



Faculty of Science



# DEVELOPMENT AND STATUS OF THE USE OF AGRICULTURAL RESIDUES FOR ENERGY IN DENMARK

## HISTORY AND POLICY DRIVERS

Inge Stupak

IEA Bioenergy Task 43

IEA Bioenergy interTask project 'Mobilising Sustainable Bioenergy Supply Chains'

## JOINT WORKSHOP USE OF AGRICULTURAL RESIDUES FOR BIOENERGY

Kiev, 25-26 September 2014

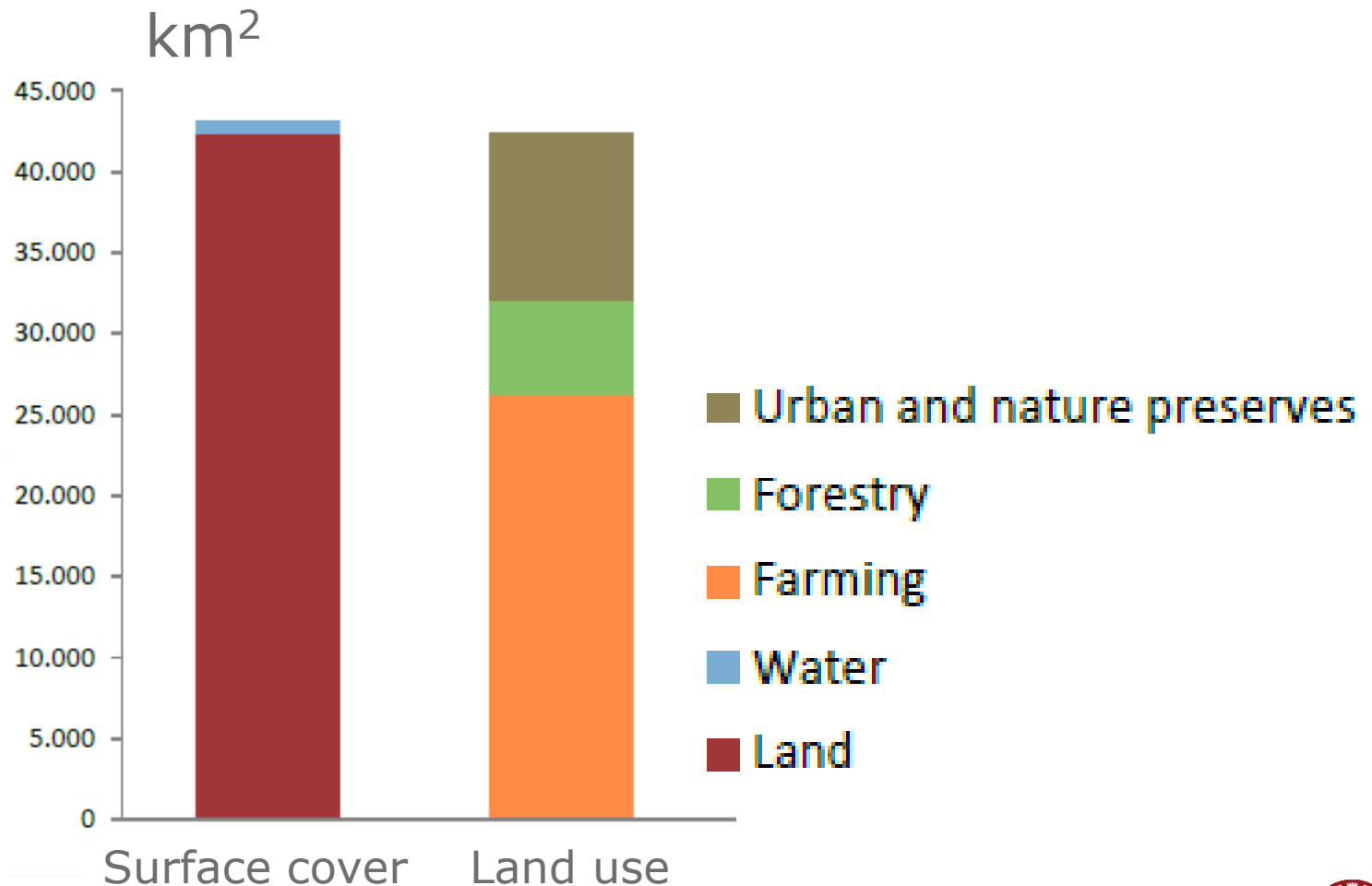


# 'THE DANISH STRAW CASE'

- Land use
- Straw uses
- The role of straw in the energy mix
- Policy drivers and instruments
- Straw and renewable targets
- Future use for biogas, bioethanol and biooil?



# LAND USE IN DENMARK



University of Copenhagen and Aarhus University (2012). The +10 million tons study.  
<http://www.biorefiningalliance.com/uploads/TimioplanUKnet.pdf>



# TRADITIONAL USE

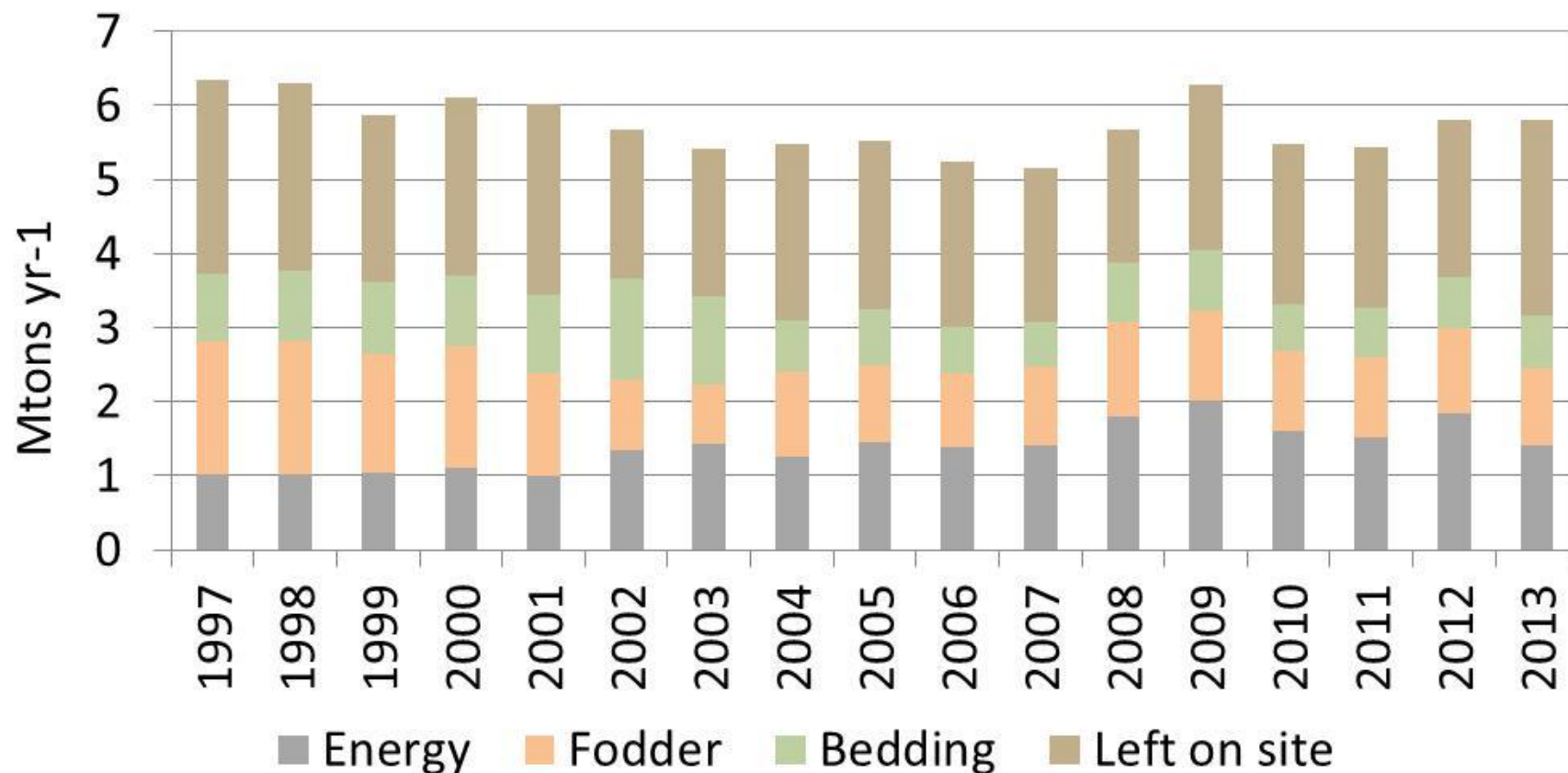


Burning straw on fields has been banned since 1990 due to environmental problems

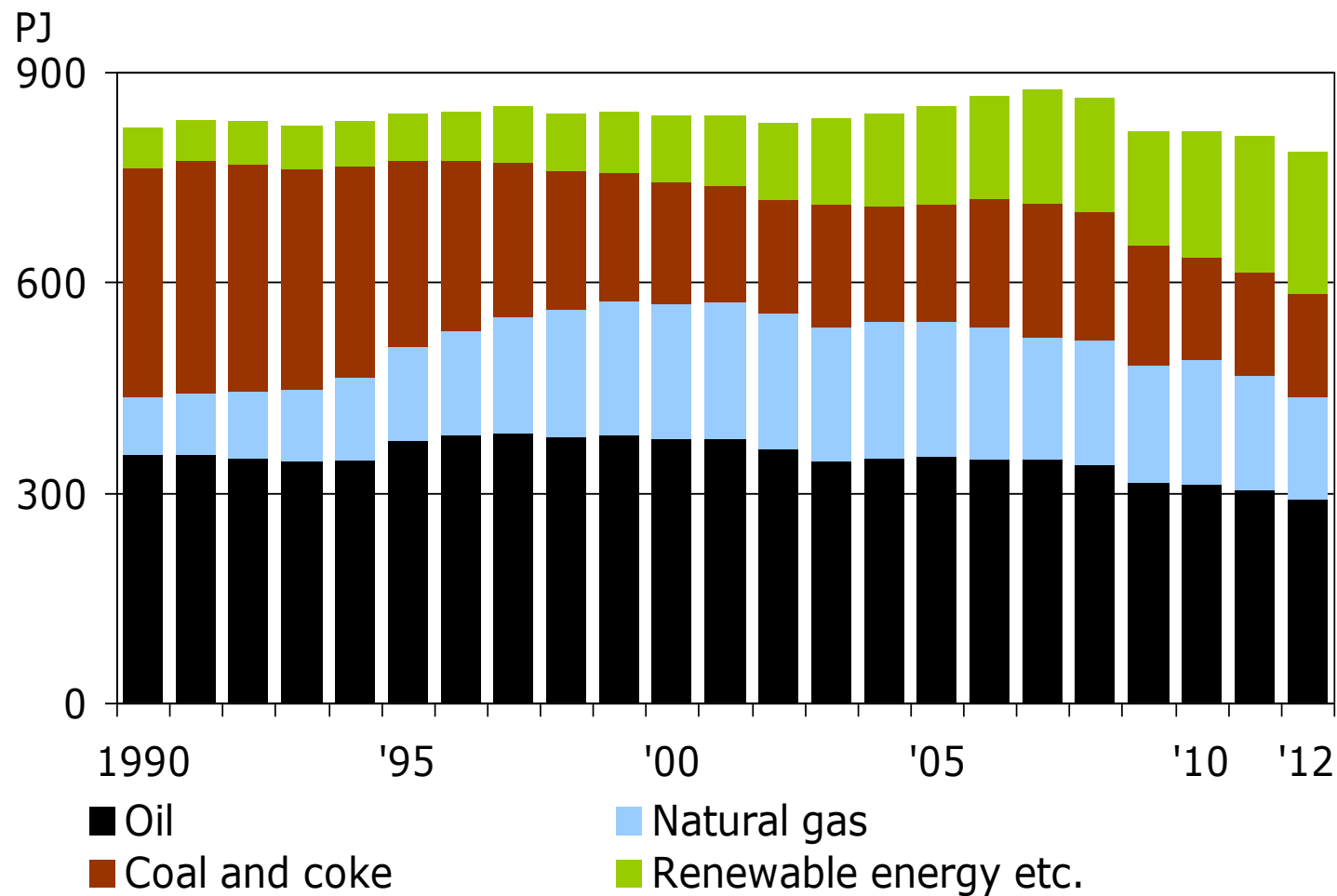
Photos: Maskinbladet, Landbrugsavisen, <http://billeder.salldata.dk/>



# DEVELOPMENT IN STRAW USE



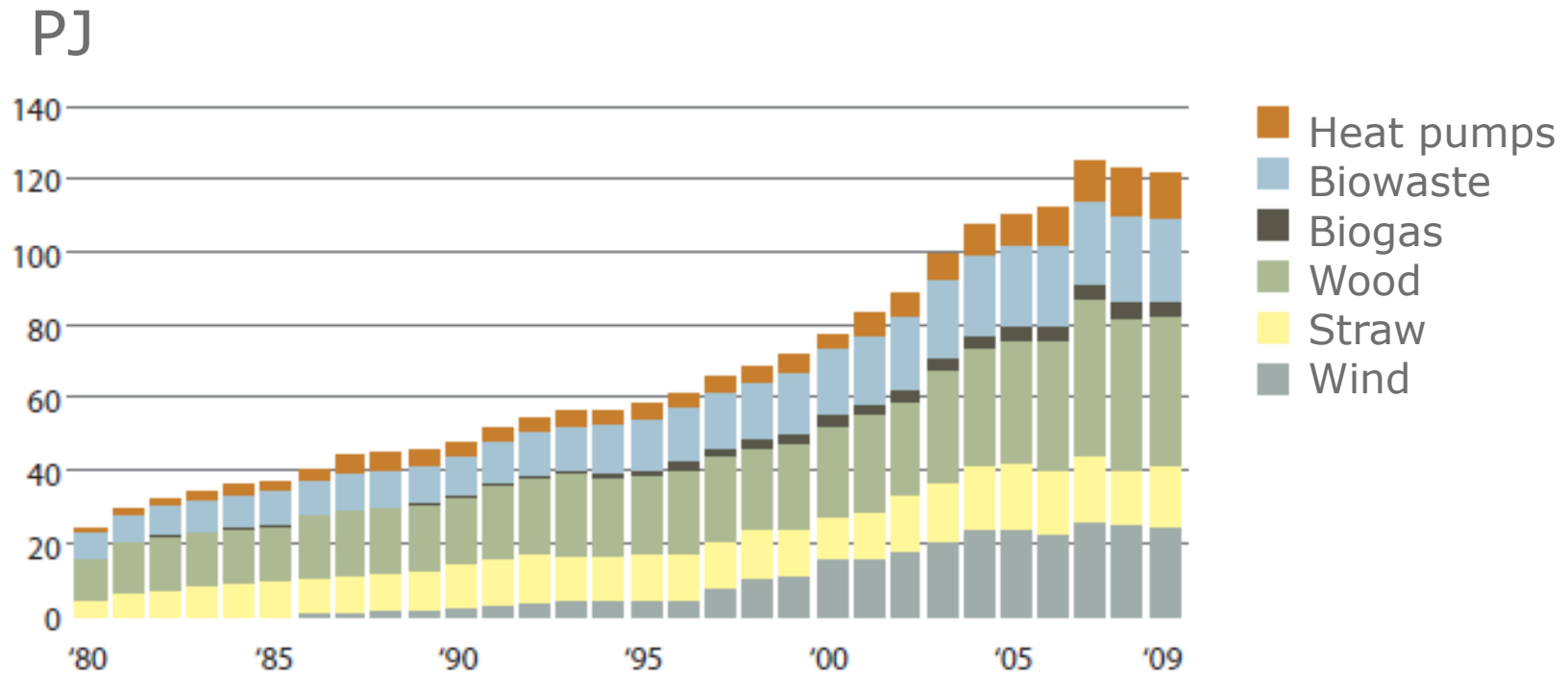
# ENERGY CONSUMPTION



Energy in Denmark 2012. The Danish Energy Agency.



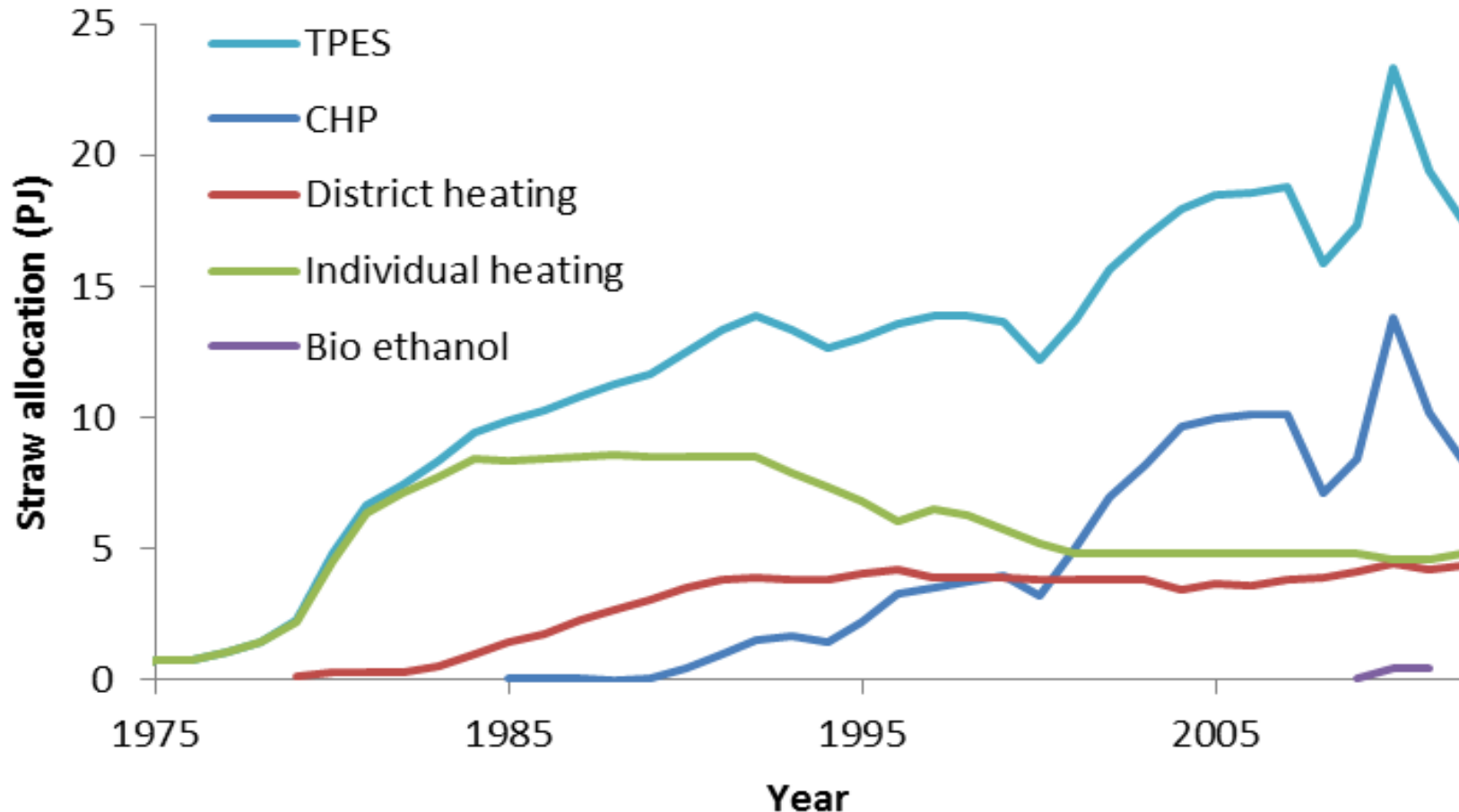
# PRODUCTION OF RENEWABLES



Straw: about 13% of renewable prod., 2-3% of total energy consumption

(Import: additional 48 PJ - wood pellets, wood chips, firewood, biofuels)

# STRAW IN THE DANISH ENERGY SECTOR



Niclas Scott Bentsen. Mobilization of agricultural residues for bioenergy: Barriers and sustainability. IEA Bioenergy Strategic Inter-Task Project. Draft report.





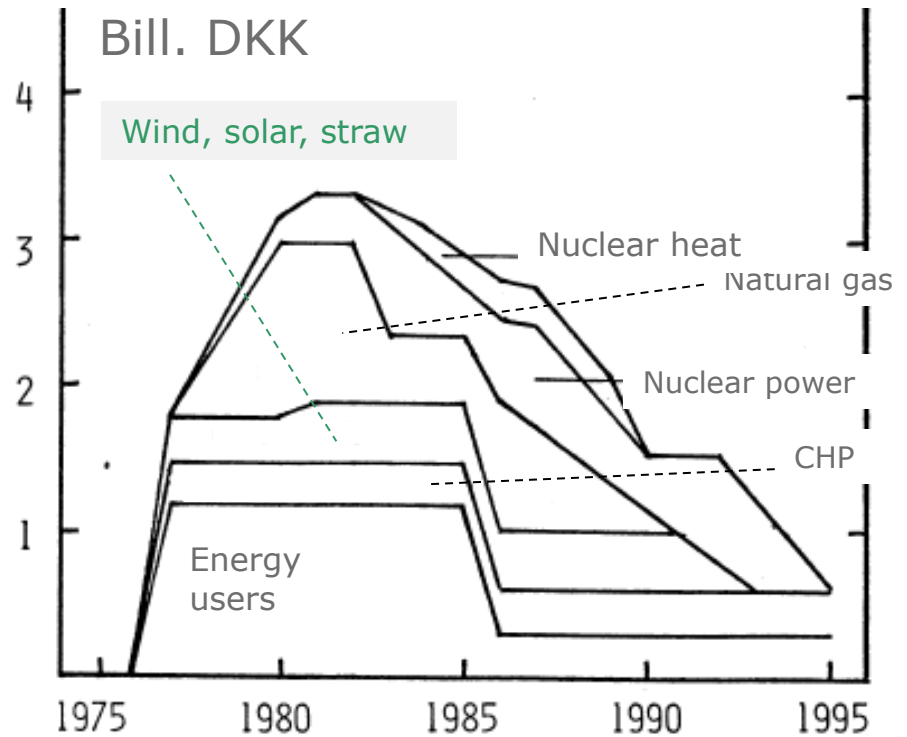
# INITIAL POLICY DRIVER

- Energy system in the 1970s: coal and oil
- Energy crisis 1973



No driving in cars allowed on Sundays  
25. November 1973 until 10. February  
1974

Investment needs 1976  
Bill. DKK



Dansk Energipolitik (1976).  
<http://www.ens.dk/info/publikationer/dansk-energipolitik-1976>



# HISTORICAL ENERGY POLICY OVERVIEW

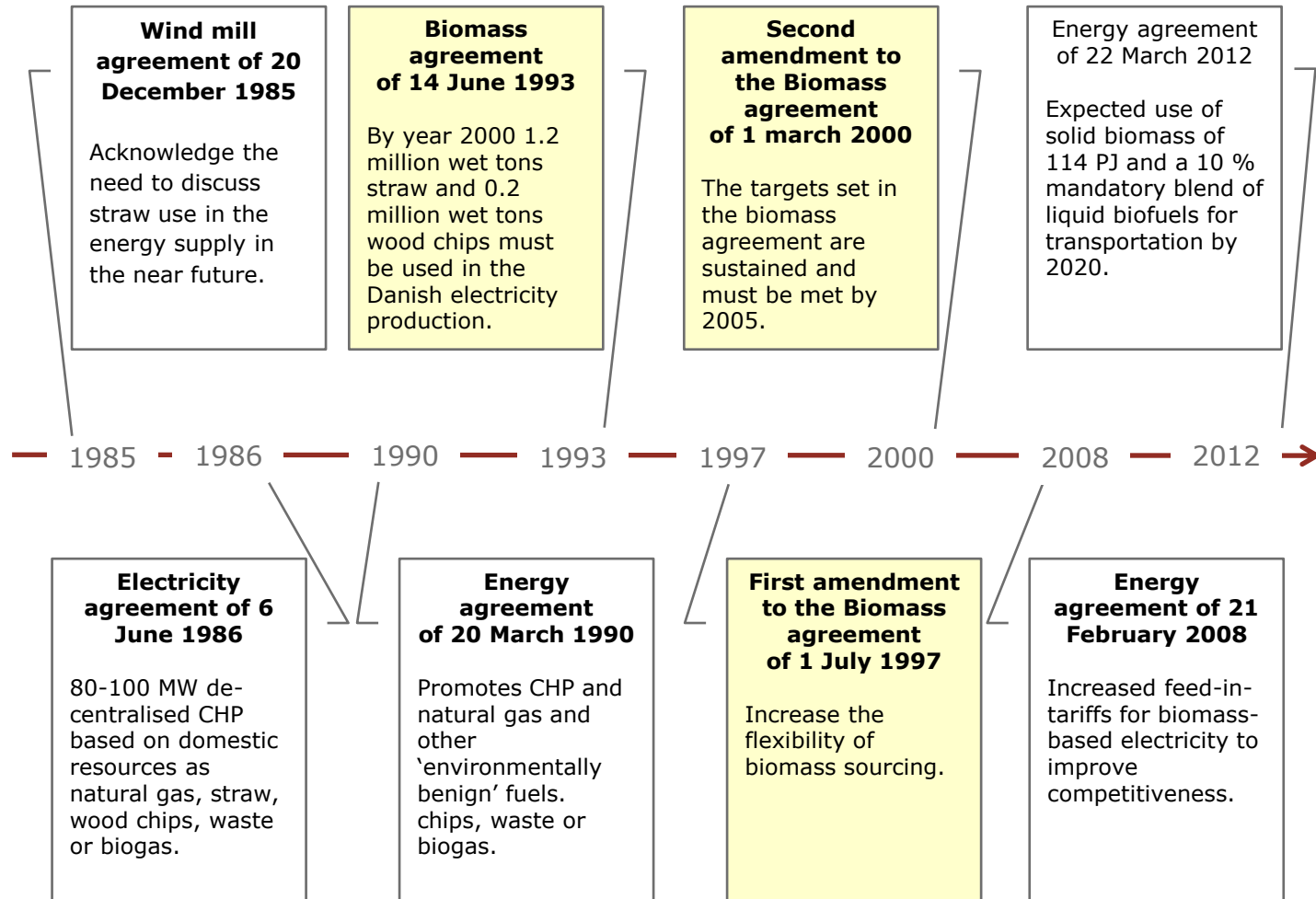
- 1976-1993:
  - **Energy security** (*'Danish Energy Policy'* – 1976)
- 1993-2001:
  - Energy security, **environmental concerns** (*'Energy 21'* – 1996)
- 2002-2006:
  - Energy security, **economic growth**, liberalization
- 2006-2011:
  - Energy security, economic growth, **fossil free energy future** (*'Energy Strategy 2050'* – 2011)
- 2011-2050:
  - Energy security, economic growth, environmental concerns, **fossil free energy future** (*'Our Future Energy'* – 2011)

Jakob Riiskjaer Nygård 2011. Denmark Country Case Analysis.

[http://greengrowthleaders.org/wp-content/uploads/2011/09/From-religion-to-reality\\_chapter-4.pdf](http://greengrowthleaders.org/wp-content/uploads/2011/09/From-religion-to-reality_chapter-4.pdf)



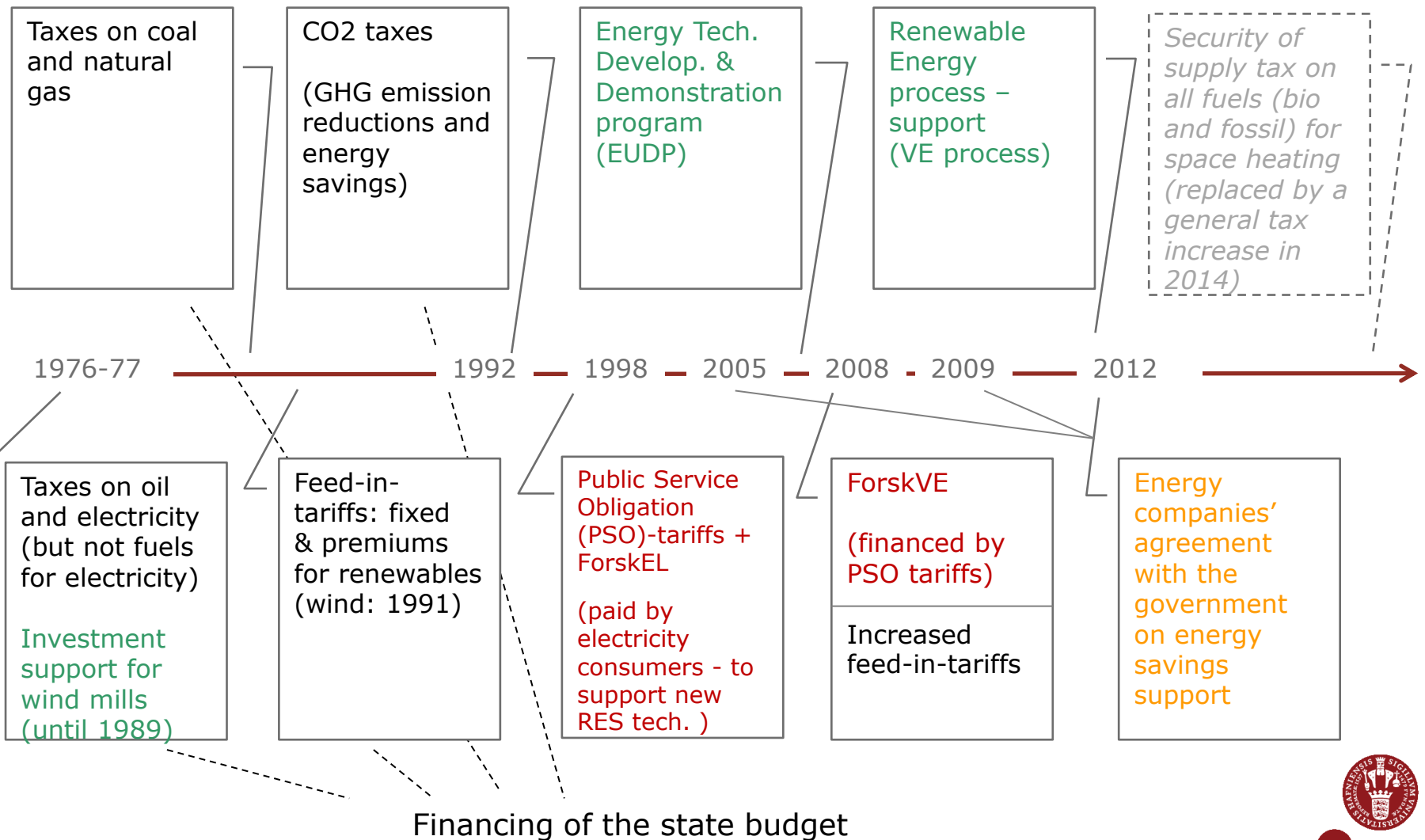
# DANISH ENERGY AGREEMENTS



Niclas Scott Bentsen. Mobilization of agricultural residues for bioenergy: Barriers and sustainability. See also <http://www.ens.dk/politik/dansk-klima-energipolitik/politiske-aftaler-pa-energiomradet>



# POLICY INSTRUMENTS

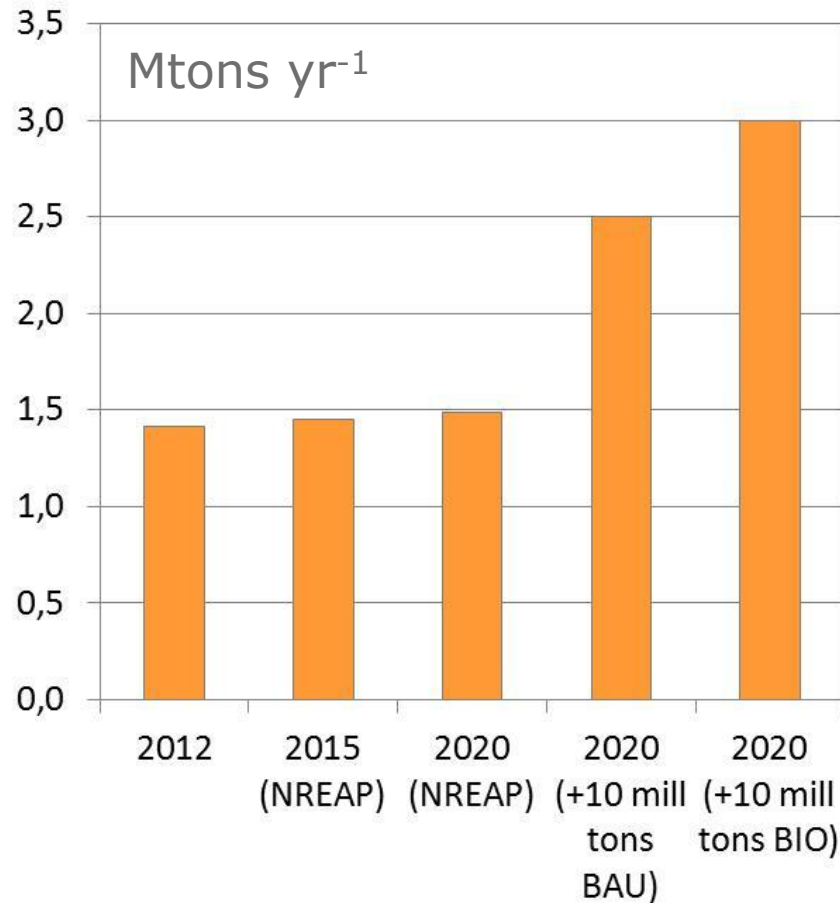


# POLICY TARGETS BY 2020

- EU Renewable Energy Directive 2009
  - DK: 30% renewables
- The Danish Energy Agreement 2012
  - > 35% renewables ~ 264 PJ (assuming 7.6% energy savings)
  - Biomass expected to contribute 114 PJ, currently 85-90 PJ yr<sup>-1</sup>
  - Approx. 50% electricity from wind power (currently 33%)
  - 7.6% reduction in energy consumption in relation to 2010 (816 PJ to 754 PJ yr<sup>-1</sup>)
  - 34% reduction in greenhouse gas emissions in relation to 1990 (target by 2012: 21%, currently 14%).
- Current use (2012):
  - 25% renewables ~ 200 PJ
  - 2-3% straw ~ 18 PJ ~ 1.4 Mtons of wet straw yr<sup>-1</sup>



# ENERGY STRAW POTENTIALS



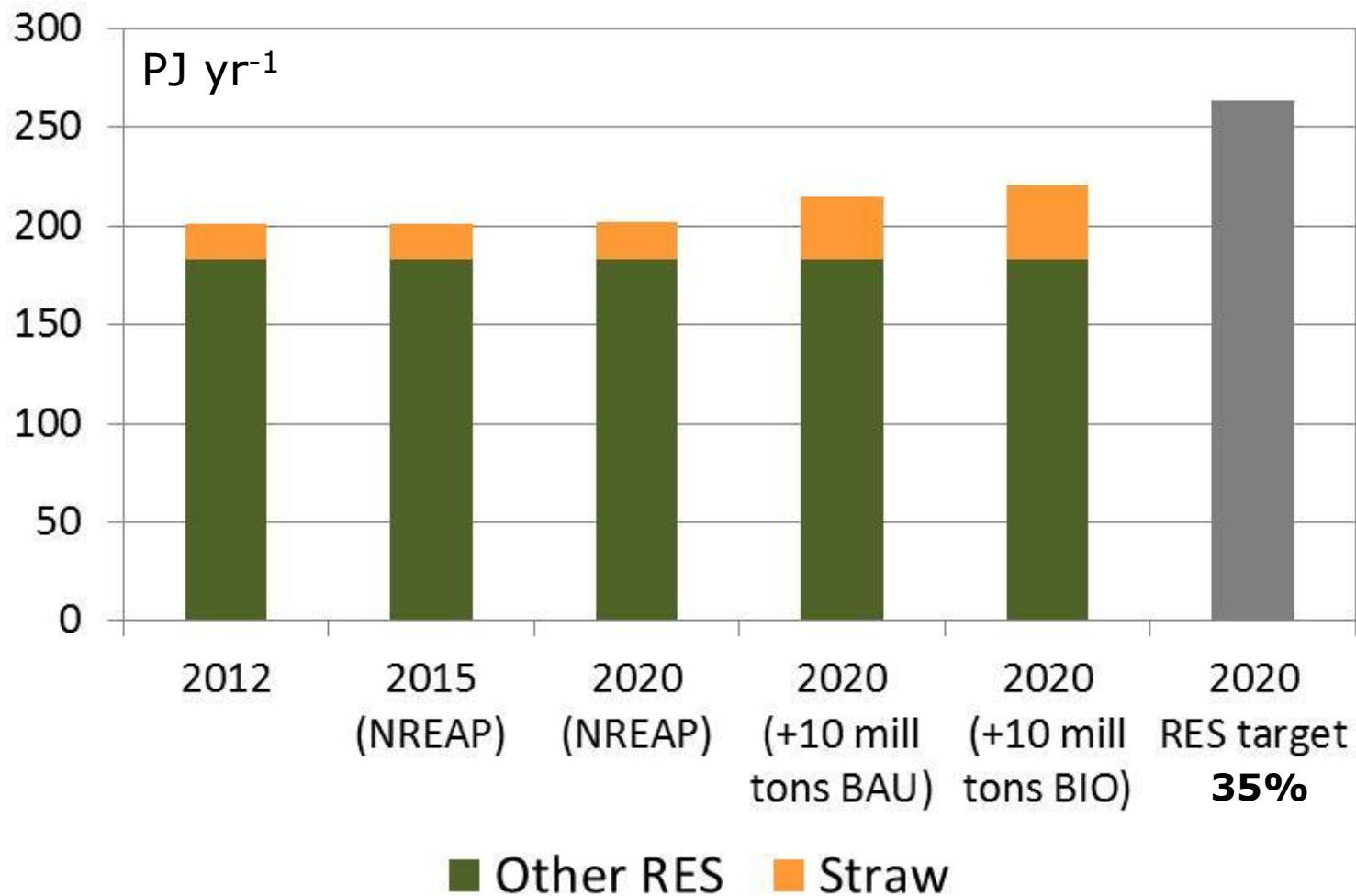
NREAP DK 2010 National Action Plan for Renewable Energy in Denmark.

[http://ec.europa.eu/energy/renewables/action\\_plan\\_en.htm](http://ec.europa.eu/energy/renewables/action_plan_en.htm)

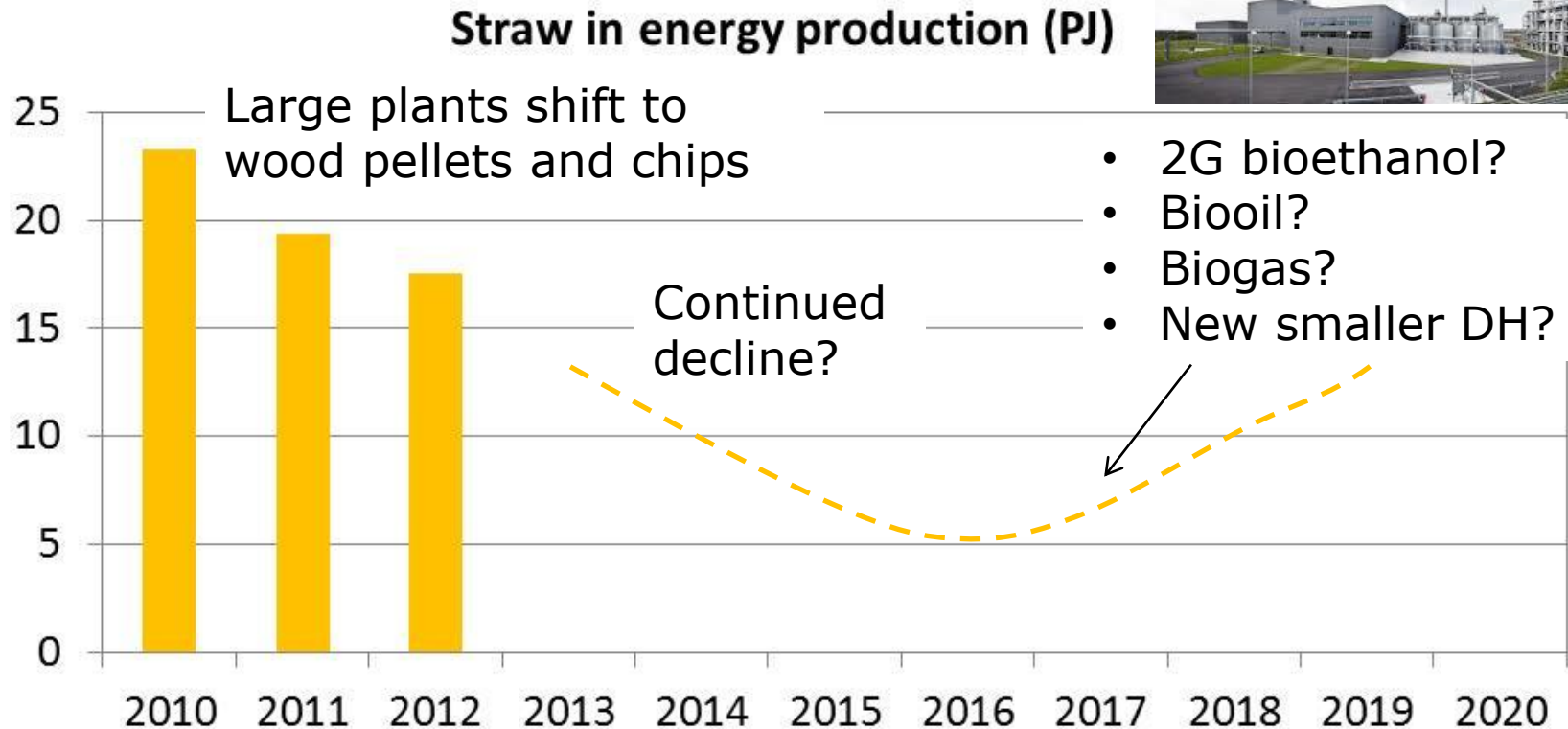
KU/AU 2012. The + 10 mioion tonnes study. Increasing the sustainable production of biomass for biorefineries. <http://biorefiningalliance.com/rapport/13/141/THE-10-MILLION-TONNES-STUDY.html>



# STRAW AND RES TARGETS



# THE FUTURE OF STRAW FOR ENERGY?



Energy in Denmark 2012. The Danish Energy Agency.

Photo: Inbicon. <http://www.dongenergy.com/EN/Innovation/utilising/Pages/inbicon.aspx>





# SUMMARY

- 1973 : Almost 100% fossil energy system - Oil crisis
- 1976 : Policies to increase energy security
- 1985 : The nuclear energy option given up
- 1986 : Decentralized CHP based on domestic energy sources
- 1990s: Feed-in-tariffs and CO<sub>2</sub> taxes
- 1993 : Biomass agreement: straw mandated for electricity
- 2006 : Emerging policies for a fossil independent future by 2050
- 2008 : Increased feed-in-tariffs
- 2009 : Biomass agreement fulfilled
- 2012 : Energy agreement – expected 114 PJ from biomass
- 2015-: Increased use for biogas, small DH plants, bioethanol and biooil? New policy measures needed?





THANK YOU!

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Photo: <http://www.veks.dk/da/varmeproduktion/fjernvarme/fjernvarme-og-miljoe>

