



Knowledge grows

# International CCS Conference

Langesund May 20-21<sup>st</sup> 2015

Knut Rutlin

HESQ-Manager Yara Porsgrunn



# Key Numbers

Revenues and other  
income (2014)

**NOK 95.3  
Billion**

Number of employees  
**> 12 000**

Operations in more than  
**50 countries**

Sales to about  
**150 countries**

**26.3 million tons**  
Crop nutrients

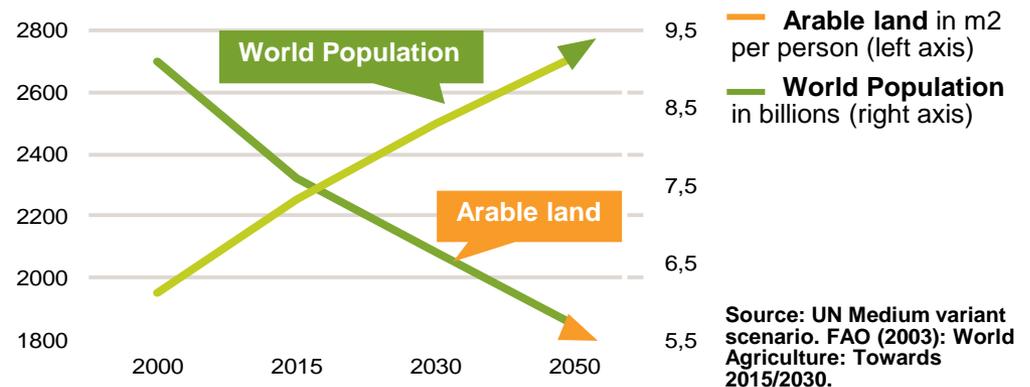
**6.6 million tons**  
Industrial products

**1.8 million tons**  
Environmental  
solutions

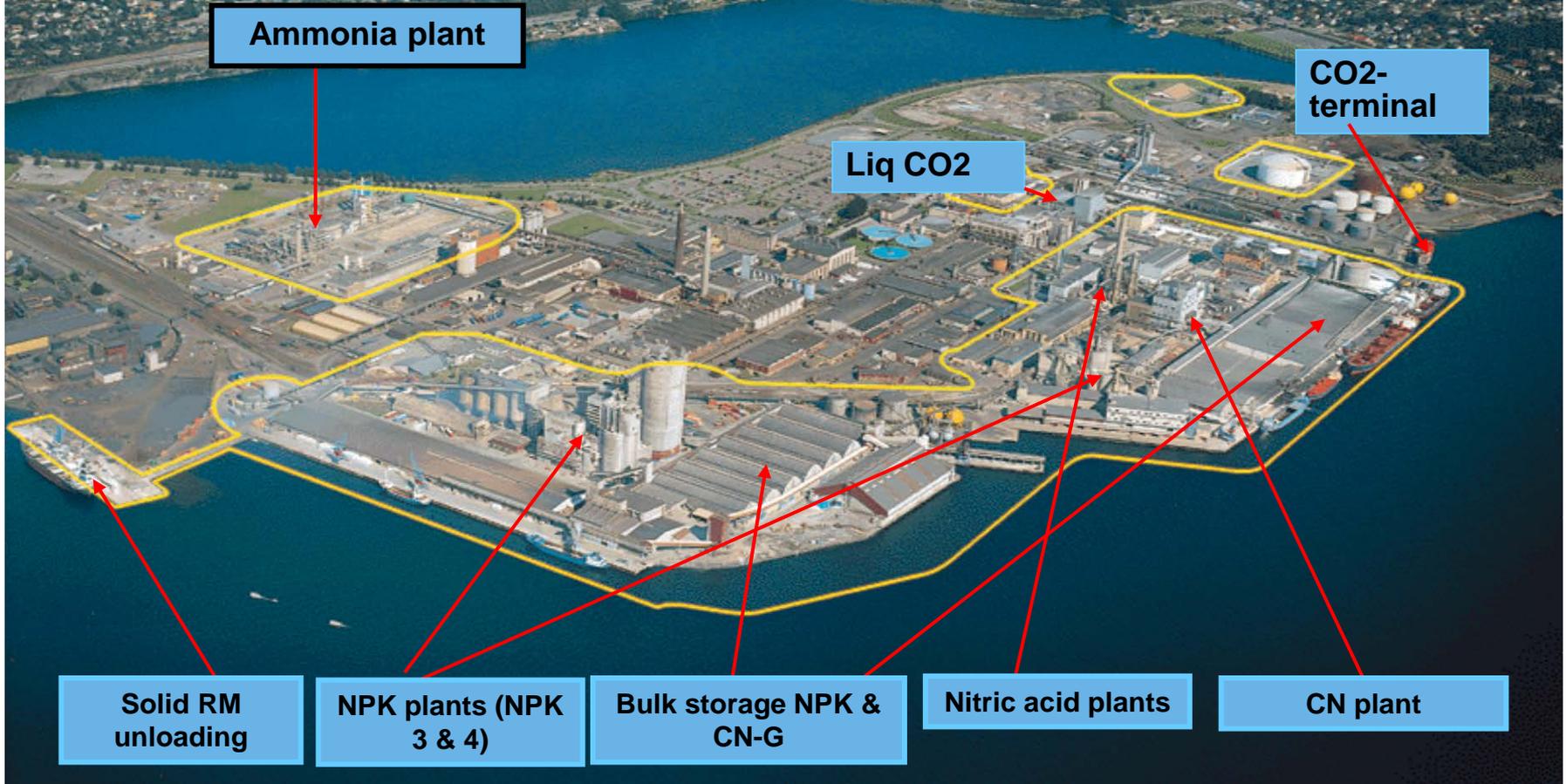
# The World Must Feed 9 Billion People by 2050

The challenge is to do so without consuming more resources

- Arable land
- Fresh water
- CO<sub>2</sub> generated per output unit



# Yara Porsgrunn



Ammonia plant

CO2-terminal

Liq CO2

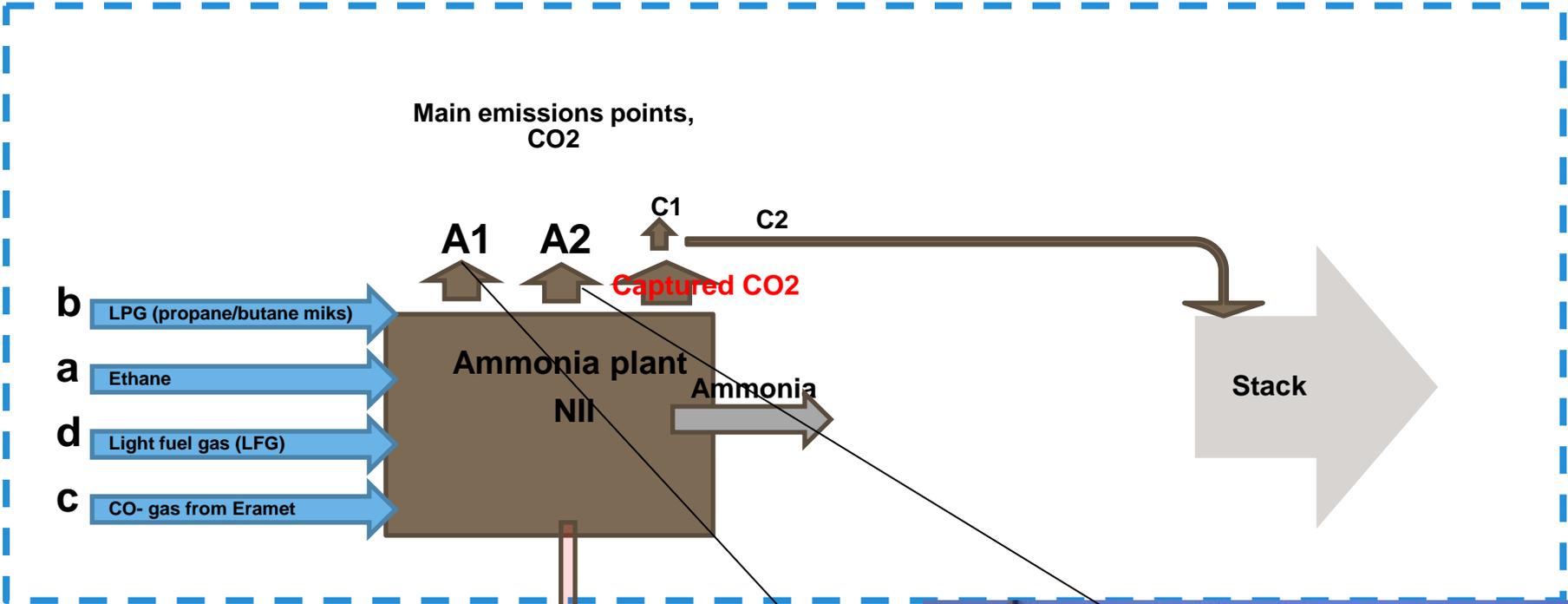
Solid RM unloading

NPK plants (NPK 3 & 4)

Bulk storage NPK & CN-G

Nitric acid plants

CN plant



**a,b,c and d = The different feed/fuel stock**

**A1 = Stack in water wash in NII**  
**A2 = Fuel gas stack in NII**  
**C1+C2 = Captured CO<sub>2</sub> in NII**



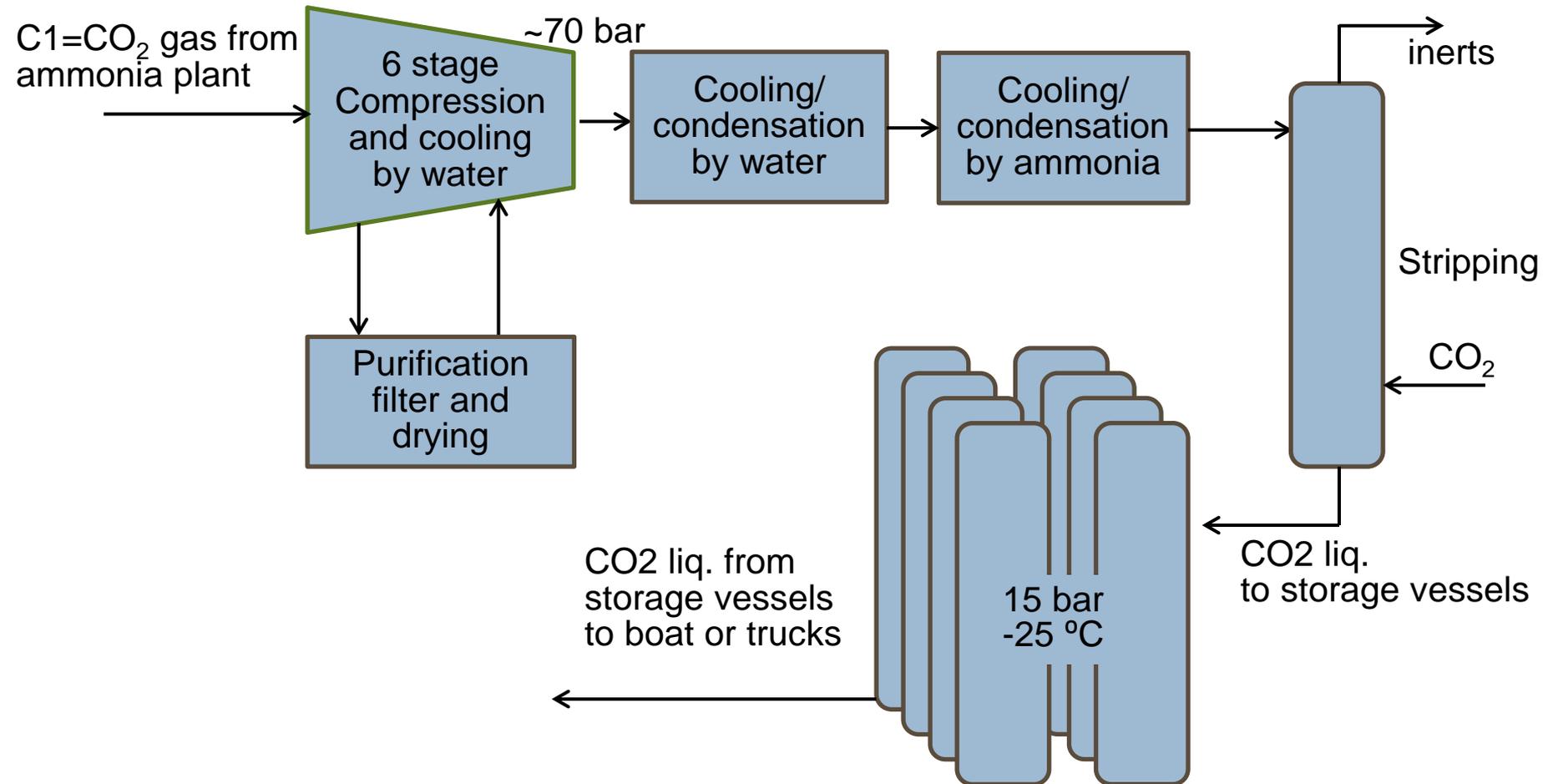
## Estimated Figures 2015

	<b>Ktons/year</b>	<b>Comments</b>
Ammonia production	520	
Total CO <sub>2</sub> -generation	1030	
CO <sub>2</sub> to fuel stack (A2)	330	Ca. 10 vol% CO <sub>2</sub> in gas
CO <sub>2</sub> to stack in water wash (A1)	280	Ca. 8 vol% CO <sub>2</sub> in gas
CO <sub>2</sub> captured (C1,2)	420	Ca. 96-98 vol% CO <sub>2</sub>
CO <sub>2</sub> -delivered as liq. (C1)	210	Ca. 50 % of captured CO <sub>2</sub>
Could be captured easily (C2)	210	With existing technology

# Water wash towers(CO<sub>2</sub>-removal by use of water)



# CO<sub>2</sub> Liquefaction Plants & Storage



# Storage Tanks

**Porsgrunn storage – cap. 3000 tons.  
Storage at 15 baro. – 25 C**



# Liquid CO<sub>2</sub> is Shipped With Yara's Dedicated Ships For Liquid CO<sub>2</sub> Distribution...

Started in 1988

- Management done by Larvik Shipping
- Under DNV GL rules
  - Own maintenance program.

# M/T "YARA GAS III"



16bar  
- 26 °C

Yara Porsgrunn 2014:

Import :	3500 t	- 4 vessels (1200-1800t/shipment)
Export :	86900 t	- 58 vessels

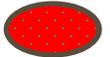
# ...to CO<sub>2</sub> Terminals Across Europe



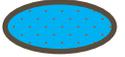
# Logistics



Production



Terminals

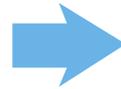


# Bringing Recovered CO<sub>2</sub> to End Users

CO<sub>2</sub> 



Fertilizer  
Production plant



Co-product  
CO<sub>2</sub>



Storage and transportation



Beverage Carbonation



Chilling, Freezing  
Packing



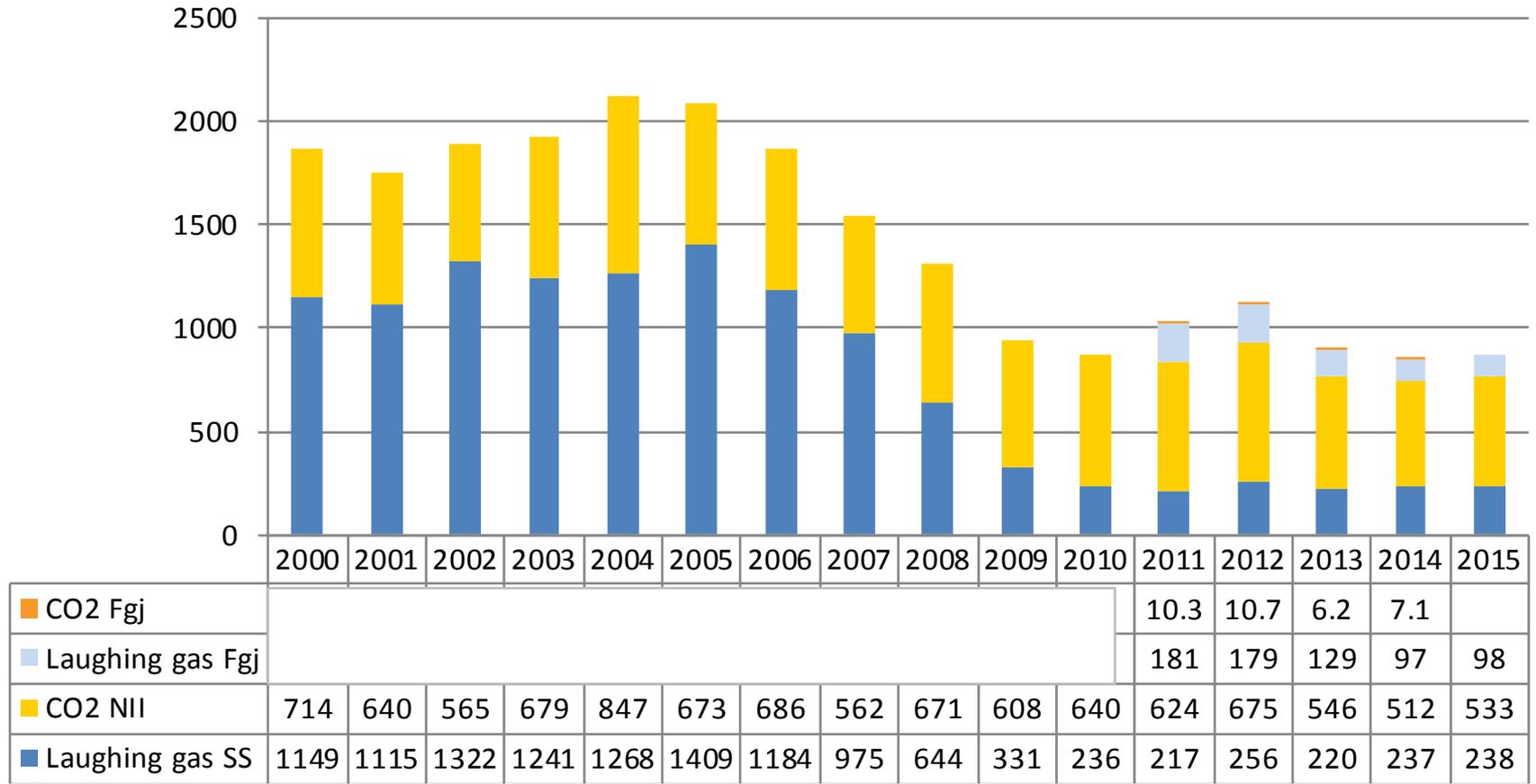
Cold Chain Assurance



Dry ice

# Emissions of GHG to Air - Challenges

Emission of climate gases from Yara Porsgrunn in CO<sub>2</sub> - equivalents (kton last 12 months)



# Conclusions

- Yara Porsgrunn have reduced outlet of CO<sub>2</sub>-eqv with 1,2 Mt CO<sub>2</sub>/year with own developed catalyst technology.
- 5 Mt of CO<sub>2</sub> have transported since 1988 (27 years) without any safety issues.
- Yara Porsgrunn can capture 210 kt CO<sub>2</sub>/year with proven/excising technology.