

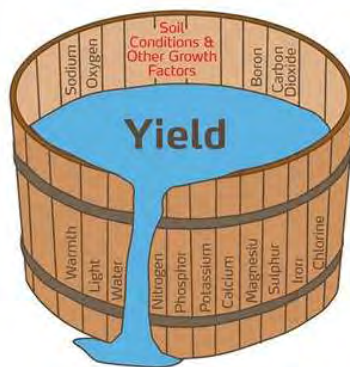
Agricultural Engineering and Climatic Responsibility?

Initiative for a holistic approach to reduce CO₂ emissions from agricultural mechanization processes...



1st AXEMA-EurAgEng Conference 25.2.2017 Dr. Eberhard Nacke

Liebig's law of the minimum factor



Reduce greenhouse gas emissions of agriculture

Management of Shortages is the main driver of Future Farming Progress

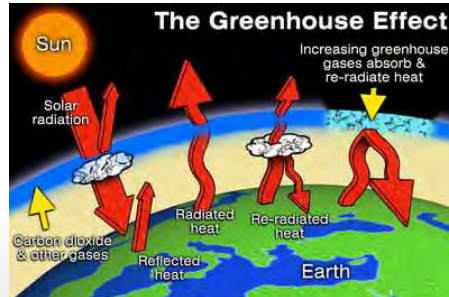
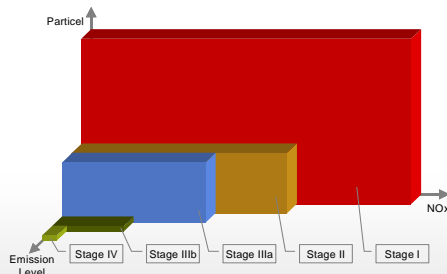
- Productivity
- Efficiency
- Precision
- Proven Quality

➤ Management

- Increase productivity of farmland
- Secure and enhance soil fertility
- Use water more efficiently
- Use fertilizer more efficiently
- Avoid losses
- Secure sustainability & profitability of farming

Our society has to react...

...Agricultural Engineering as part of our society has to accept responsibility



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
>560kW	Stage 2/ TIER2		Stage 2/ TIER4i				Stage IV/ TIER4i			Stage V			
130kW>P<560kW	Stage IIIa / TIER3		Stage IIIb/ TIER4i				Stage IV/ TIER4			Stage V			
75kW>P<130kW	Stage IIIa / TIER3		Stage IIIb/ TIER4i				Stage IV			Stage V			
56kW>P<75kW	Stage IIIa / TIER3		Stage IIIb/ TIER4i				Stage IV			Stage V			

Future legislation initiatives will focus most likely on reduction of CO₂ and other green house gases

Graphic source: EPA

Construction and agricultural machinery are only a minor contributor to total emissions from transport

Total Fuel Consumption



1 litre of Diesel converts into 2,65 kg CO₂

Non-Road Fuel Consumption



Share of total CO₂ emissions from agricultural and construction machinery

Construction Equipm. ~2,3%
AG machinery ~3,9%

Source: JRC

Reduction of CO₂-emissions = minimize engine-emissions?



- ✓ Bearings?
- ✓ Transmission?
- ✓ Drivetrain?
- ✓ Tire inflation?
- ✓ Knife sharpening?
- ✓ Corn Cracker-efficiency?
- ✓ ...



Process efficiency and CO₂ emissions



Machines in agriculture may be optimized individually


However, they are not working independently from each other



Process efficiency and CO₂ emissions

- Tractors do emit CO₂
- However, the very reason is the job of the implement behind, or the combination of tractor and implement







- All components in a mechanization chain are relevant - not just engine carrying vehicles

CO₂-Strategy of the Agricultural Machinery sector

Market-based approach instead of regulatory approach by



Potential of agritechnological process chains for efficient use of fuel

Machine Efficiency	Process Efficiency	Operation Efficiency	Alternative Energy sources
Optimizing Engine Gearboxes Hydraulics Threshing drum Tires etc.	Selection of optimal machine combinations for a process Optimal tuning of the individual process steps to each other	Training and education of users Understanding and adaption to local needs of a specific agricultural area	Use of renewable fuel and lubricants Introduction of alternative drive concepts

Use the innovative power of competition to achieve solutions with the highest efficiency

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Target: Voluntary Commitment to reduce CO₂ emissions from Agricultural Machinery

Joint research project
EKoTech
„Effiziente Kraftstoffnutzung in der Agrar**Tech**nik“
“Efficient fuel use in agricultural **Tech**nology“

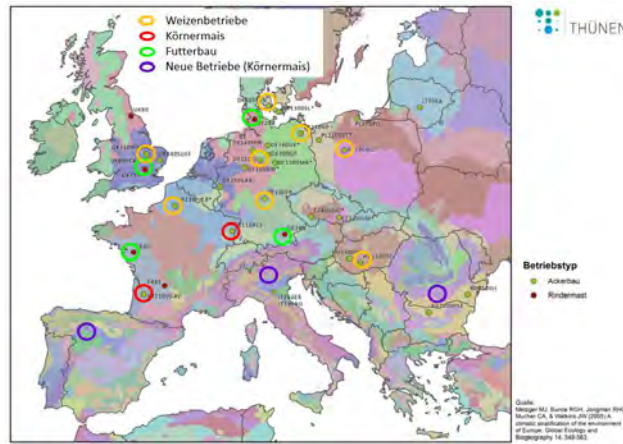
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VDMA CO₂ Project EKoTech
System boundaries

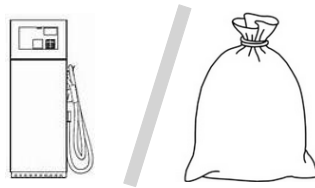
- Definition of model farms in 7 countries
- 3 crops to cover about 80 % of the agricultural area in EU 28

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APPROACH
Typical Farms

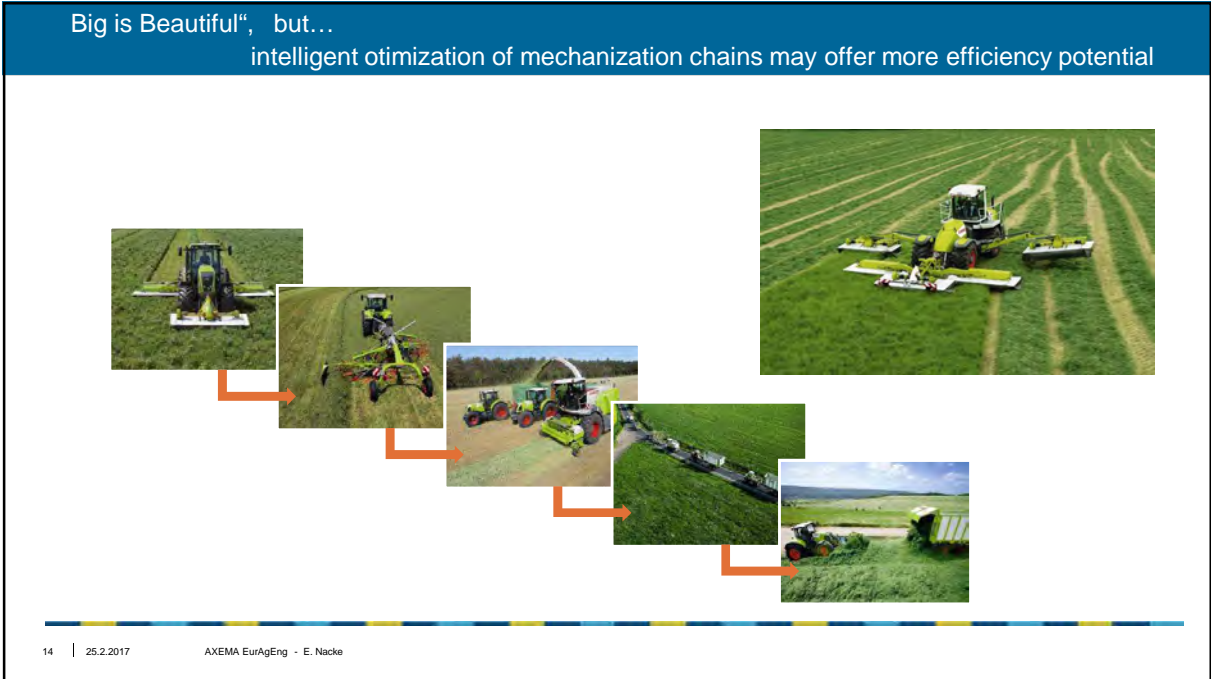
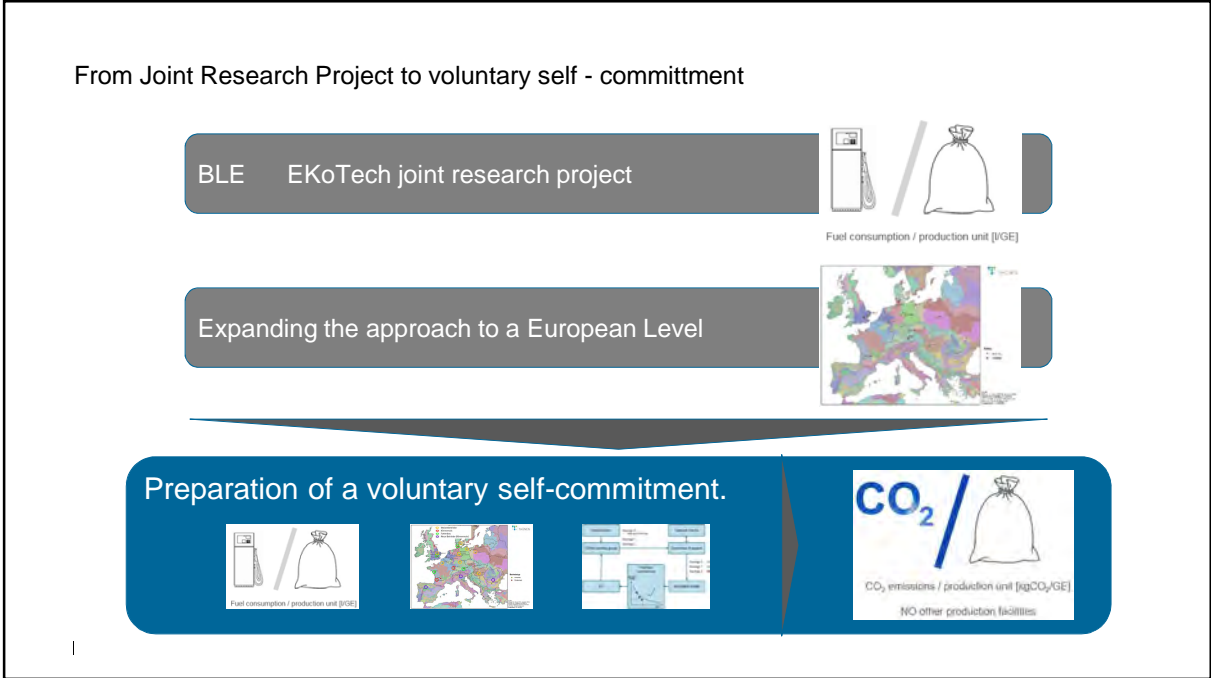


APPROACH
Reference parameter

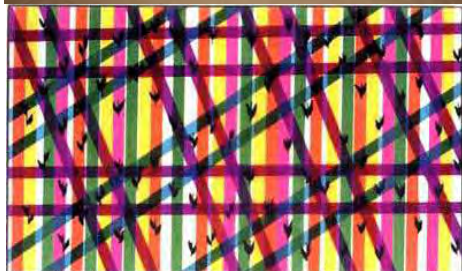


Fuel consumption / production unit [l/GE]

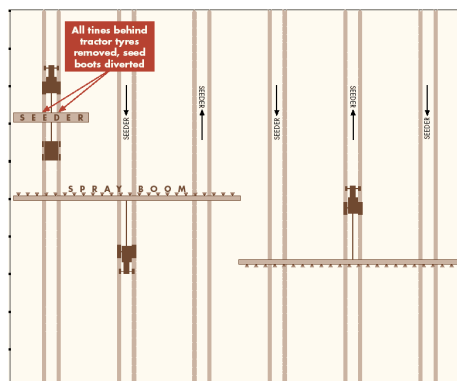
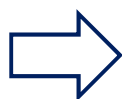
Focus purely on machinery use
NOT a total life cycle approach



Precision Steering by GPS is only a first step...
 ...in Australia farmers are dedicated to Controlled Traffic Farming



Illustrates path of:
 Planter, RC cultivator, Tillage, Anhydrous applicator, Grain cart, Combine



Very precise satellite positioning allows for an exact duplication of working paths over years

Farming 4.0
 New efficiency by solutions derived from a digitalization of all elements influencing production



Farming 4.0

New technologies may even be disruptive

...we have to insure, that they contribute to clima-efficiency as well

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EKoTech

Let's take responsibility - together



How far would we like to grant to our great-grand children that they may live as good as we are living today

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