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Il Dipartimento Incontra PROGEO

Stoccaggio di metano, il ruolo dei Gas Idrati

Dr. Simone Arca, Ph.D.
CEO
RDPOWER s.r.l.

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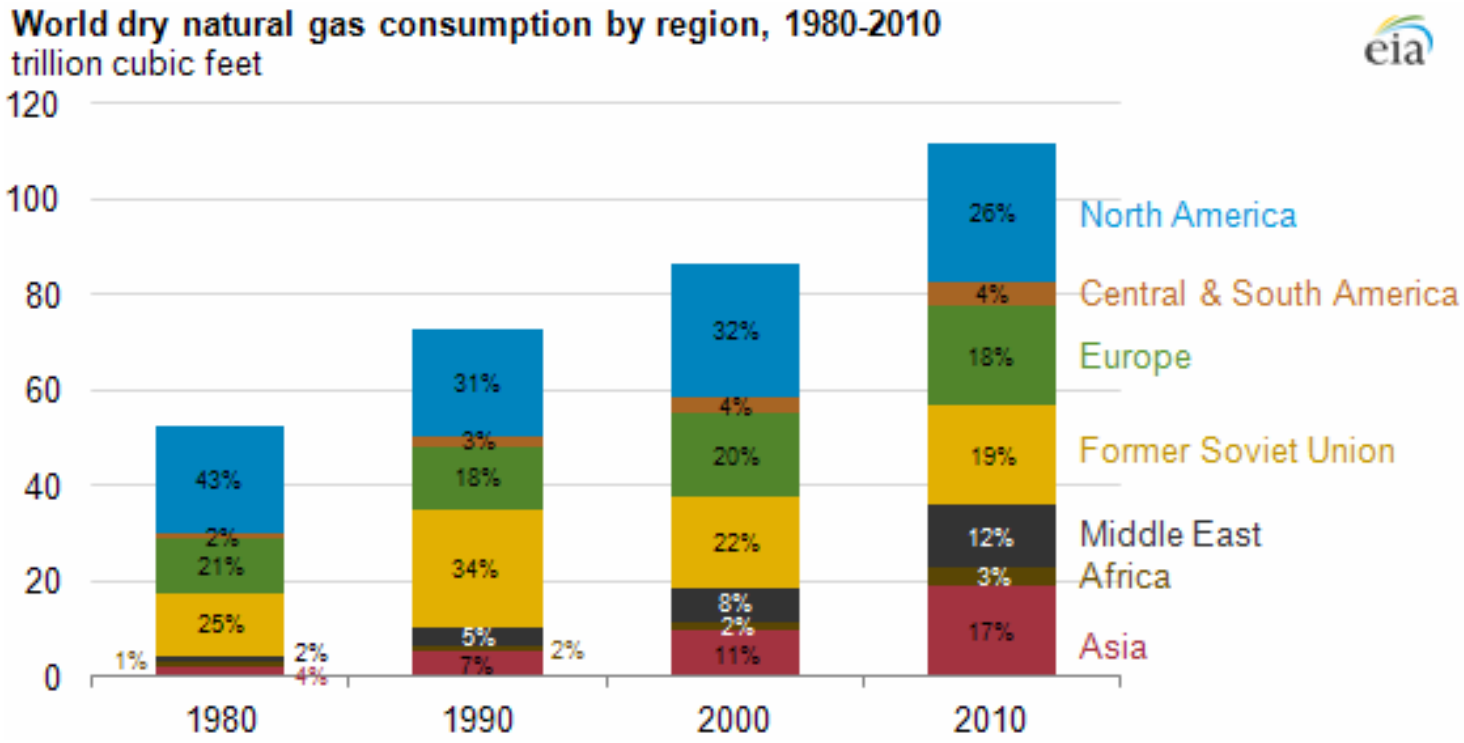
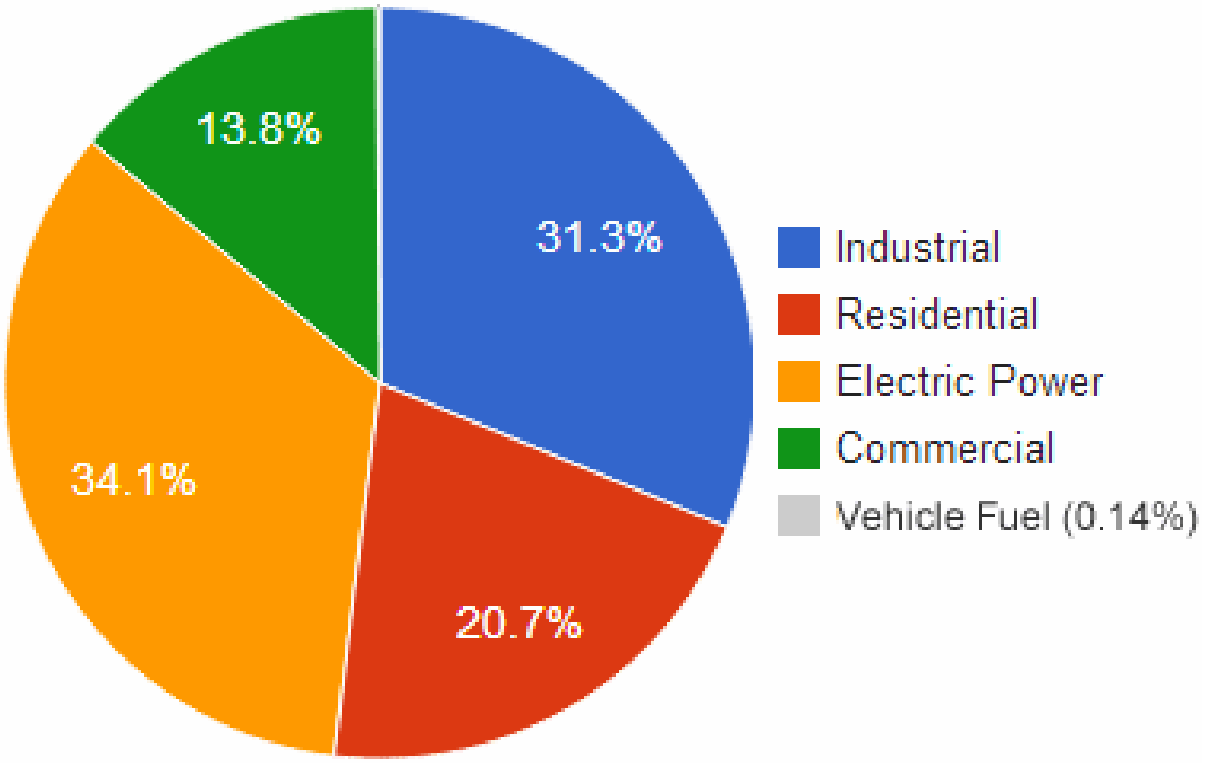
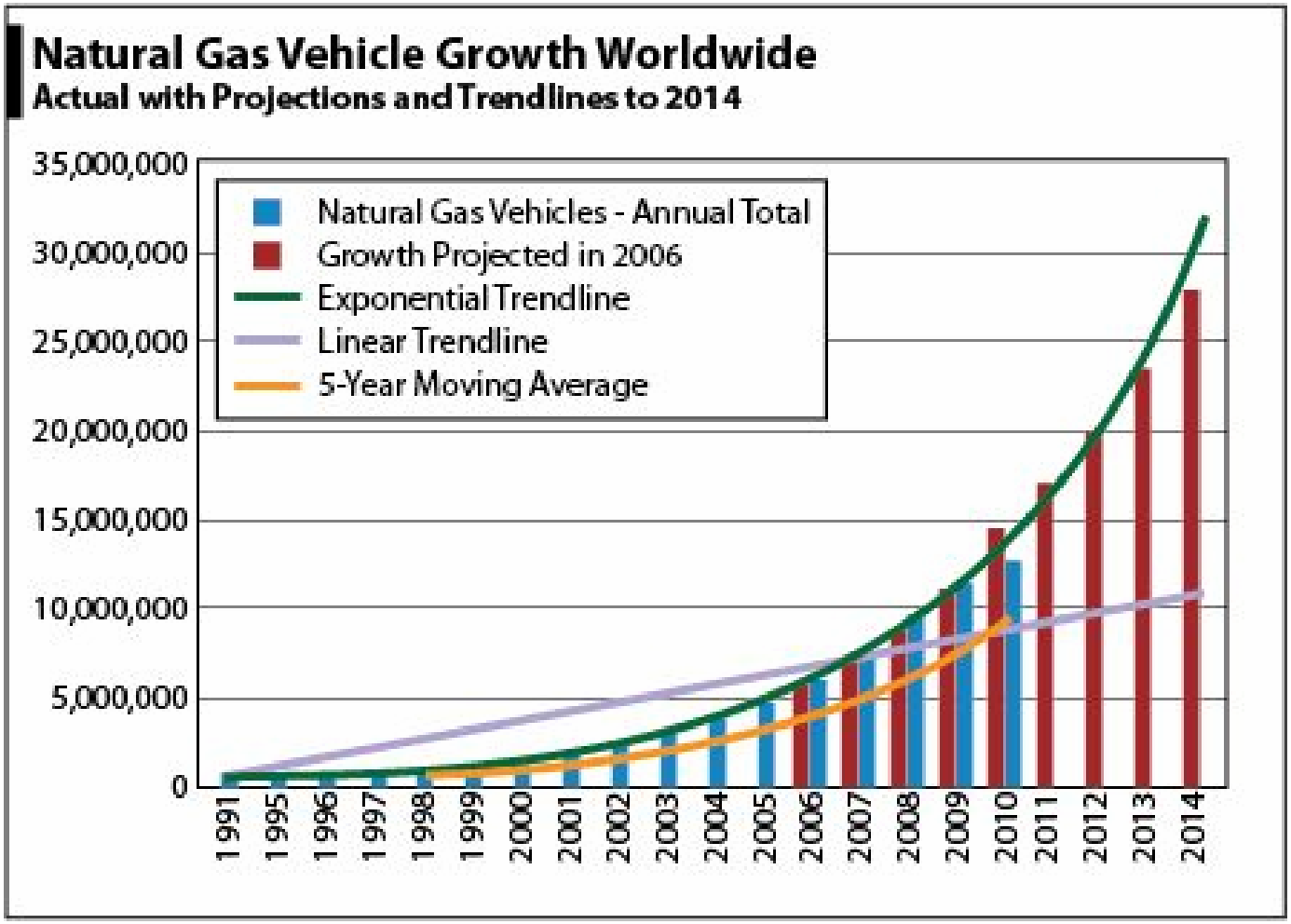
Il Consumo di METANO



Per TUTTI gli usi



Settore Automotive



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Ricarica Domestica

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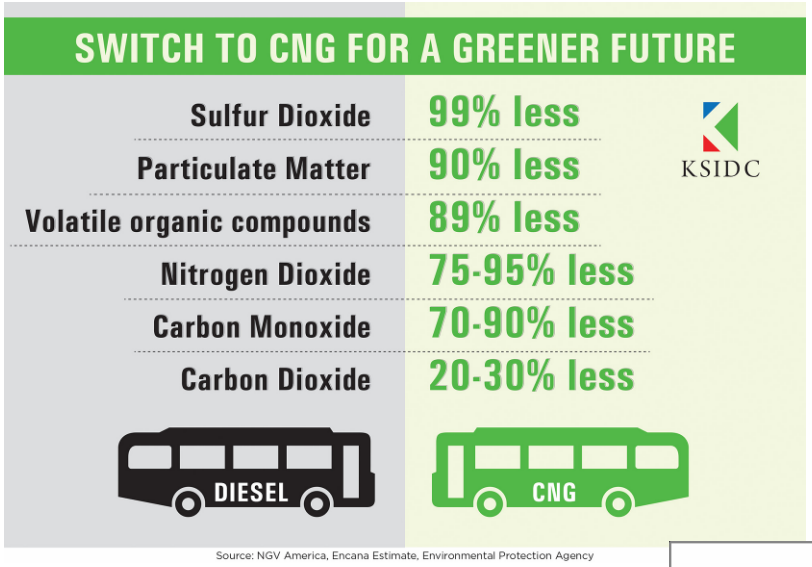
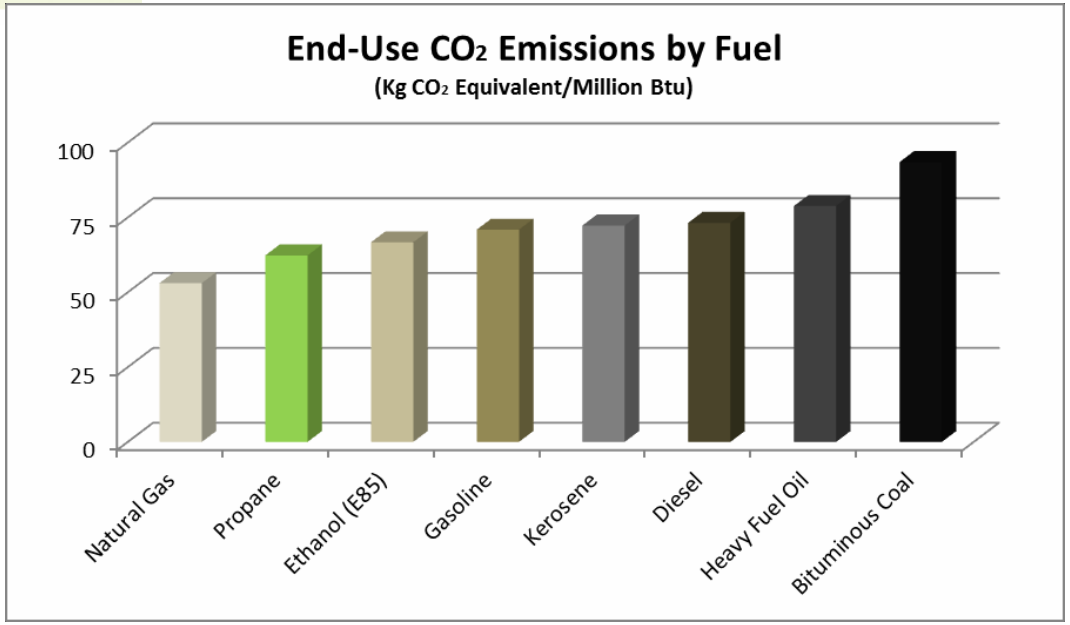
Impatto Ambientale





Metano Rinnovabile

Germania

Giugno 2014 - 151 Impianti di Biometano Connessi alla Rete Nazionale del Gas

Capacità Produttiva 93650 Nm^3/h di Biometano

Punta a coprire il 10% consumo nazionale di Metano entro il 2030

Italia

Leader Europeo indiscusso sui veicoli a Metano

Circolano più di 840000 veicoli a metano pari a circa il 2% del parco auto

Sono 8 volte di più di quelli circolanti in Germania

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Storage & Transport

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Su VASTA Scala

Su RIDOTTA Scala

I TARGET del DOE

US Advanced Research Project Agency-Energy (ARPA-E) US-DOE Methane Storage Target

2. CATEGORY 2: Sorbent Materials for Low Pressure Storage

PRIMARY TECHNICAL TARGETS

ID	Category	Value (Units)
2.1.1	Volumetric energy density	> 12.5 MJ/L (sorbent) > 9.2 MJ/L (inner tank)
2.1.2	Gravimetric energy density	> 0.5 $g_{CH4}/g_{sorbent}$ (sorbent) > 0.4 g_{CH4}/g (inner tank)
2.1.3	Cost of sorbent (credible route to)	< $10/kg

SECONDARY TECHNICAL TARGETS

ID	Category	Value (Units)
2.2.1	Specific desorption rates	> 2.6 kW/L (0.2 kg/h-L)
2.2.2	Lifetime	100 cycles
2.2.3	Desorption temperature	< 85 °C
2.2.4	Temperature tolerance	-40 °C to 85 °C
2.2.5	Impurity tolerance	Pipeline quality natural gas (C_2H_6,C_3H_8,CO_2,H_2O,S)
2.2.6	Safety requirements	Tolerant of abusive conditions and physical damage without catastrophic failure

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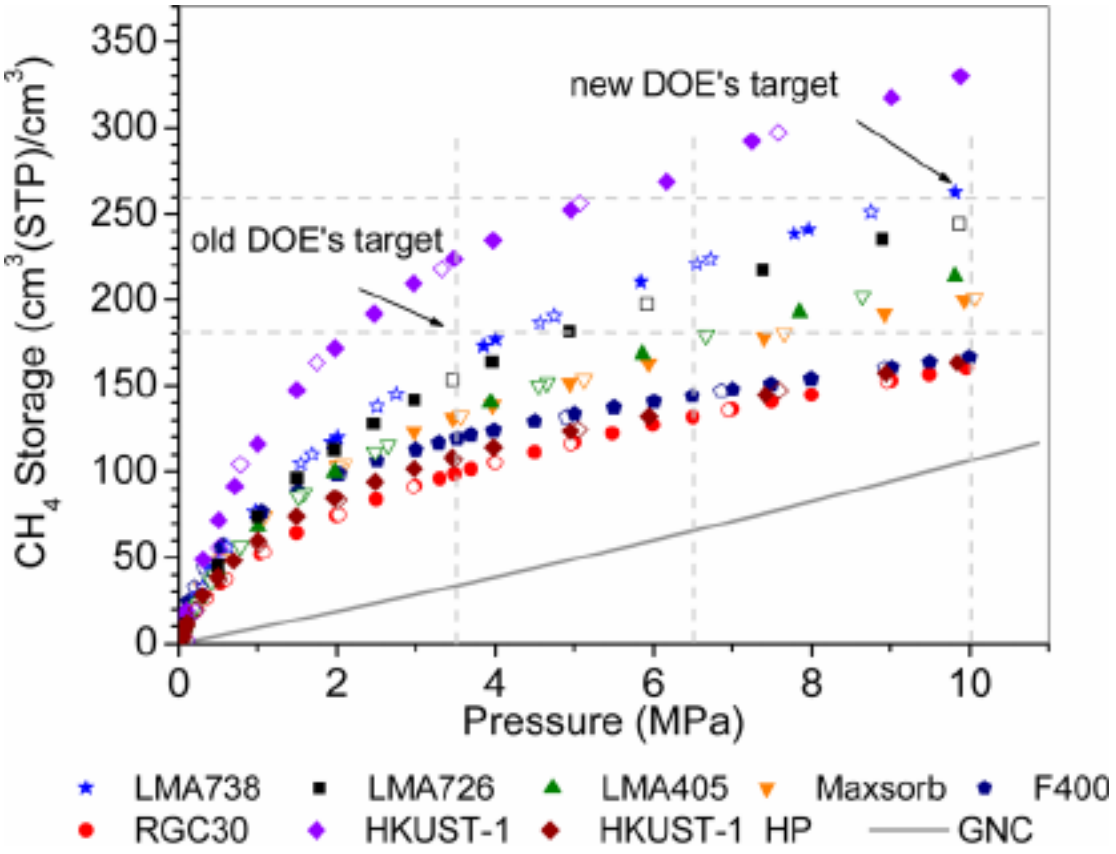
Sistemi Avanzati


new DOE's target
old DOE's target
CH4 Storage (cm3(STP)/cm3)
Pressure (MPa)
0
50
100
150
200
250
300
350
0
2
4
6
8
10
LMA738
LMA726
LMA405
Maxsorb
F400
RGC30
HKUST-1
HKUST-1 HP
GNC

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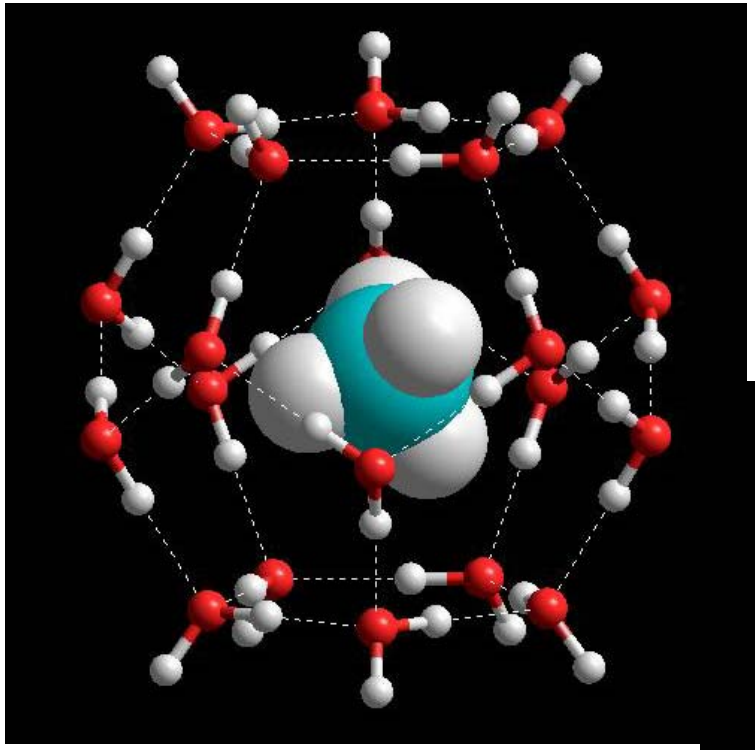
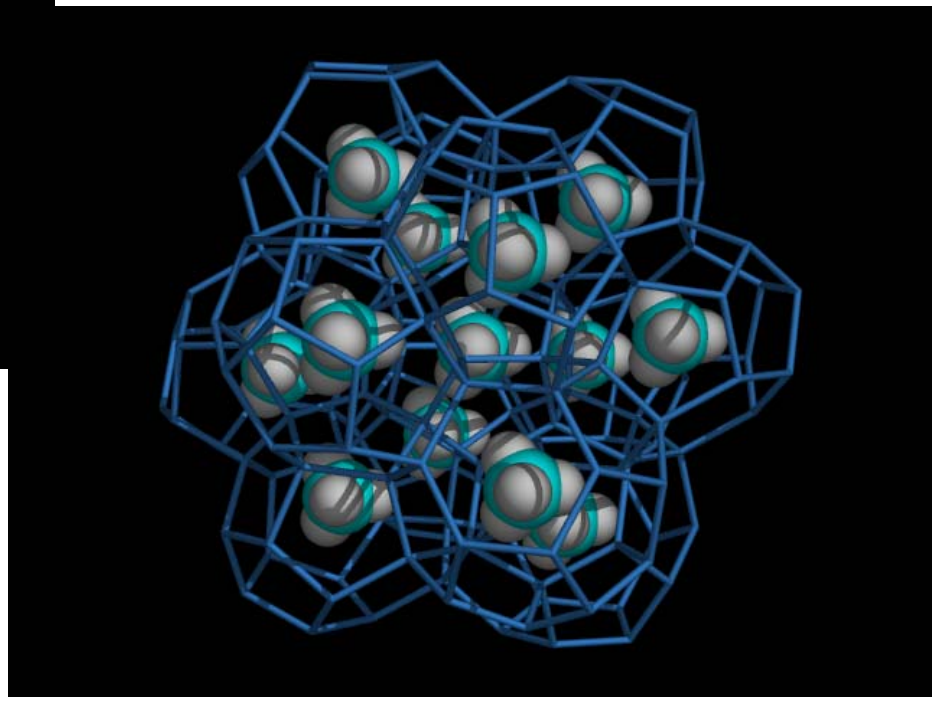
I Gas Idrati





Il Ghiaccio che Brucia

Giacimenti Naturali

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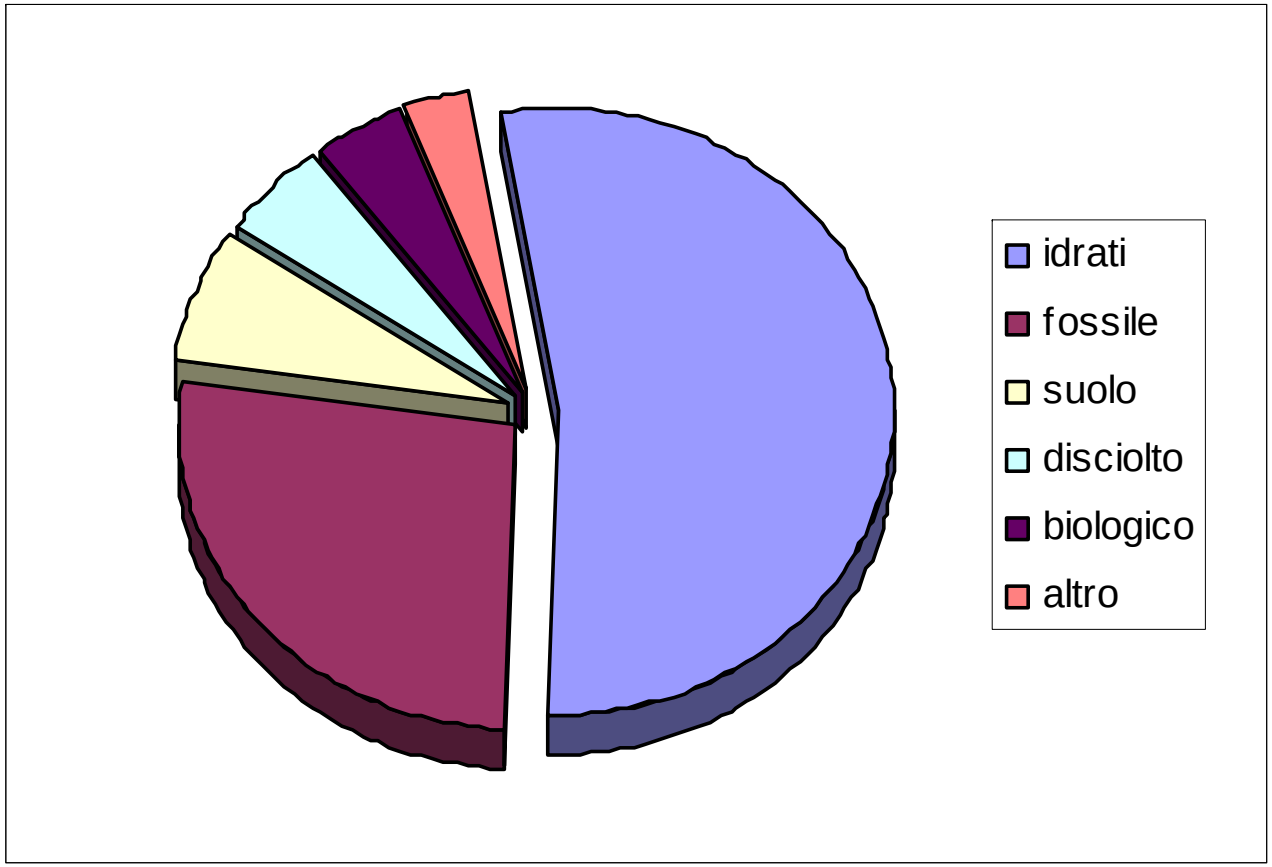
Nel Mondo

Le Quantità



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Un Problema nel Trasporto

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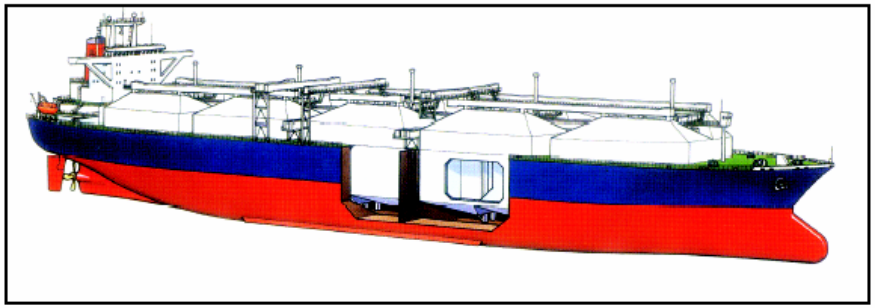
Tecnologia di Stoccaggio

15.5%wt ; 1/200 v/v ; 24% Più Economico ; Più Sicuro.

Da: Mitsui Engineering & Shipbuilding Co., Ltd.- MES



An impression of a possible ship specifically designed to carry natural gas hydrate (NGH) pellets at around -20°C and atmospheric pressure. Insulated holds would be inside a double-skin structure, and cargo capacity would be 155,000m³. A length of 300.00m is anticipated, with a breadth of 46.00m, and a draught of 13.5m. Speed would be a 17.00knots.

Metano Liquido: –162°C; 1Bar
Costo Energetico 57%
CO_2 Emessa 1,74 Kg/Kg_{CH4L}
Liquido: Pericoloso

Metano Idrato: –8°C; 1Bar
Costo Energetico 6%
CO_2 Emessa0.06 Kg/Kg_{CH4H}
Solido: Piu Sicuro ed Economico

Frozen Hydrate for Transport of Natural Gas
J.S. Gudmundsson and A. Børrehaug,
2nd International Conference on Natural Gas Hydrate, Toulouse, France, June 2-6, (1996)

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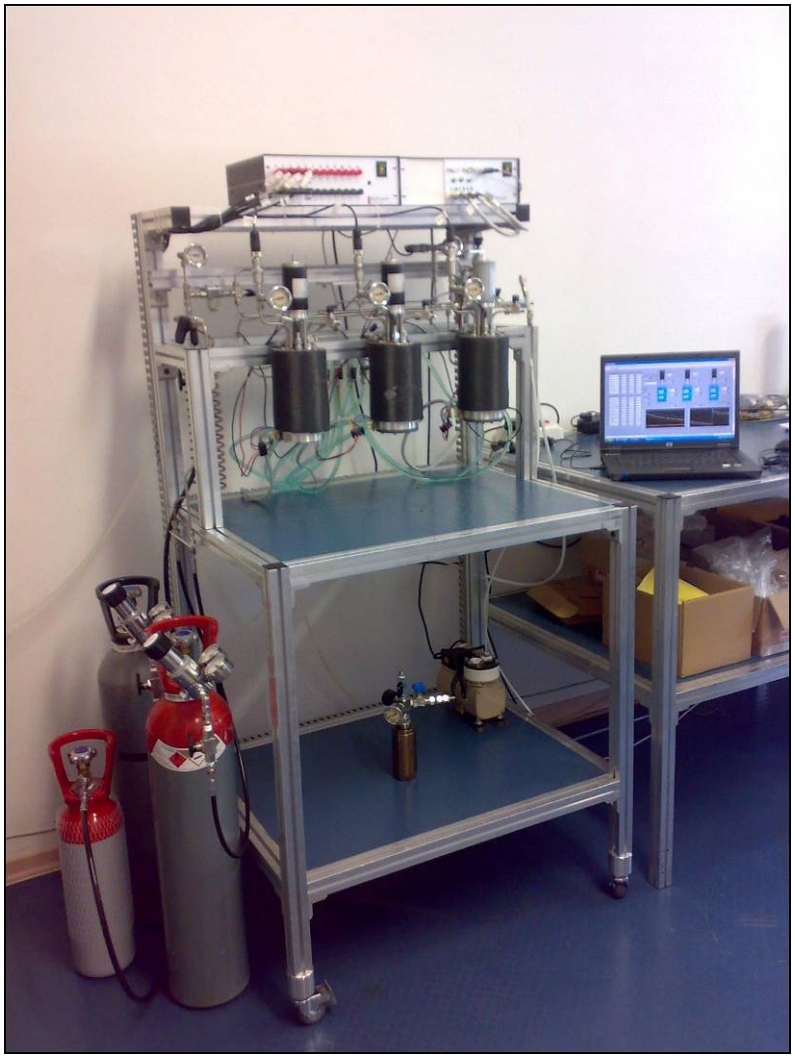
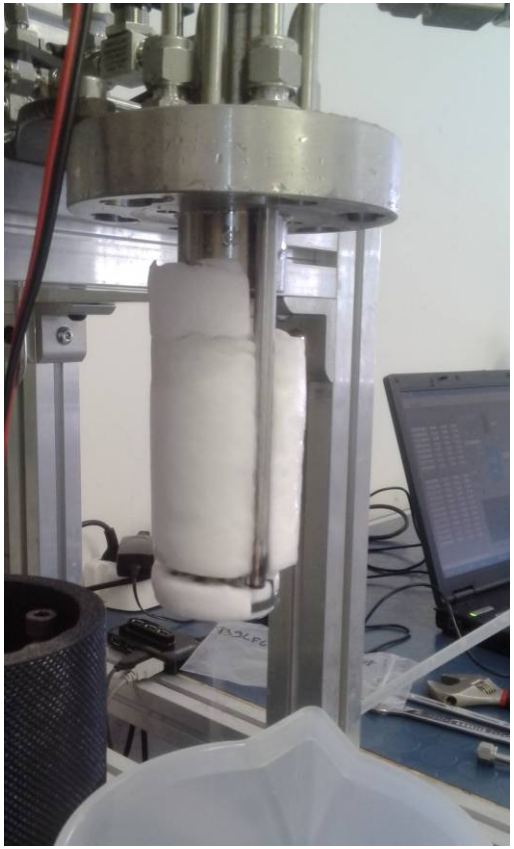
Le Nostre Attrezzature





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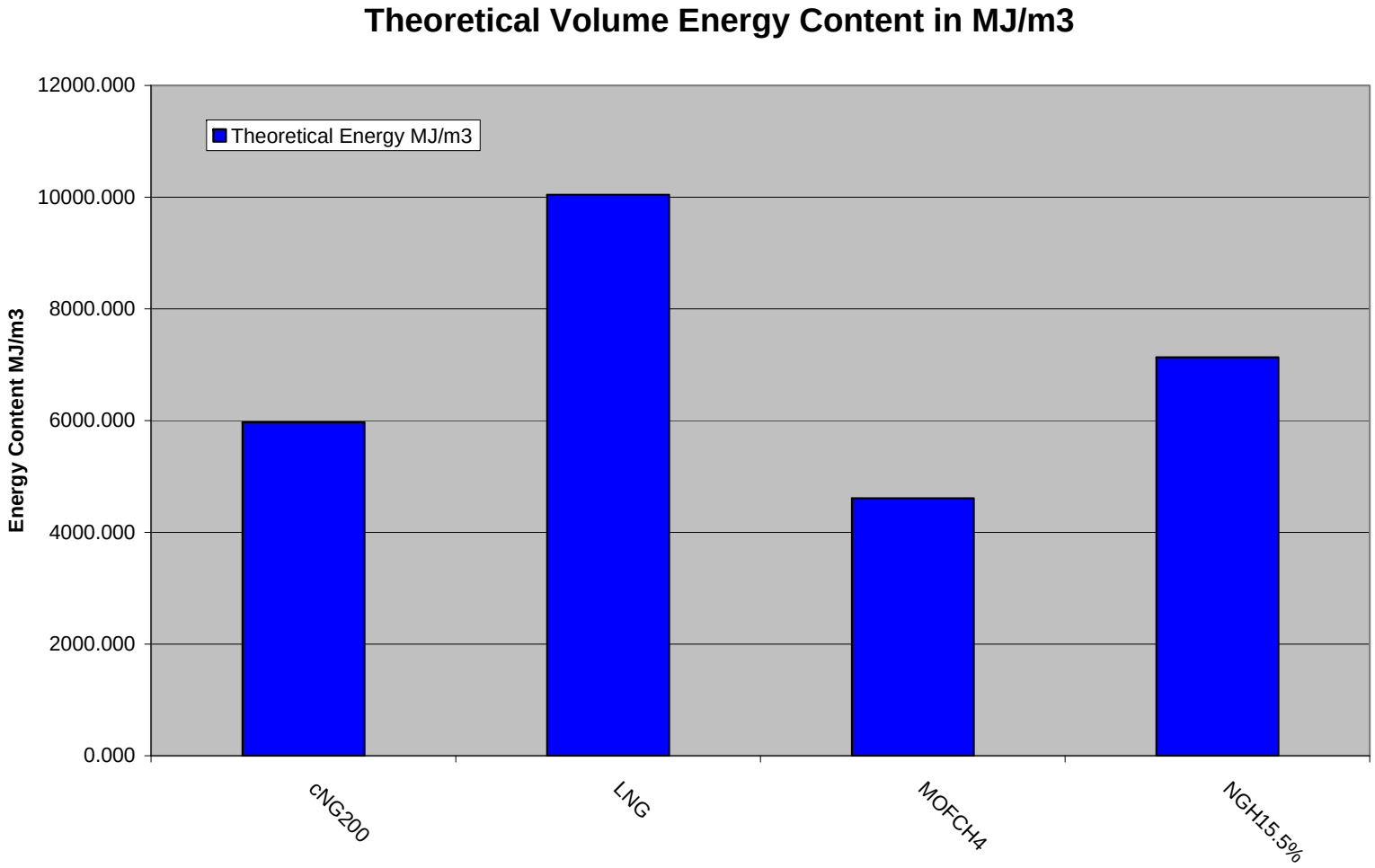
Tecnologie a Confronto



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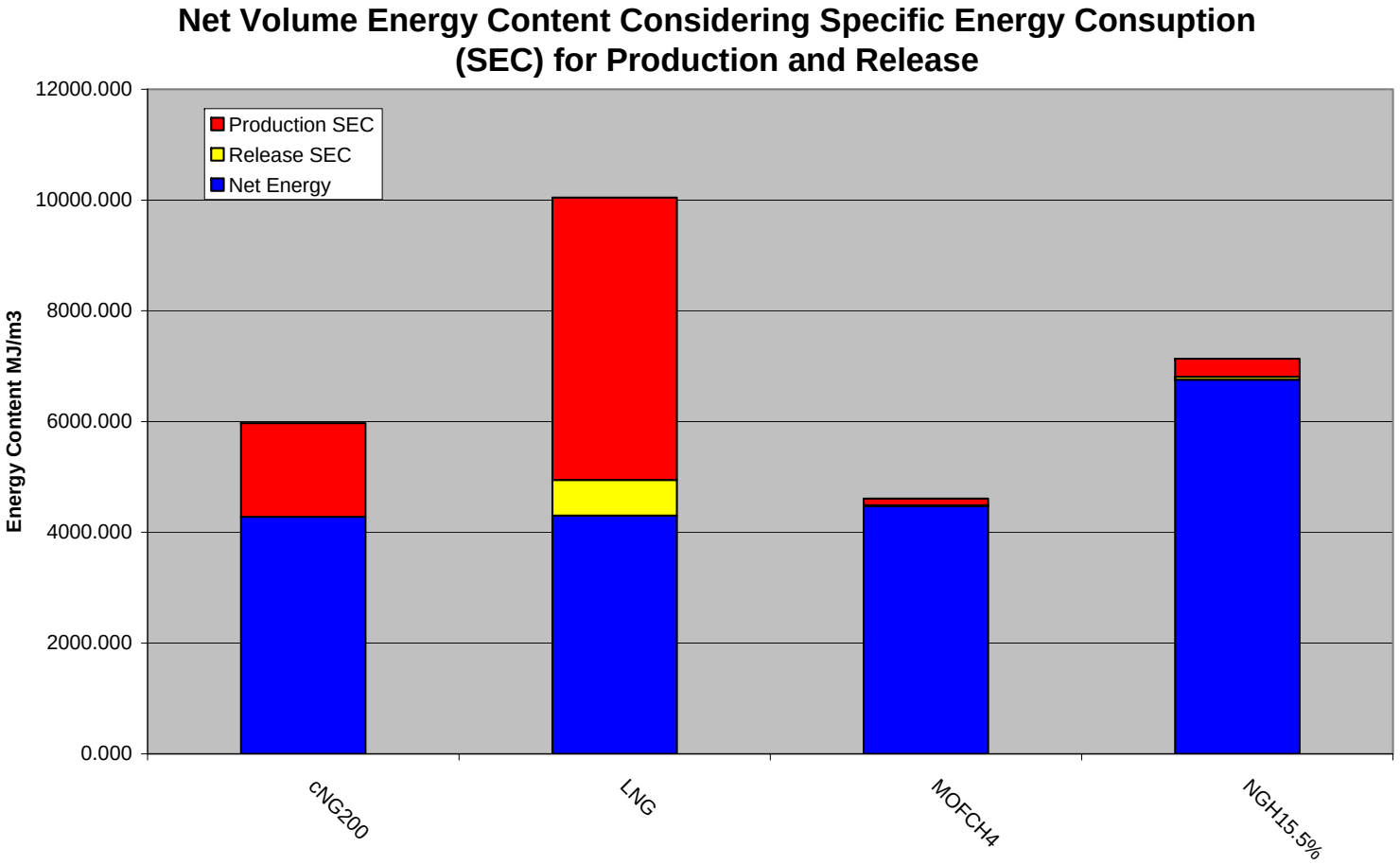
Tecnologie a Confronto



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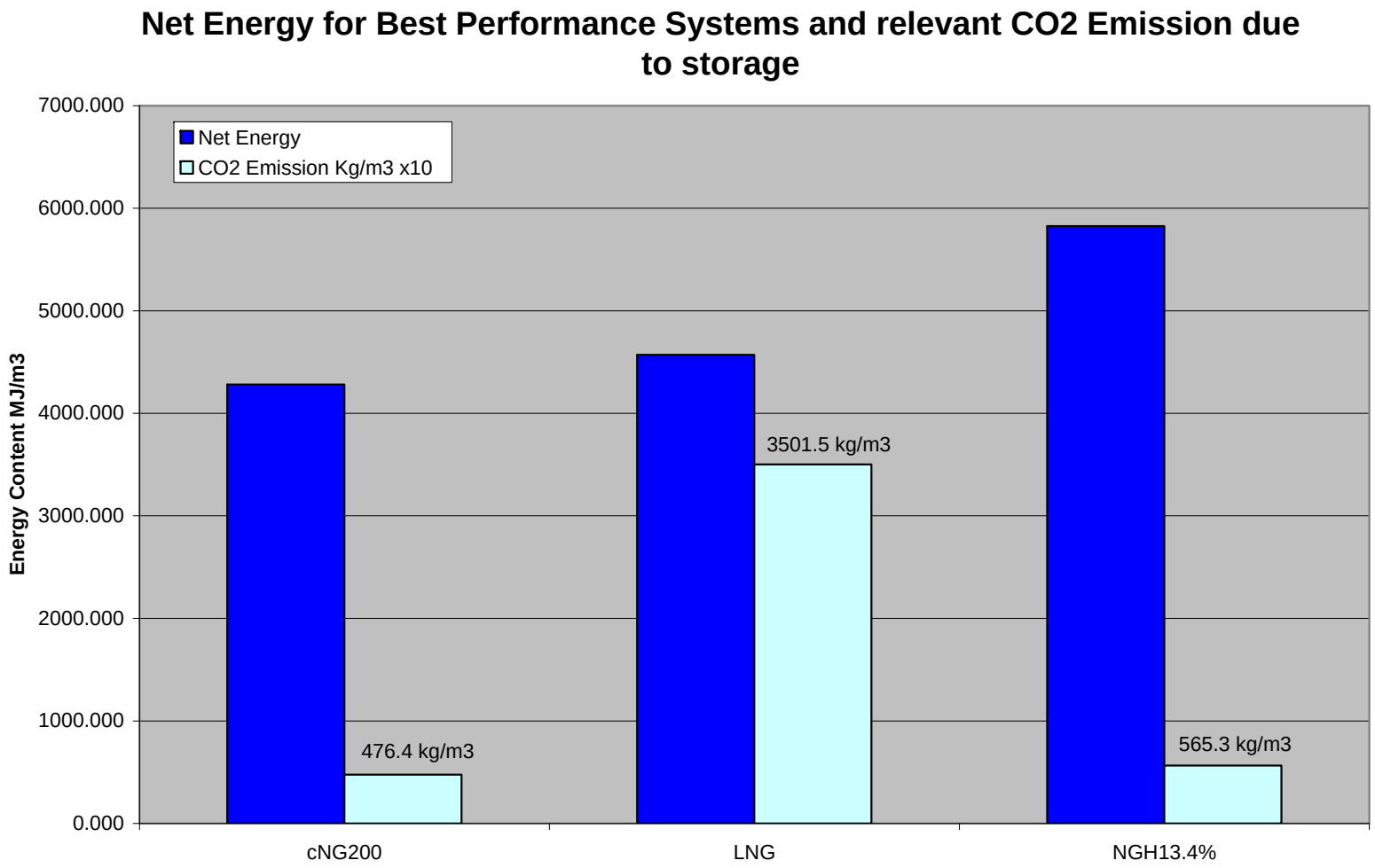
Tecnologie a Confronto



2. CATEGORY 2: Sorbent Materials for Low Pressure Storage

PRIMARY TECHNICAL TARGETS

ID	Category	Value (Units)	
2.1.1	Volumetric energy density	> 12.5 MJ/L (sorbent) > 9.2 MJ/L (inner tank)	9.3 MJ/L
2.1.2	Gravimetric energy density	> 0.5 $g_{CH4}/g_{sorbent}$ (sorbent) > 0.4 g_{CH4}/g (inner tank)	0.155 g_{CH4}/g
2.1.3	Cost of sorbent (credible route to)	< $10/kg	Nullo

SECONDARY TECHNICAL TARGETS

ID	Category	Value (Units)	
2.2.1	Specific desorption rates	> 2.6 kW/L (0.2 kg/h-L)	OK
2.2.2	Lifetime	100 cycles	OK
2.2.3	Desorption temperature	< 85 °C	OK
2.2.4	Temperature tolerance	-40 °C to 85 °C	OK?
2.2.5	Impurity tolerance	Pipeline quality natural gas (C_2H_6,C_3H_8,CO_2,H_2O,S)	OK
2.2.6	Safety requirements	Tolerant of abusive conditions and physical damage without catastrophic failure	OK