



XXV. Encontro Economico Brasil-Alemanha 2007
XXV. Deutsch-Brasilianische Wirtschaftstage 2007

Workshop (6) “Energy Efficiency”

Dr. Stefan Spindler
Member of the Executive Board, MAN Diesel

Blumenau, November 19th 2007



MAN Diesel

The MAN Group today

Business areas



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Internationally active manufacturer of vehicles, engines and machinery
Approx. €13 billion in sales, nearly 54,000 employees in 120 countries
Four leading business areas



Commercial Vehicles

- Trucks
- Engines
- Buses
- Services



Diesel Engines

- 2-Stroke
- Turbocharger
- 4-Stroke
- Services



Turbomaschinery

- Compressors
- Reactors
- Turbines
- Services



Industrial Services

- Contracting
- Logistics
- Service Platform

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Applications of diesel engines



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Marine Applications

Main Propulsion & Auxiliary Gensets



Stationary Power Generation

Power Plants & Emergency Gensets

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MAN Diesel in Brazil



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MAN Diesel do Brasil

- Head office: Rio de Janeiro
- No. of employees: 47

Some power plant references:



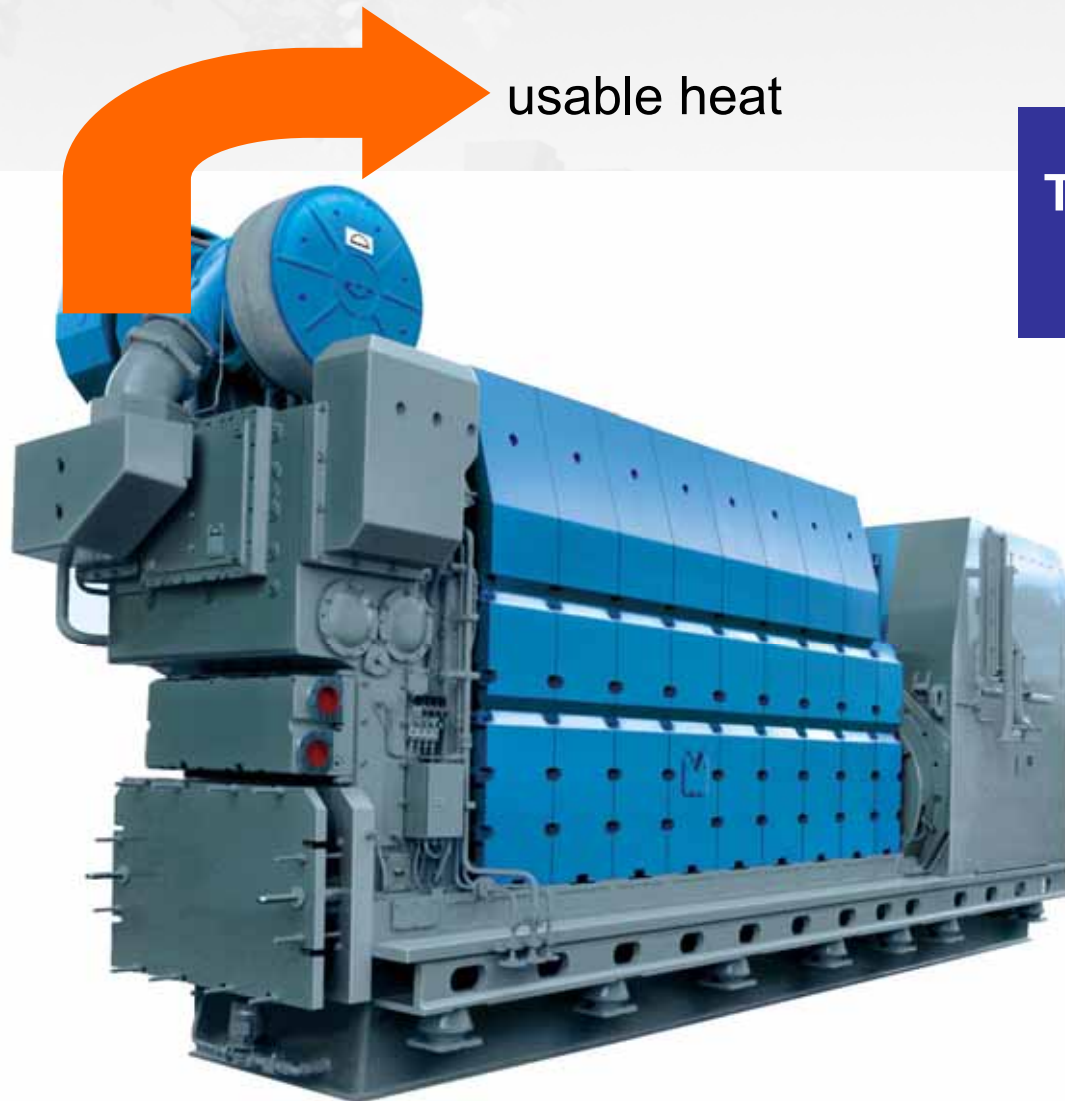
| | | | |
|--|---------------------|------------------|--------|
| Mineracao Rio do Norte S.A. (MRN) | Porto Trombetas, PA | Mining (Bauxite) | 47 MW |
| Caulin da Amazonia S.A. (CADAM) | Monte Dourado, PA | Mining (Kaolin) | 6,5 MW |
| Amapari Energia S.A. | Serra do Navio, AP | Mining / IPP | 23 MW |
| Breitener Tambaqui S.A. | Manaus, AM | IPP | 81 MW |
| Breitener Jaraqui S.A. | Manaus, AM | IPP | 81 MW |
| Energética Camacari Muricy I (ECMI) | Salvador, BA | IPP | 148 MW |



Energy utilization with diesel engines



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usable heat

**Total energy utilisation
80 - 90 %**



electrical
energy



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Fuel flexibility



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- Today, medium-speed diesel engines run on heavy fuel oil, marine diesel oil, diesel oil, natural gas or various bio fuels
- Diesel engines designed for heavy fuel (HFO) operation can use bio fuel without significant modifications
- Existing HFO diesel engine power plants can easily be refitted for bio fuel application

Advantages of operation with bio fuel:

- Soot emissions are significantly lower
- No SO_x emissions, due to lack of sulphur in fuel



Sources of bio fuel



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Castor Bean
(Mamona)



Soy Bean



Jatropha

Palm Oil



Rape Seed



Bio fuel in diesel engine power plants

Contribution to CO₂ reduction (Kyoto)



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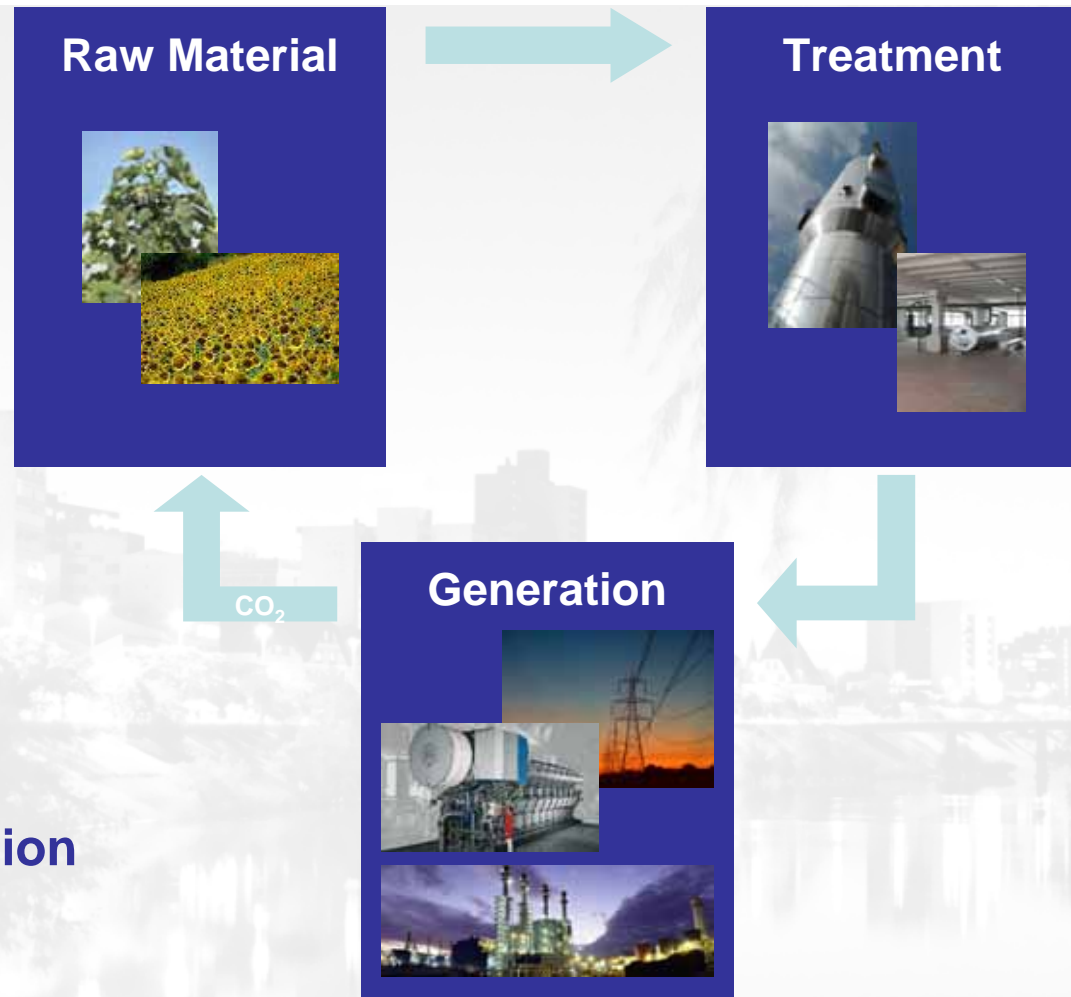
Replacement of fossil fuels

- Heavy fuel oil (78 t CO₂/TJ)
- Natural gas (55 t CO₂/TJ)

With bio fuels (~0 t CO₂/TJ)

- Vegetable oil
- Recycled frying fat
- Animal fat

 **No additional CO₂ emission when burning bio fuels**





Examples for bio fuel power plants

Fritzens

- Location: Innsbruck, Austria
- Engine: 6L 21/31
- Output: 1,2 MW_{el}
- Commissioned: 2004
- Operating hours: >27.000
- Fuel: used cooking oil
- Oil is collected from restaurants and private households
- Oil is conditioned in a settling tank and by filtration



Examples for bio fuel power plants



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Electrawinds

- Location: Mouscron, Belgium
- Engine: 18V 48/60
- Output: 17.4 MW_{el}
- Commissioned: early 2007
- Operating hours: >5.500
- Fuel: animal fat & different vegetable oils
- Own oil refining plant



Examples for bio fuel power plants

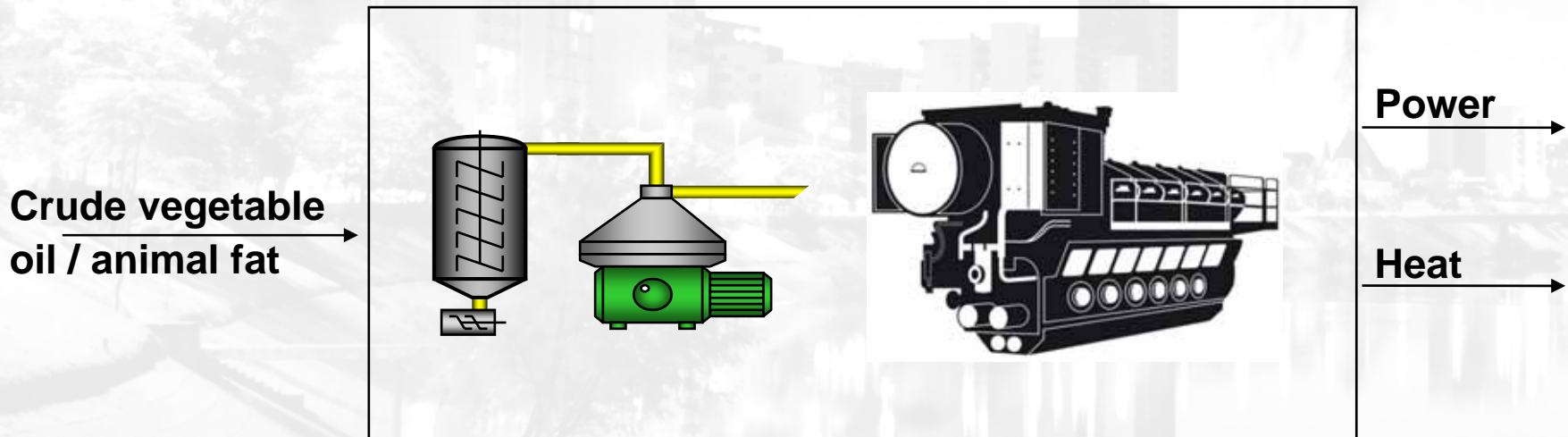


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Concept:

“integrated plant”: oil refining and power generation

- use of crude vegetable oil or animal fat
- feasible above 15 MW



Added value of bio fuel power plants



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- “Diversification” & “decentralization” of electrical power production
- Reduction of dependence on energy imports
- Prevention of future power shortages
- Independence from fluctuations of fossil fuel prices, since bio fuel is locally produced
- Self-sufficiency in energy and fuel production for the country
- Use of renewable energy sources

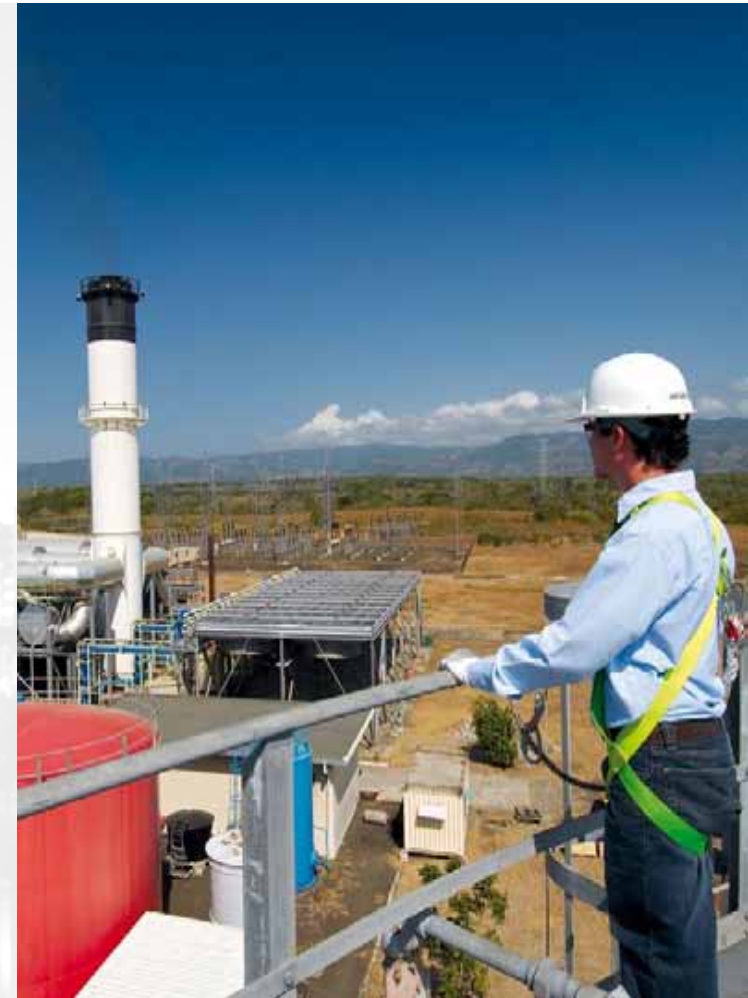


Added value of bio fuel power plants



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- Proximity of fuel production to foreseen power plants, decreasing logistical & transportation costs
- Use of bio fuel from renewable vegetable oil conservs the environment (CO₂ neutrality)
- Support sustainable development and industrialization in agricultural areas
- Creation of employment
- Contribution to regional welfare and development
- Exploration of new business opportunities



Summary



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- We have a proven technology for CO₂ neutral bio fuel power generation
- We can solve the energy needs for remote locations with small biofuel gensets 1 to 5 MW
- We can also meet the energy needs of larger sites with 35MW and more



Cleaner air with bio fuel





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with bio fuel

powering the world