



**RAN**  
GROUP

# Your MTBE Expert

MTBE/ETBE/TAME Technology and Turn-Key Solutions

Refining

Gas Processing

Petrochemicals

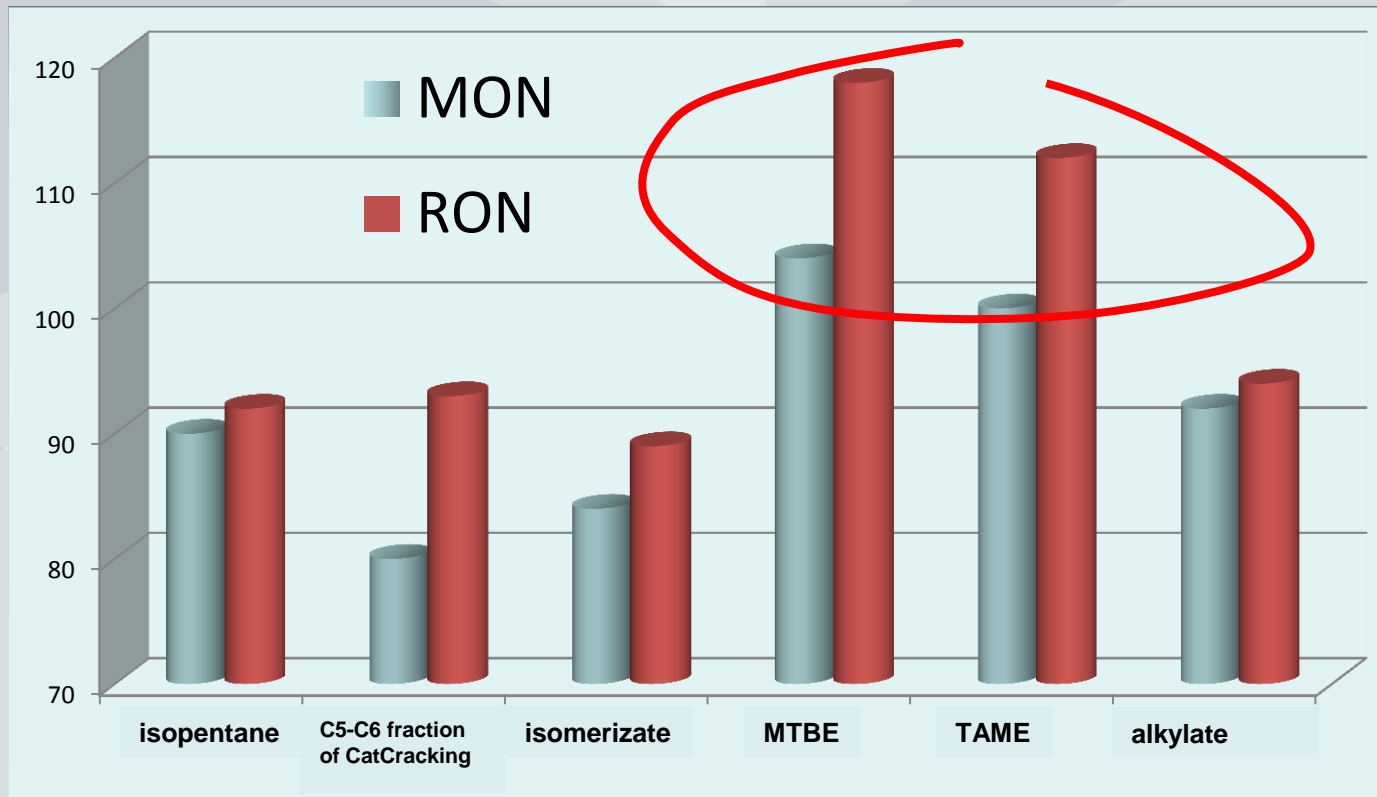
Gas Chemicals

2016

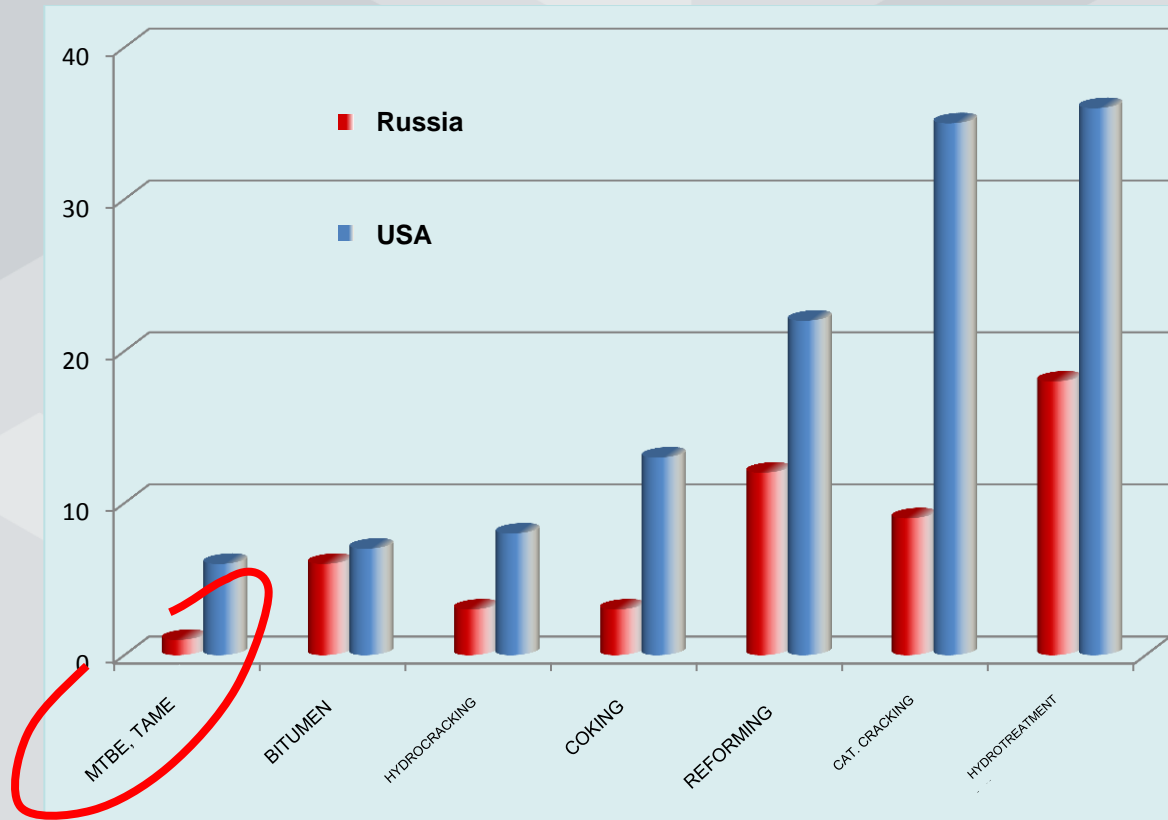
# **RUSSIAN TECHNOLOGY FOR PRODUCTION OF MTBE / ETBE / TAME**

**Technology for Oxymethylation of Isopentenes  
in *Reactor-Rectifier***

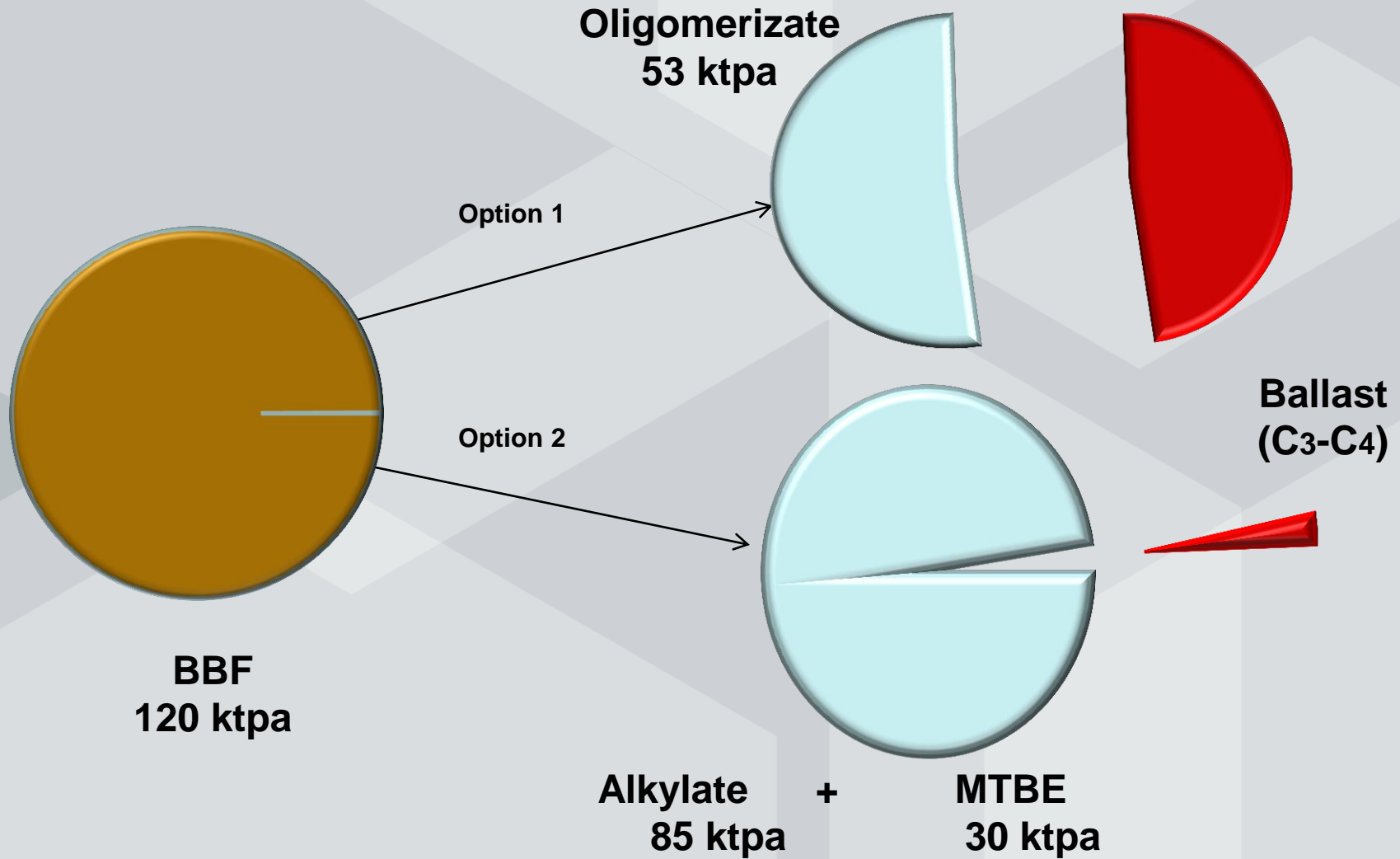
## ANTIKNOCK PROPERTIES OF GASOLINE COMPONENTS



## RELATIVE SHARES OF SECONDARY PROCESSES







**OCTANE-TON PARAMETER  
 COMPARISON TABLE**

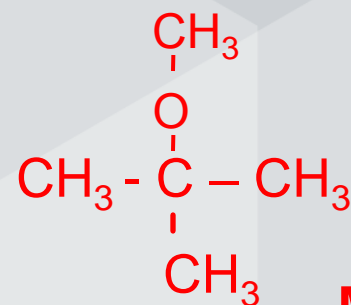
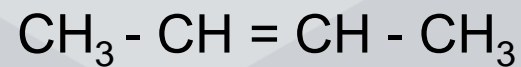
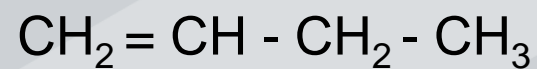
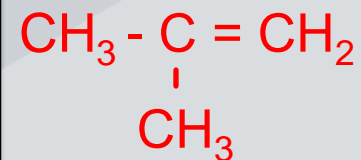
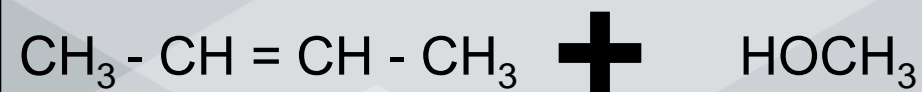
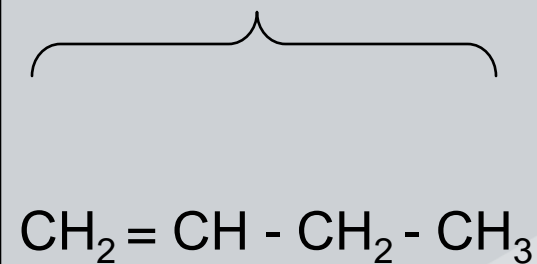
	Component	Volume, ktpa	RON	MON	(RON+M ON)/2	Octane-ton, thousand per year
1.	Alkylate	85,2	95	93	94	8000
	MTBE	29,8	117	101	109	3260
		<b>115</b>				<b>11 260</b>
2.	Oligomerizate	<b>52</b>	97	85	91	<b>4 420</b>

**COMPOSITION OF NAPHTA from 240 ktpa CAT-CRACKER (fraction C5-C6)**

Component	Contents, % mass	Volume, ktpa
SC4	12	28,8
C5 paraffin	37	88,8
<b>C5 isopentenes</b>	<b>20</b>	<b>48,0</b>
C5 other olefins	15	36,0
C6+	14,5	34,8
C6 isohexenes	1,5	3,6
Total:	100	240

**BUTYLENES**

**METHANOL**



**MTBE**

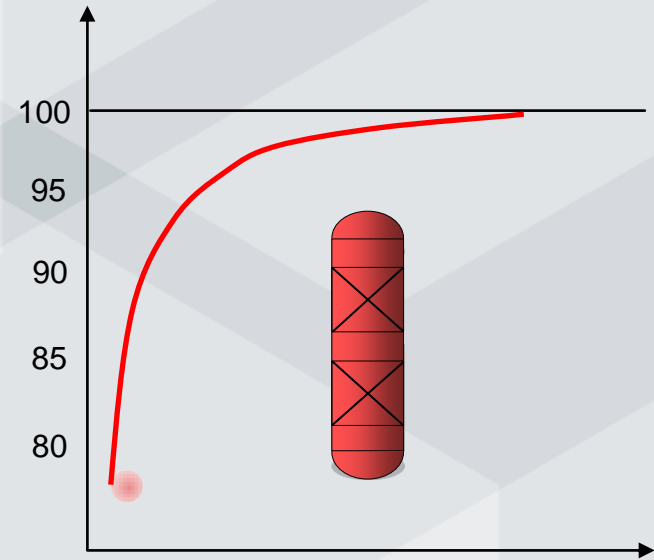
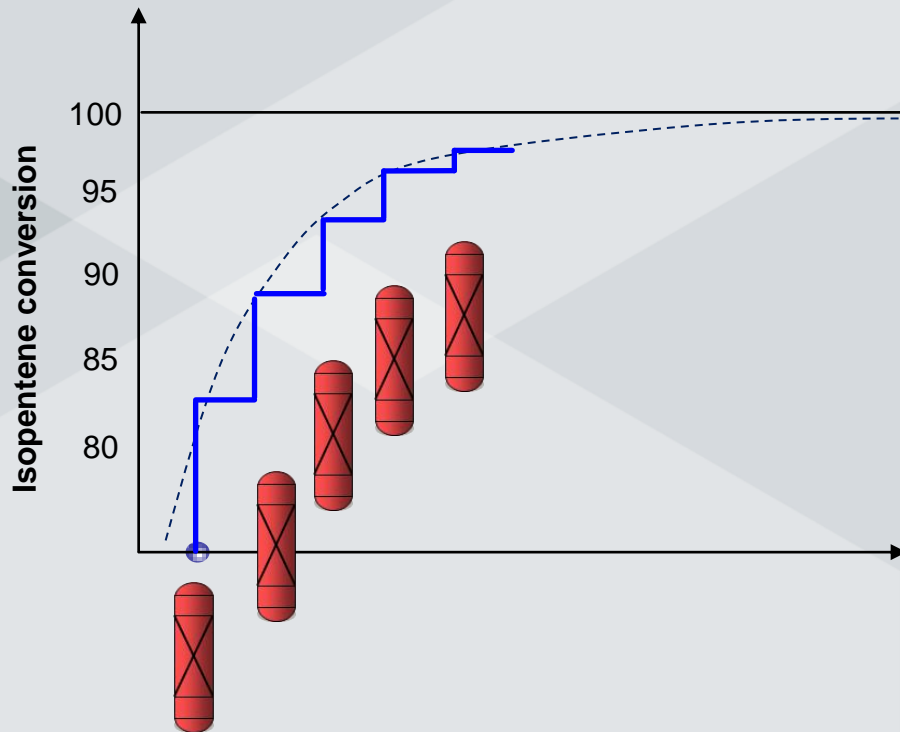
## **MTBE**

- ❑ Individual compound, contents over 95% of target product.
- ❑ Contents no aromatics, unsaturated hydrocarbons, sulfur, plumb, ferrum, manganese.
- ❑ RON 118-120.
- ❑ Chemically-stable; perfectly meets target gasoline characteristics.



## Reactors Flowline

100% conversion = infinite number of reactors  
with intermediate distillation

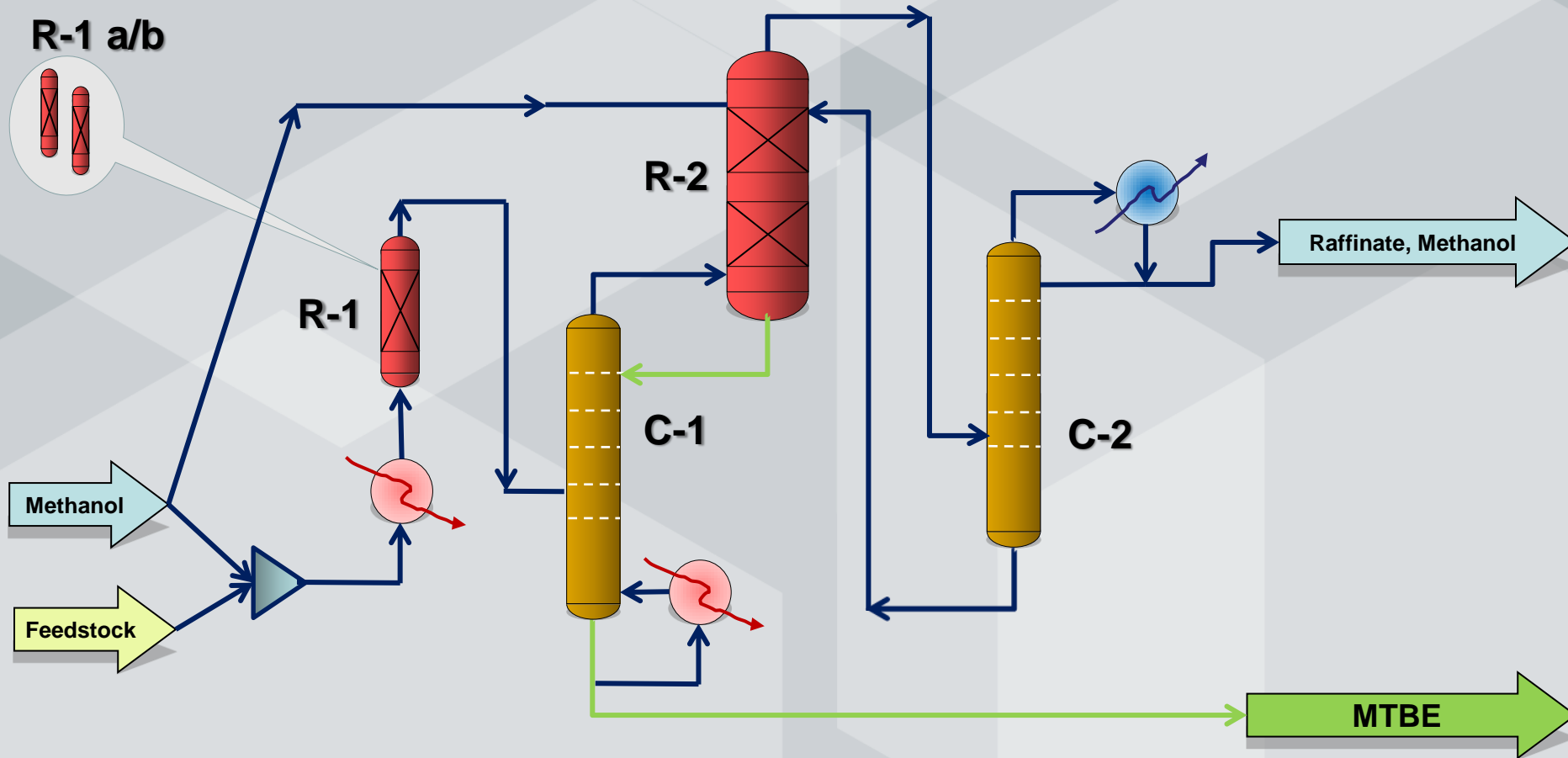
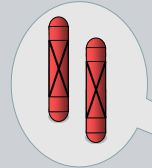


## Reactor-Rectifier

100% conversion = 1 vessel

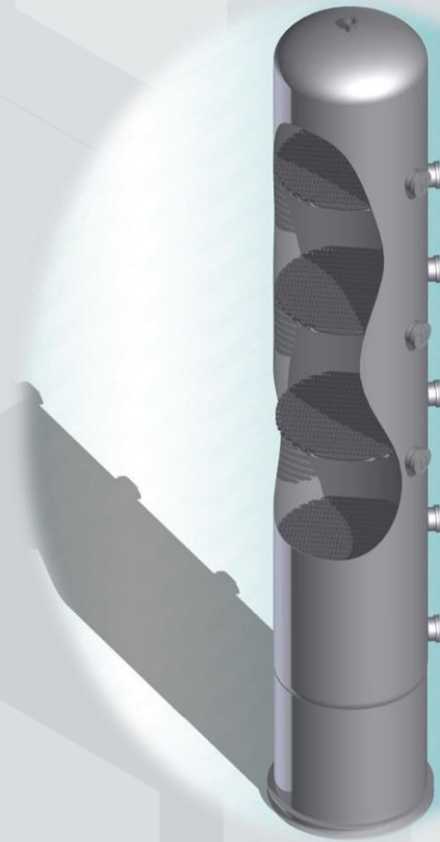
## REACTOR-RECTIFIER UNIT FOR MTBE PRODUCTION

R-1 a/b



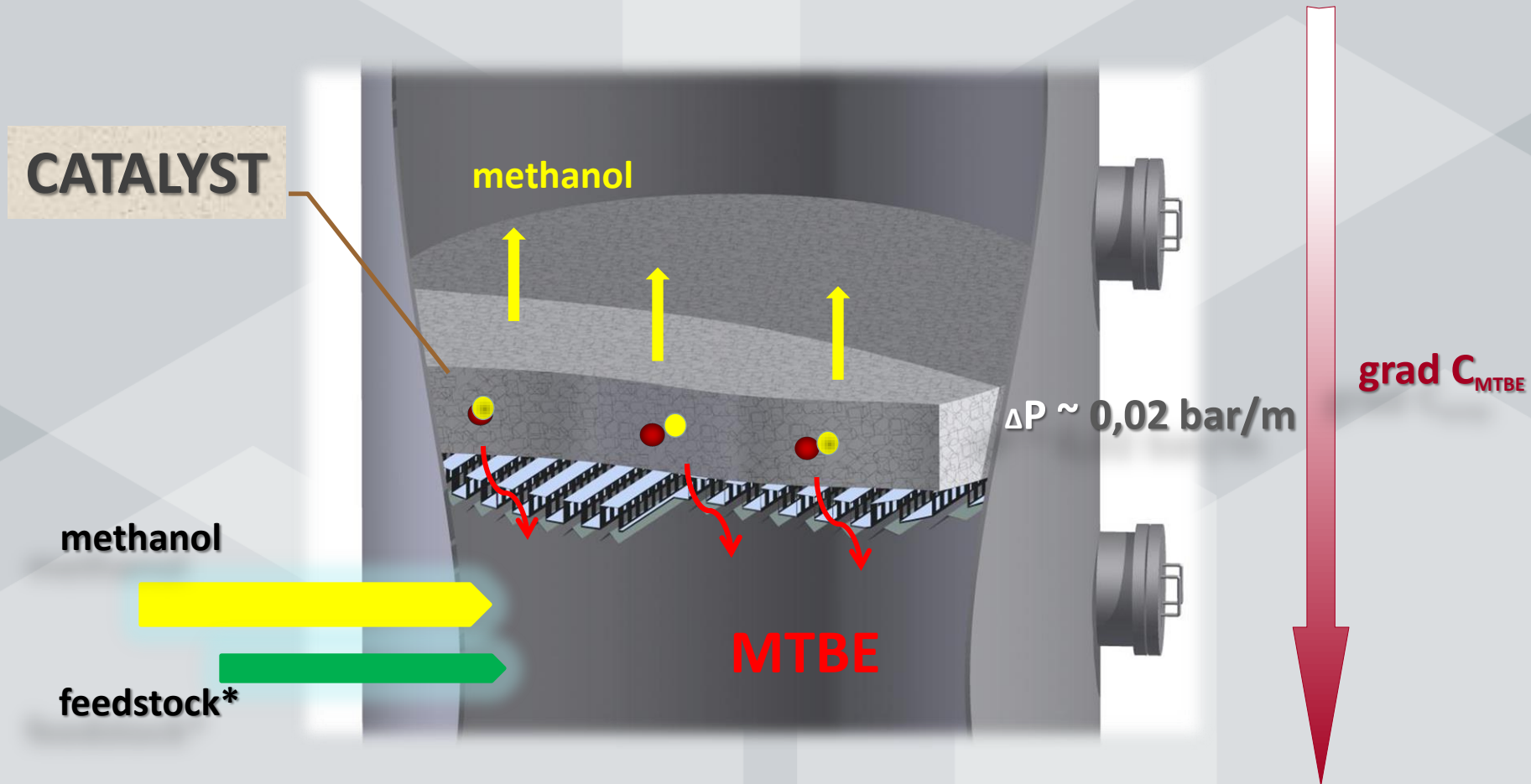
## REACTOR-RECTIFIER FEATURES

- Weight
- Volume of Catalyst
- Operational Pressure
- Linear Velocity
- Volume Velocity
- Operational Temperature
- Capacity



- 80 ton
- 170 cbm
- 4 bar
- 0,08 m/s
- 0,35 h<sup>-1</sup>
- 65 °C
- 200 tpd

# OPERATION PRINCIPLE REACTOR-RECTIFIER



\* ballast hydrocarbons are not shown

**Large-Granule  
Catalyst**

**3,4 mg-eqv./g**



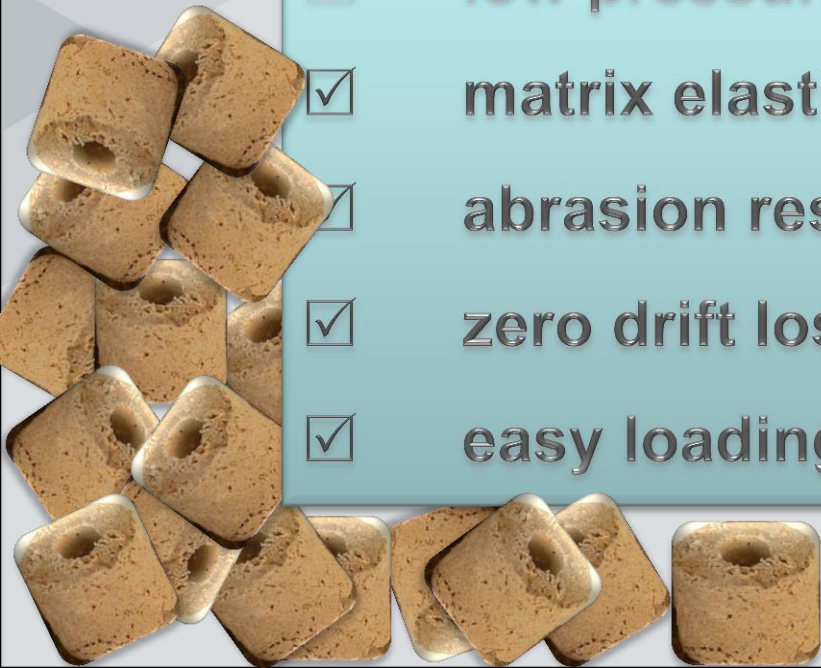
**3,8 mg-eqv./g**

**Standard  
Catalyst**



## **ADVANTAGES** of large-scale granulated catalyst system

- high catalytic reactivity**
- low pressure drop in the layer**
- matrix elasticity**
- abrasion resistance**
- zero drift loss**
- easy loading and off-loading**



## Typical requirements to feedstock impurities

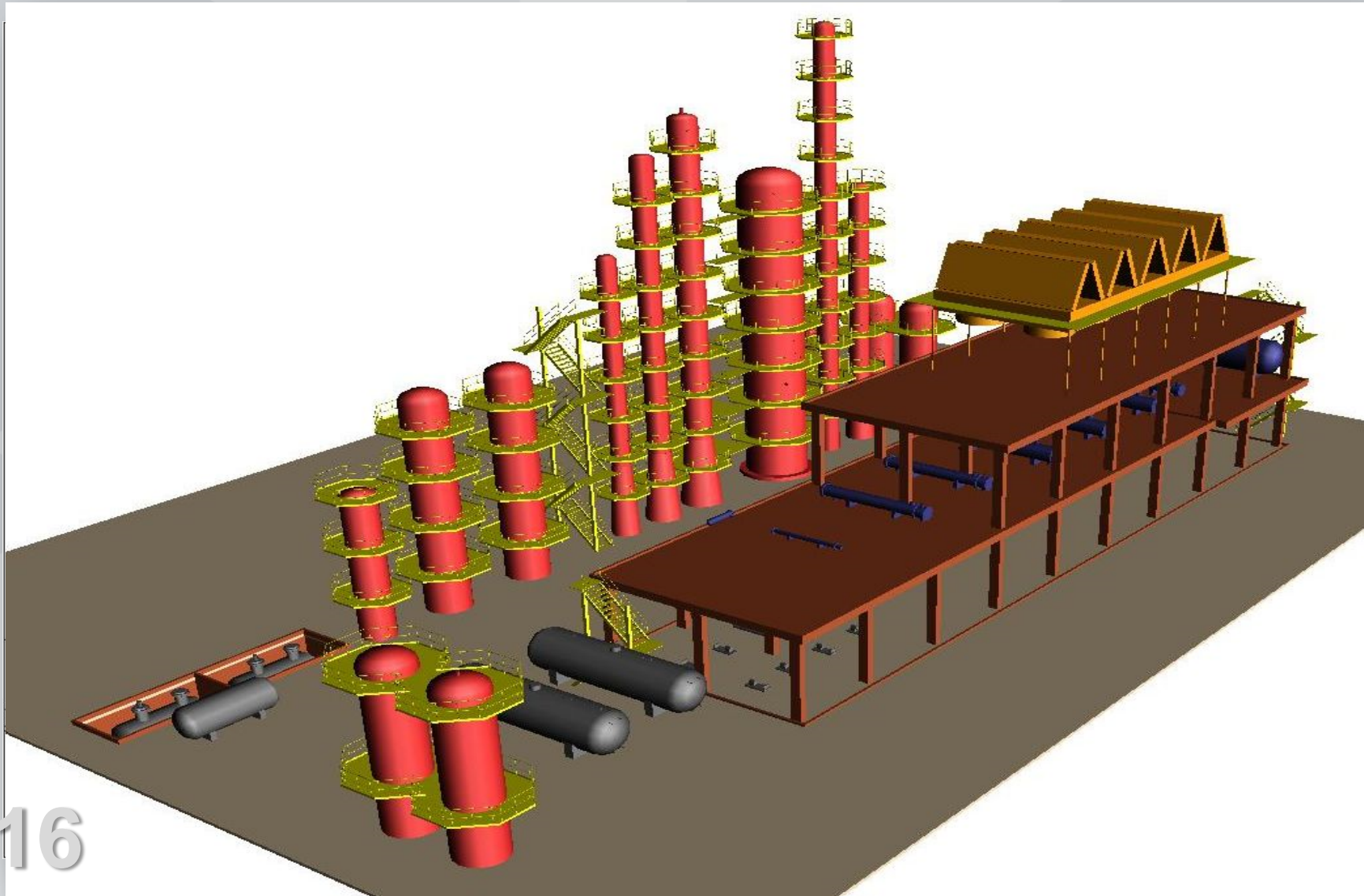
Component / Impurity	Influence	RAN Group	Other Licensors
<b>Water</b>	inhibitor	<b>400 ppm</b>	<b>15 ppm</b>
<b>Dienes</b>		<b>5000 ppm</b>	<b>1000 ppm</b>
<b>Sulfur</b>	inhibitor	<b>20 ppm</b>	<b>20 ppm</b>
<b>Mercaptans</b>	inhibitor	no requirements	<b>5 ppm</b>
<b>Total Nitrogen</b>		no requirements	<b>5 ppm</b>
<b>Main Nitrogen</b>	permanent catalyst poison	<b>5 ppm</b>	<b>1 ppm</b>
<b>Caustic</b>	permanent catalyst poison	<b>1 ppm</b>	<b>0,1 ppm</b>
<b>Resins</b>	permanent catalyst poison	no requirements	<b>35 ppm</b>
<b>Heavy Metals</b>	permanent catalyst poison	no requirements	<b>10 ppm</b>

# TECHNOLOGY OF MTBE PRODUCTION IN REACTOR-RECTIFIER

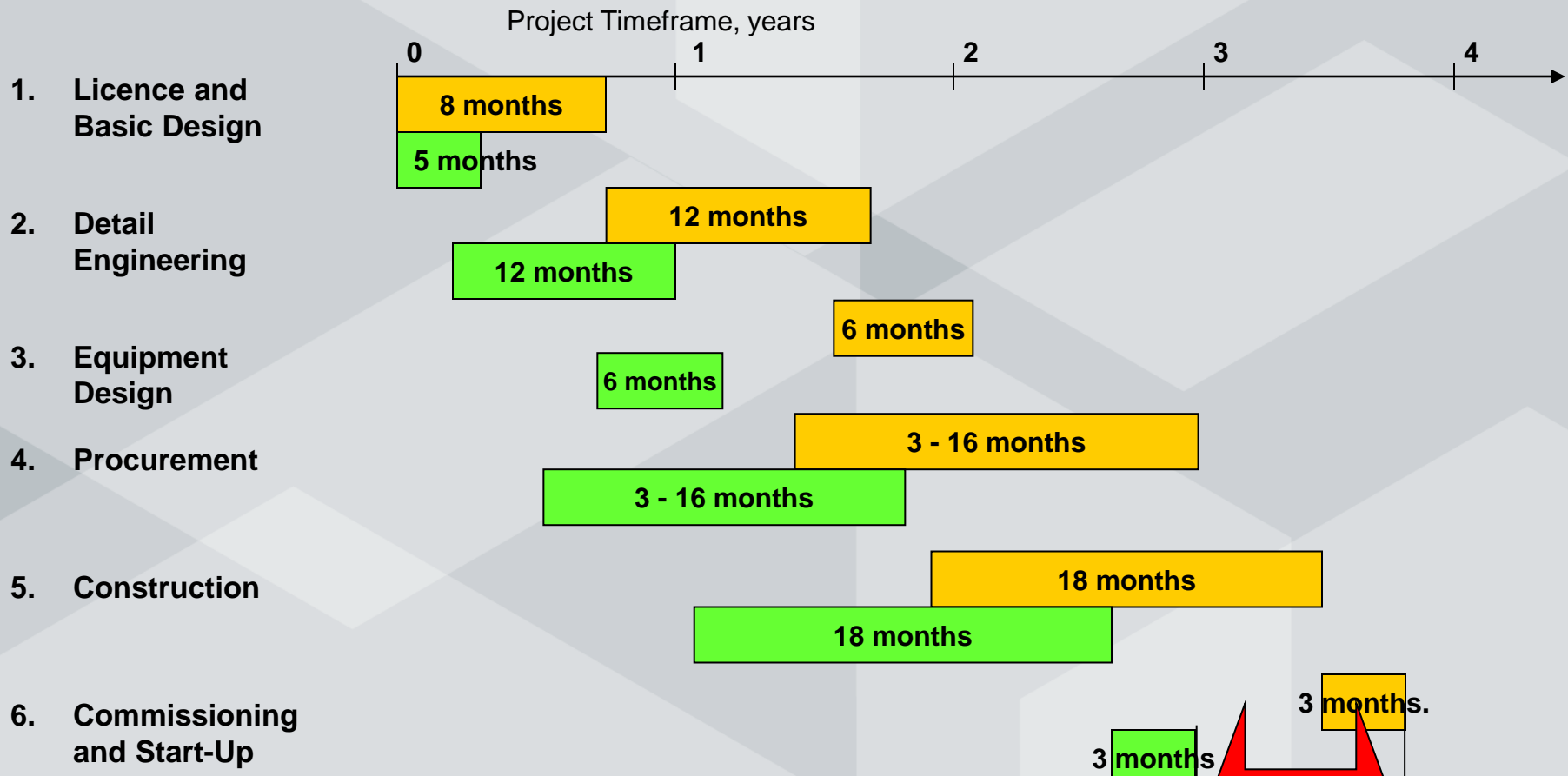


- ❑ **98% olefin conversion**
- ❑ **standalone commercial product**
- ❑ **2-way feedstock operability:  
isobutylene or isoamylene**
- ❑ **low sensitivity to impurities in  
feedstock**
- ❑ **simplicity and reliability of production  
unit**
- ❑ **easy maintenance and servicing**

**Industrial Experience since 1989**



	<b>RAN Group</b>	<b>Other Licensors</b>
<b><i>Operation Details</i></b>		
Operational Temperature max, °C	<b>70</b>	<b>85</b>
Operational Pressure max, bar	<b>12</b>	<b>16</b>
Guaranteed Conversion, %	<b>98,5</b>	<b>88-90</b>
MTBE content in final product, %	<b>95</b>	<b>90</b>
Volume of Catalyst, m <sup>3</sup>	<b>230</b>	<b>200</b>
<b><i>Consumption</i></b>		
Steam, ton / hr	<b>19</b>	<b>22</b>
Cooling water, m <sup>3</sup> / hr	<b>100</b>	<b>120</b>
Fusel water, m <sup>3</sup> / hr	<b>5</b>	<b>5</b>
Power consumption, kW	<b>240</b>	<b>200</b>



Detailed Consturcion plan is developed in Microsoft Office Project and can be adopted according to Customer needs

**Time Savings**  
0.7 - 1 year

- ❑ **Successful Operations of RAN Group licensed MTBE units since 1989**
- ❑ **Our catalyst shows extra performance comparing with other Licensors' catalyst**
- ❑ **Conversion up to 98.5%; Selectivity 97%.**
- ❑ **OPEX and maintainability are better than other technologies which can be found in the market**
- ❑ **We offer turn-key MTBE solution on EPC basis which can reduce project timeframe by 12 months**

Client	Capacity, ktpa	Feedstock	Products	Scope of Work
Mazeikiu Nafta, Lithuania	MTBE - 40, HOEC* - 200	Cat-Cracking	MTBE, ETBE, HOEC	License, Basic Design, Supervision
Omsk Refinery, Gazprom Neft	MTBE - 35	Cat-Cracking	MTBE	License, Basic Design, Supervision
EcoOil Omsk	MTBE - up to 150	Pyrolysis / Isobutane Dehydration	MTBE, ETBE	License, Basic Design, Supervision
Ufa Refinery, Bashneft	MTBE - 35, HOEC - 100	Cat-Cracking	MTBE, HOEC	License, Basic Design, Supervision
KoriMos, Moscow	MTBE - 25, TAME - 30	Cat-Cracking	TAME, MTBE	License, Basic Design, Supervision
Siburhimprom	MTBE - 25	Pyrolysis	MTBE	License, Basic Design, Supervision
Tobolsk Petrochemical, Sibur	MTBE - 100	Isobutane Dehydration	MTBE	License, Basic Design, Supervision
Nizhnekamsk Petrochemical	MTBE - 40	Pyrolysis / Isobutane Dehydration	MTBE	License, Basic Design, Supervision
LINOS Refinery, Ukraine	MTBE - 35, HOEC - 100	Cat-Cracking	MTBE, HOEC	License, Basic Design, Supervision
YANOS Refinery, Slavneft	MTBE - 52	Cat-Cracking	MTBE	License, Basic Design, FEED, permitting, DE, procurement, Cm, supervision, commissioning
Petrotel-LUKOIL, Romania	MTBE - 23, TAME - 20	Cat-Cracking	TAME, MTBE	License, Basic Design, Supervision
SANORS, Novokuibyshevsk	TAME - 300	Isopentane Dehydration	TAME	License, Basic Design, Supervision

\* - High-Octane Ether Component



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