

# Co-product from wheat and corn as second generation feedstocks in Europe

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## **PRESS RELEASE**

### **Nedalco builds second-generation bioethanol plant**

**Investment of €150 million in production of lignocellulosic ethanol**

*Bergen op Zoom, 1 March 2007* – **Royal Nedalco has today announced plans to build a bioethanol plant in the Dutch town of Sas van Gent for the production of second-generation biofuels. From the end of 2008 it will be capable of producing 200 million litres of bioethanol annually or around 2.5 per cent of the European market. Nedalco will therefore be one of the first producers in the world to start producing second-generation biofuels on an industrial scale. It will be using a patented yeast that it has developed itself that can convert xylose into bioethanol. Using this innovative biofuel the CO<sub>2</sub> emissions of road transport can be reduced by 60 to 80% compared with petrol.**

Managing director Ger Bemer emphasises that this investment of roughly €150 million is in keeping with Nedalco's ambition both to strengthen its leading position in the field of advanced ethanol technology and to become a member of the leading group of European bioethanol producers. "This is the first large-scale investment in the production of second-generation biofuels. We will be using the unique technology for converting xylose into ethanol that we developed ourselves on an industrial scale. This demonstrates our ambition and our daring to take the development of second-generation bioethanol one step further and actually to launch this advanced biofuel on the market."

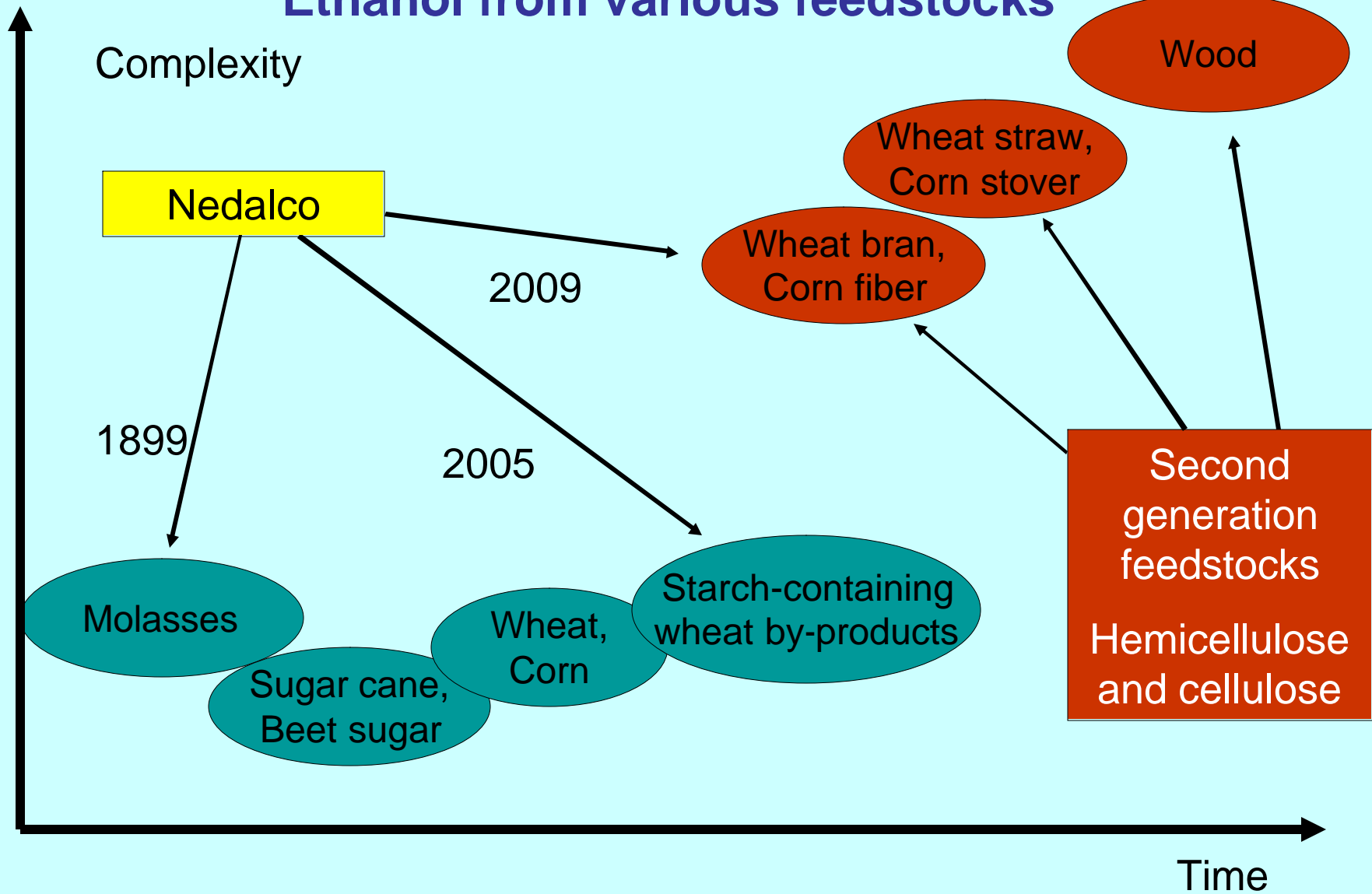
## Example of First Generation Initiative

SINGAPORE (ICIS news)--Food, ingredients and retail group Associated British Foods (ABF) said on Tuesday that it plans to form a joint venture with energy giant BP and chemicals major DuPont to build a large biofuel plant in the UK.

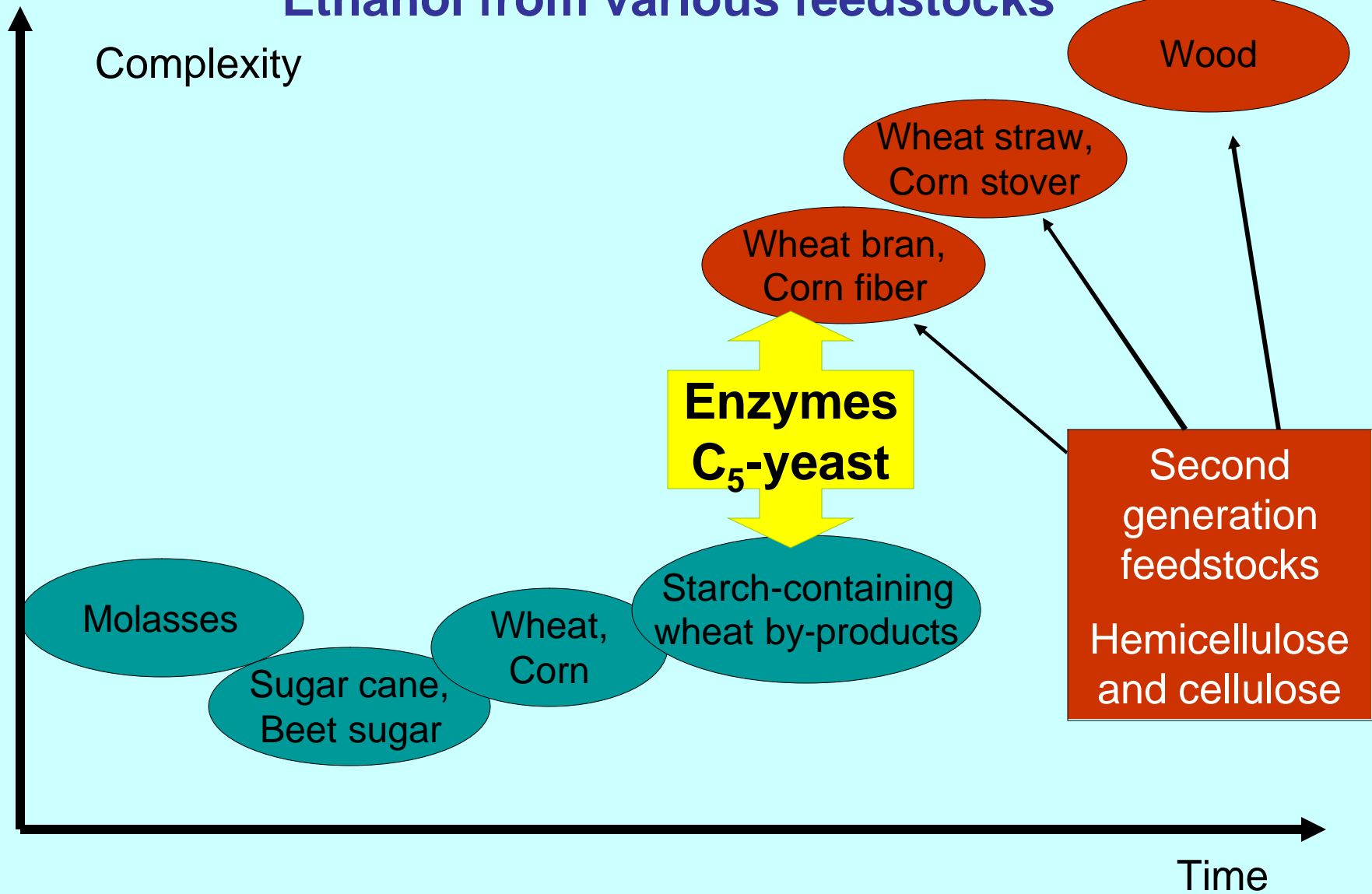
ABF and BP will each hold 45% of the joint venture and DuPont will hold the remaining 10%

The plant will have capacity of 420m litres/year, or 330,000 tonnes/year, producing bioethanol from wheat and will be built at a cost of £200m (\$400m , €\$298.5m) at BP's chemicals site at Saltend, Hull.

# Ethanol from various feedstocks

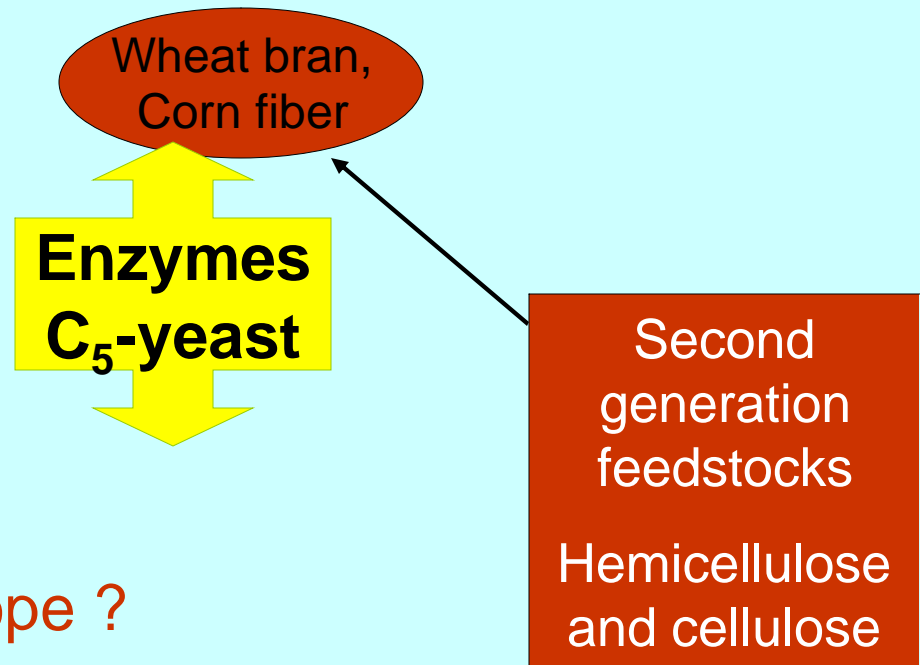


# Ethanol from various feedstocks



# Ethanol from various feedstocks

Complexity



Substantial volumes in Europe ?

Technology feasible ?

Time

## Composition of feedstocks (%w/w dry weight).

	Corn	Corn fiber	DG Corn	Wheat	Wheat bran	DG wheat
Starch	70	21	1	66	23	1
Cellulose	2	<b>15</b>	<b>19</b>	2	<b>8</b>	<b>14</b>
Arabinoxylan	7	<b>29</b>	<b>16</b>	7	<b>22</b>	<b>20</b>
$\beta$ -glucan	1	1	1	1	3	1
Other sugars	3	7	5	4	10	5
Lignin	1	8	9	1	5	8
Protein	11	15	29	12	18	39
Lipid	4	3	14	4	5	6
Ash	1	1	6	3	6	6

## Feedstocks available in Europe for bioethanol from lignocellulosics from corn and wheat

Feedstock	Dry matter (Tons per year)	Cellulose	Hemi- cellulose	
Corn Fiber	1.000.000	150.000	290.000	Mainly from wet milling to starch
DG Corn	2.000.000	380.000	320.000	Expected for 2009
Wheat Bran	10.000.000	800.000	2.200.000	15% from starch industry; 85% from milling
DG Wheat	5.000.000	700.000	1.000.000	Expected for 2009
<b>Total</b>	<b>18.000.000</b>	<b>2.030.000</b>	<b>3.810.000</b>	

# Supply and Demand in Europe (tons dry weight per year)

Cellulose	2.030.000
Hemicellulose	<u>3.810.000</u>
Total (hemi-)cellulose	5.840.000
<b>Ethanol (40%yield)</b>	<b>2.336.000</b>
<b>Ethanol if starch and other sugars included</b>	<b>3.504.000</b>

# European Summit

## June 23, 2007 in Brussels



**Angela,  
We have only  
first generation  
bioethanol**

# European Summit

## June 23, 2007 in Brussels



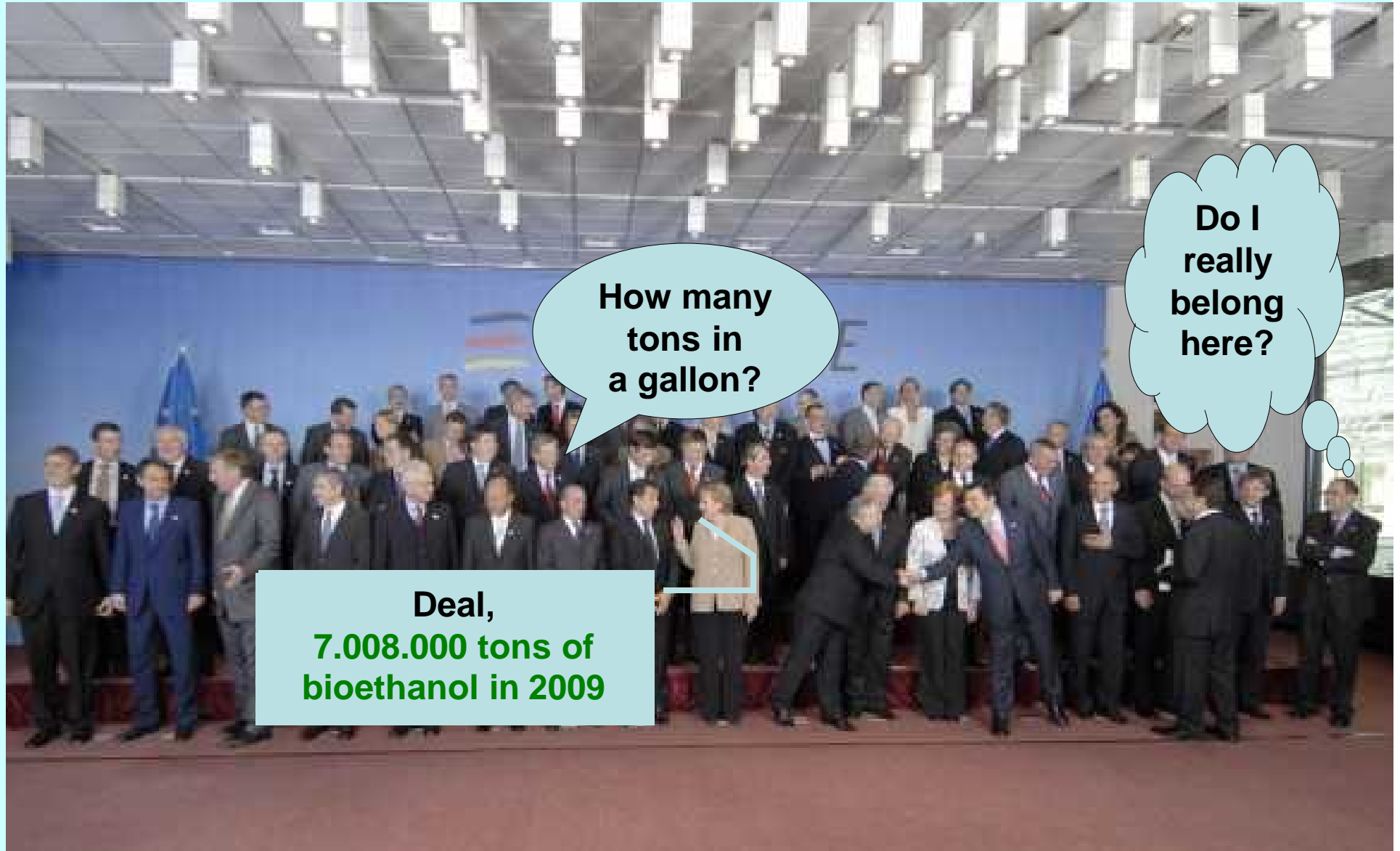
**Angela,  
Nedalco can  
provide second  
generation  
bioethanol**

## Dutch Prime Minister at Nedalco



# European Summit

## June 23, 2007 in Brussels



How many  
tons in  
a gallon?

Do I  
really  
belong  
here?

Deal,  
7.008.000 tons of  
bioethanol in 2009

Last Updated: Wednesday, 27 June 2007, 12:02 GMT 13:02 UK



## Blair to Brown: Day at-a-glance



[The emotional farewell to MPs](#)  
[Tony Blair 'to become envoy'](#)  
[Why is Blair stepping down?](#)  
[The Gordon Brown Story](#)

**It is a historic day for British politics, as Tony Blair leaves Downing Street after more than 10 years as prime minister.**

Tony Blair has faced his final prime minister's questions and is due to visit Buckingham Palace to resign.

Shortly after he leaves there, Gordon Brown will arrive and the Queen will invite him to form the next government and lead the country.

Here are the main events as they unfold throughout the day, with insight from BBC presenters and correspondents, as well as their guests.



The Blairs' possessions have been removed from their home

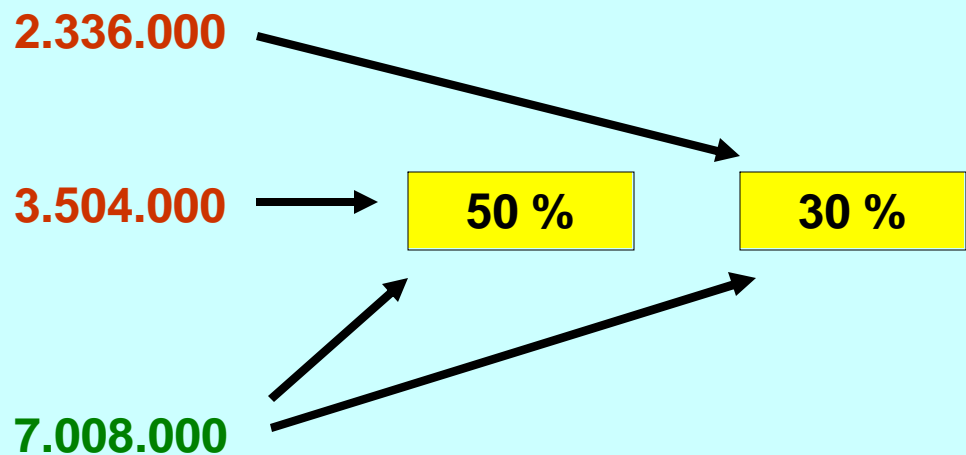
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**Ethanol (40%yield) 2.336.000**

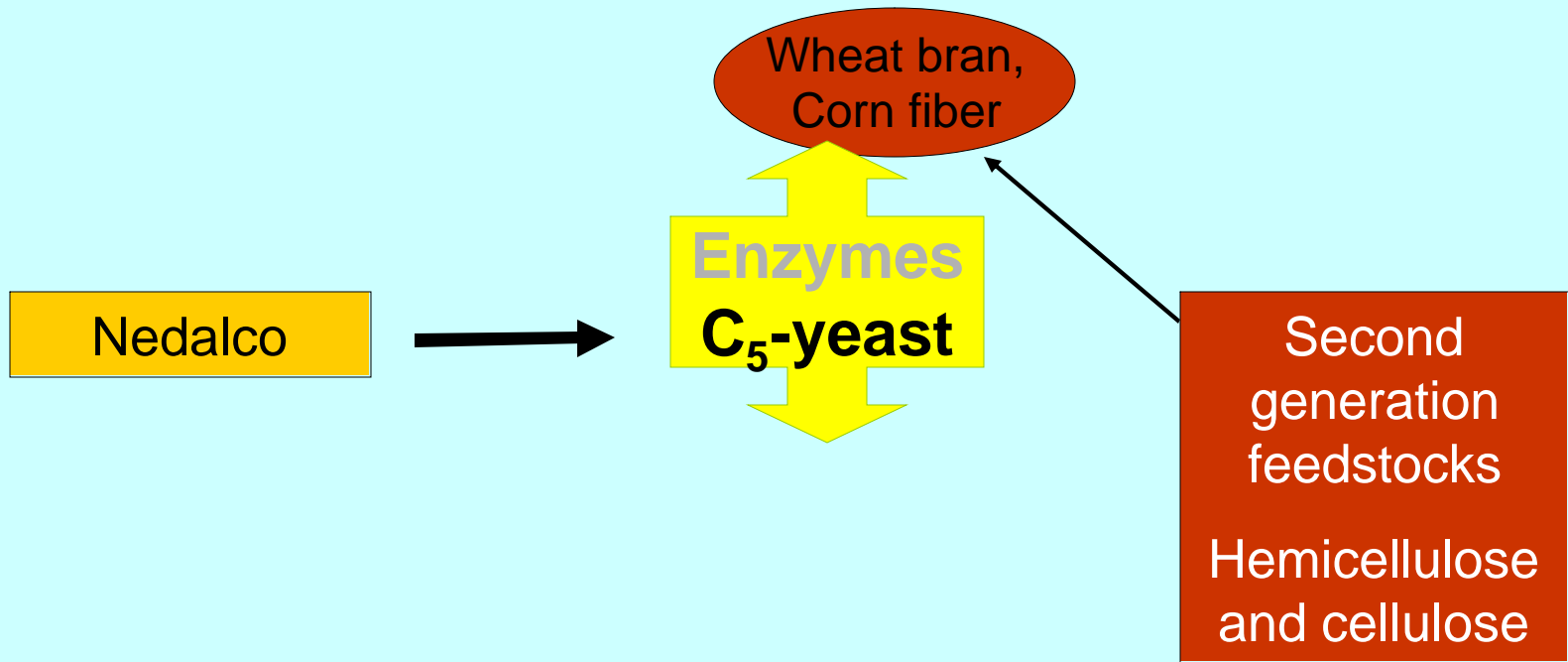
**Ethanol if starch and other sugars included 3.504.000**

**European consumption Bioethanol in 2009 7.008.000**



# Ethanol from various feedstocks

Complexity



Nedalco

Enzymes  
C<sub>5</sub>-yeast

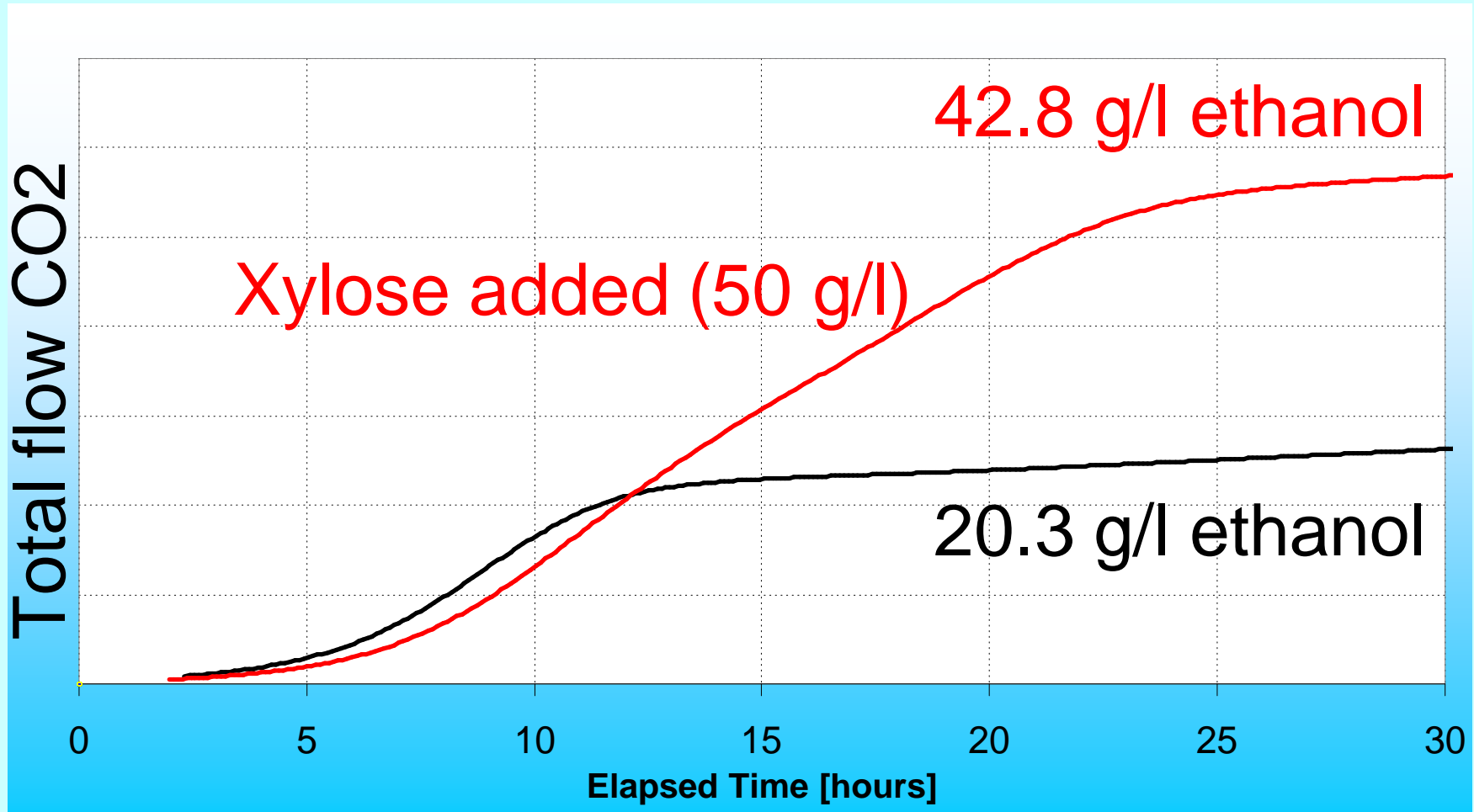
Wheat bran,  
Corn fiber

Second  
generation  
feedstocks

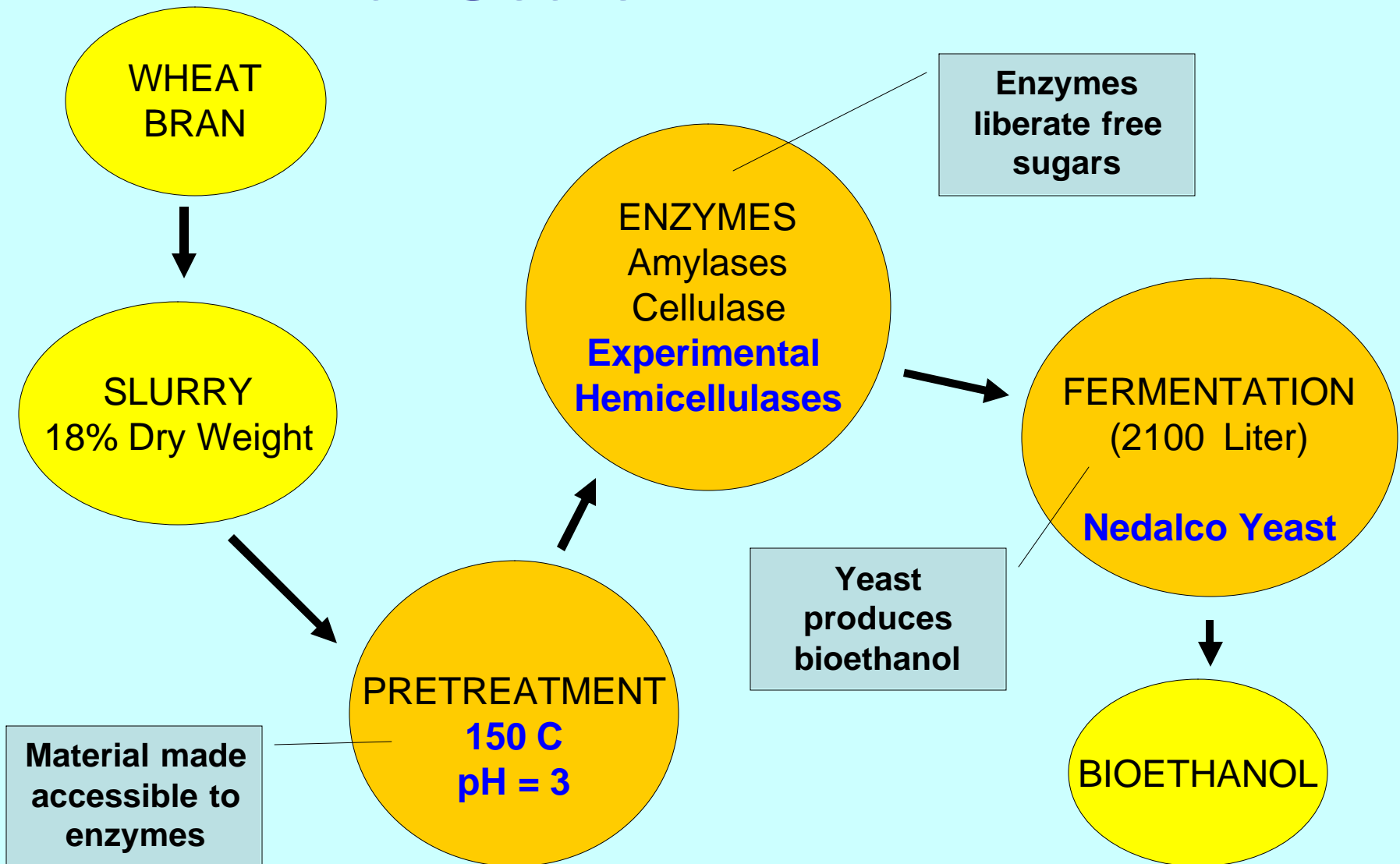
Hemicellulose  
and cellulose

Time

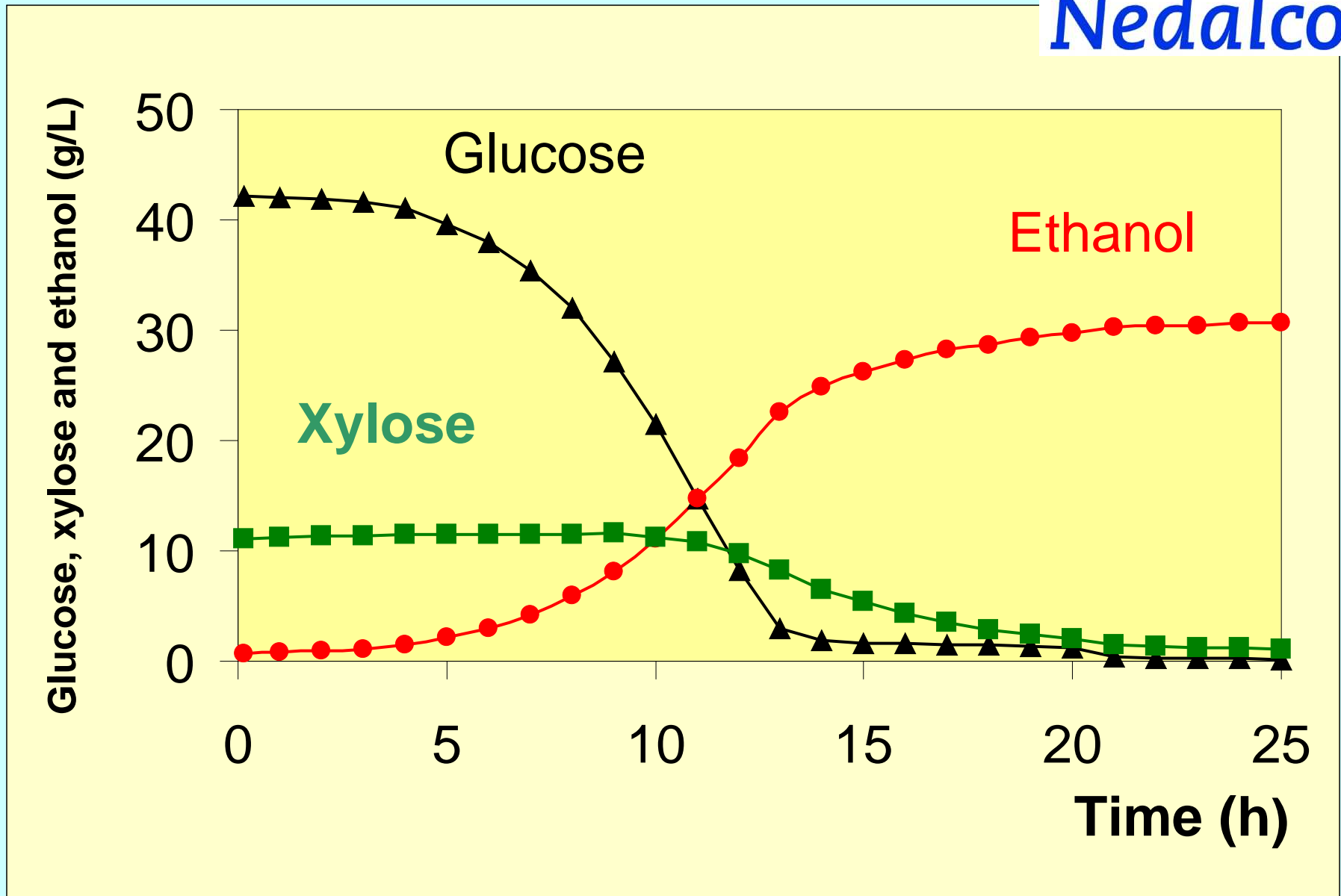
# Wheat Bran Small Scale with Additional Xylose



# Experiment Wheat Bran at Scale 2 m<sup>3</sup>



# Glucose, Xylose and Ethanol in Time during 2 m<sup>3</sup> fermentation



# Conclusions and Issues

- Many initiatives first generation
- Co-products wheat and corn suitable European feedstocks for second generation
- Large volumes, also elsewhere
- Feedstocks available at central places
- Yeast available that produces ethanol from xylose
- Enzymes?
- Economics in general terms
  
- Only later more difficult second generation feedstocks

# Examples of Options for Second Generation Bioethanol from Wheat

