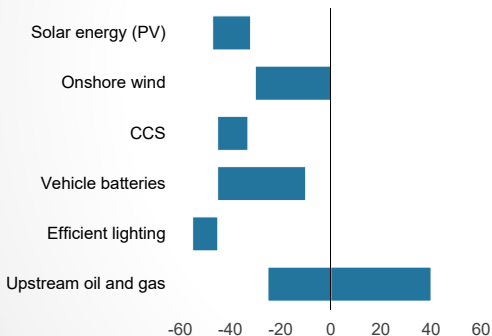
Source: International Energy Agency, 2015. World Energy Outlook 2015. IEA. Paris.

8

Energy technology

“Black swan” - or “Slow train coming”?

Unit cost by technology
Change 2014-2040 (per cent; New Policies Scenario)



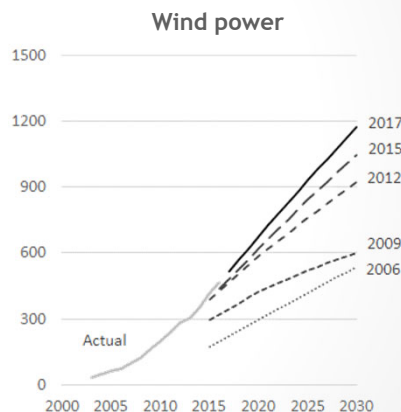
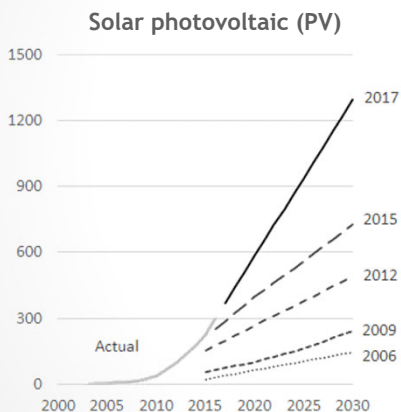
- Means to an end
- Modelling strategy
- Prices and policies
- Economic behaviour
- Role of uncertainty



Source: International Energy Agency. 2015. *World Energy Outlook 2015*. IEA, Paris.

Outlook outpaced by renewables growth

IEA's outlook for solar energy and wind power



Source: Mohn, Klaus (2018). The gravity of status quo: A review of IEA's WEO. *Economics of Energy and Environmental Policy* (forthcoming).

The gravity of status quo

Potential bias in data generation, modelling, and application

- Broadness & detail have a cost
- Model short on flexibility
- Assumptions are crucial
- Stakeholder interests
- Transparency is key

