

Kvinnerstaprojektet, RME  
Örebro den 9 juni 1993

## **Project final report**

### Introduction

In March 1992, was a first contact with the principal, Bo Holmström, at Kvinnersta School to discuss the conditions for a transesterification plant at farm level.

The interest of such a facility was very large, so a rough plan of the project began. Schematic diagram of a farm system was developed and funding possibilities of the project were investigated. Both the County Council as Örebro County Administrative Board has made funds available for the project.

### Summarizing

A first series of five 25 liter cans were prepared to verify the cold process. Analysis of the products was made continuously to ensure reaction course and quality. Thereafter made different series with varying amounts of chemical compounds to access the critical reaction parameters.

In June began reconstruction of the production hall and installation of explosion protected electrical equipment. Process vessels, pumps and filters were installed in August and September.

In late September, the first large-scale transesterification started. In the following months made some changes and development of the process.

On November 14 an interim report of the project was held at the County Council's Environmental Commissioner situated ca. 20 km from Kvinnersta school and that one of the tractors from the school were on display and had the tank filled only with self-produced methyl ester.

No operating disruptions.

On December 3, made exhaust analysis and power measurements on a Valmet tractor, a project work by Lars Edwartz from Katrineholm Technical College. Appendix 1.

During January and February arose malfunctions that was remedied in March.

On February 4, makes Farmers Health boundary-value measurements in the process building. Appendix 2.

In February inspects Fire Brigade process locale and Explosive Inspection examines and categorizes the factory.

Development of textbooks and other documents required to produce rapeseed methyl ester at the farm level were taken.

In March, started the first course for 16 farmers. Representatives from the Agricultural Health Service, Fire Brigade, Rudbecks school and Kvinnersta school were responsible for its contents.

In April and May RME produced in such quantities that two Valmet tractors could be used in the planting season beyond a loading machine.

To reduce the methanol costs built a room for methanol tank, a reaction vessel was modified and the final design of the mixing vessel was installed in the processing room.

The costs for the production of biodiesel according to the Cold Process from small laboratory to full-scale experiments are given in Appendix 3.

## Final Result

With these changes, the plant is ready to produce rapeseed methyl ester at farm level with better quality than the rapeseed methyl ester analyzed in Germany, 1985.

Together with the financial report may constitute final document the Kvinnersta project: Rapeseed methyl ester. Appendix 4

## Signatures

~~Ulf Skoog~~ ~~Carl-Johan Lindquist~~

Ulf Skoog

Carl-Johan Lindquist

## Appendix 1.

Comparative measurements on exhaust emissions from fossil fuel (MK1) and two biodiesel fuels prepared according the Cold Process, namely Lin methyl ester (LME) and rapeseed methyl ester (RME), made by the Valmet tractor at Kvinnersta School in Örebro, gave the following results.

**Tabell 1.**

	<b>NO<sub>x</sub></b> ppm	<b>CO</b> ppm	<b>O<sub>2</sub></b> ppm	<b>CO<sub>2</sub></b> ppm	<b>η</b> %
<b>Diesel</b>					
No load	327	<b>385</b>	18,3	<b>1,9</b>	69,4
67 hk	1085	1110	10,5	<b>7,5</b>	64,5
<b>LME</b>			18,1		
No load	<b>153</b>	1060	<b>18,1</b>	2,1	<b>78,6</b>
60 hk	<b>950</b>	980	<b>8,9</b>	8,9	75,0
<b>RME</b>					
No load	188	600	18,3	2,0	72,4
60 hk	1120	<b>560</b>	9,4	8,5	<b>77,8</b>
Diagram:	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>

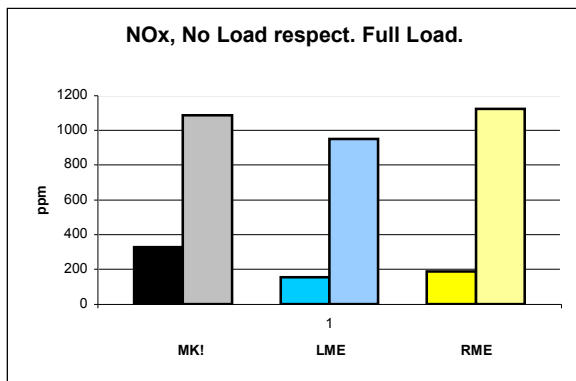


Diagram: 1

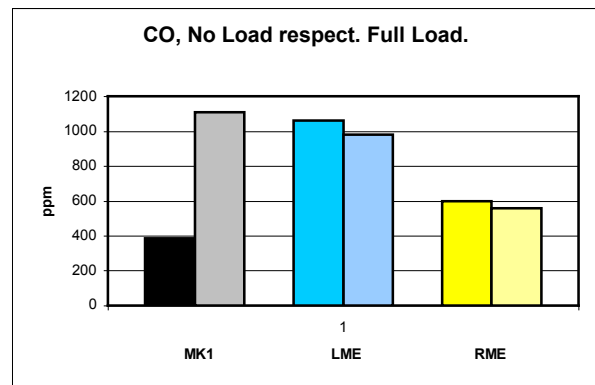


Diagram: 2

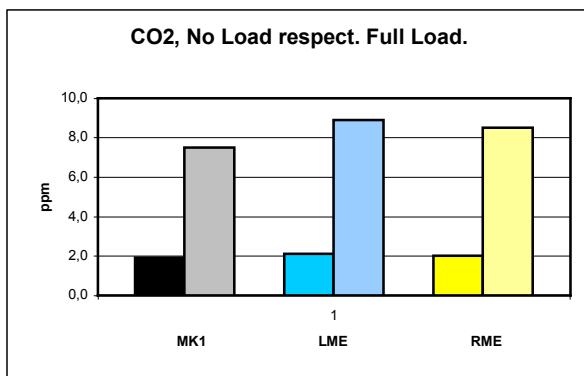


Diagram: 3

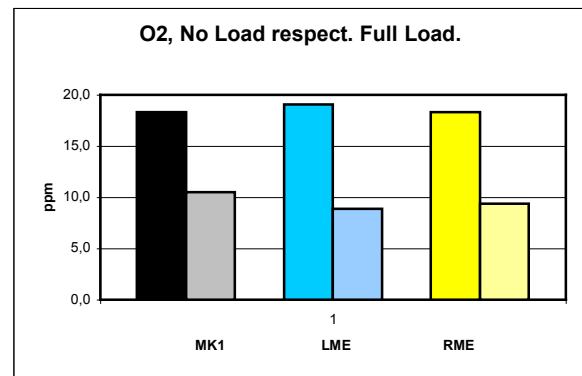


Diagram: 4

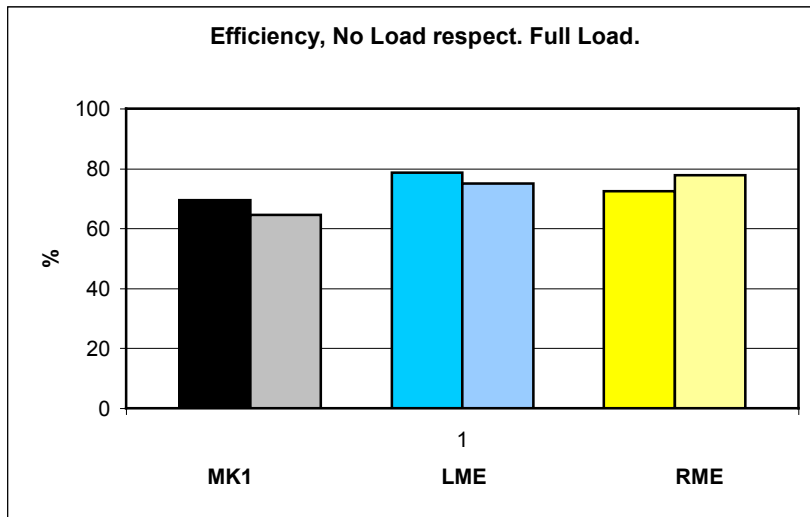


Diagram: 5

The test tractor was a Valmet tractor trimmed and adjusted for optimum functioning on the fossil diesel fuel MK1.

No changes were made to the Valmet tractor before or during the test. The test results therefore benefits MK1 fuel and disadvantages the Biofuels, such as LME and RME.

In spite of the unfavorable conditions for these Biofuels, the efficiency still increased no less than 13 % at No Load test and by 20% at Full Load test.

## Appendix 2.

February 4, 1993

### METHANOL MEASUREMENT

Measurements were made in the process room for the production of biodiesel according to the Cold Process.

Results of methanol measurements were performed at Kvinnersta School of safety engineer Lennart Bergius, Forestry and Agriculture Health Centre, Örebro, 93 02 04.

Measuring equipment: Drägerpump + reagent tubes.

· At the closed-end management	50-100 ppm
· In open reactor vessel	400 ppm
· Current level limit is	200 ppm
· Room temperature	15 C
· Air exchange	2 times / hour
· Carbon dioxide level	500 ppm

~~Lennart Bergius~~

Lennart Bergius  
Skyddsingenjör

Forestry and Agriculture Health Centre.

Boställsvägen 4  
70227Örebro

Phone Number  
019-211160

Fax  
019-272427

Bank  
395-8062

Post  
92 20 87-2

## Appendix 3

### Rapeseed Methyl Ester 92-03-03

Costs for the purchase of raw materials for the production of one liter of Rapeseed Methyl Ester.

	Egna försök 0,1 liter	Kvinnersta 5-25 liter	Kvinnersta 1500 liter
Cold-pressed canola oil	3,80	2,80	2,20
Methanol	5,00	2,50	1,50
Catalyst	1,00	1,00	0,80
<b>Total:</b>	<b>9,80</b>	<b>6,30</b>	<b>4,50</b>

## Appendix 4.

### Estimate for Kvinnersta project: "Methyl Ester Production"

#### Costs:

Two people for ten months,

2 x 20' x 1,38 552'

Insurance, 2'

Travel and Subsistence, 25'

Material costs, 110'

Cold pressed oil, 20 m3 56'

Methanol, 4 m3 50'

Catalyst, 20'

Patent Costs, 120'

Översätt från: 935'

#### Revenues:

Sale of ester. All biofuel consumed in the project, 0'

Residual Value 110'

After consumption and depreciation, 45'

**Total: 45'**

~~Carl Johan Lindquist~~

Carl-Johan Lindquist  
**Björkliden 5**  
**703 58 Örebro**  
**Tel.: 019-188046**