



G L O B A L F O R U M



**On Flaring and Venting Reduction  
and Natural Gas Utilisation**

# Micro-turbines

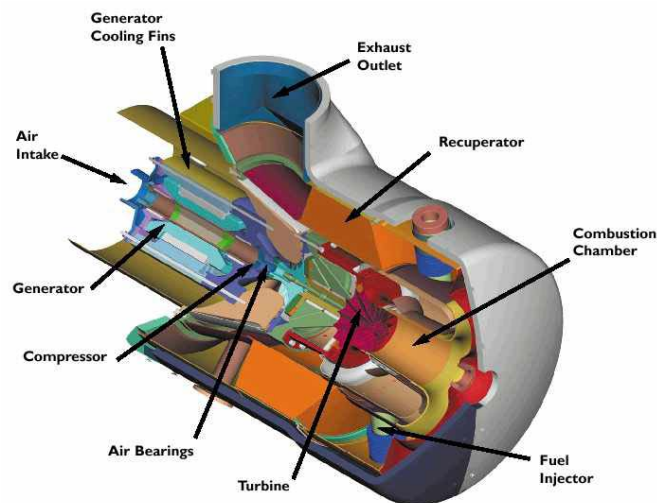
## Low Volume/Pressure Gas Usage

Gordon Smith

BP

# Micro-Turbine

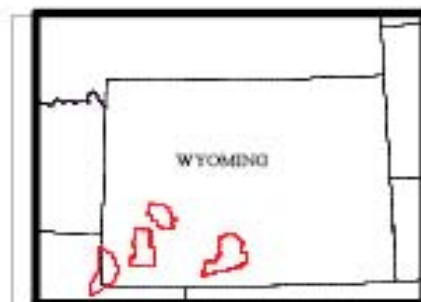
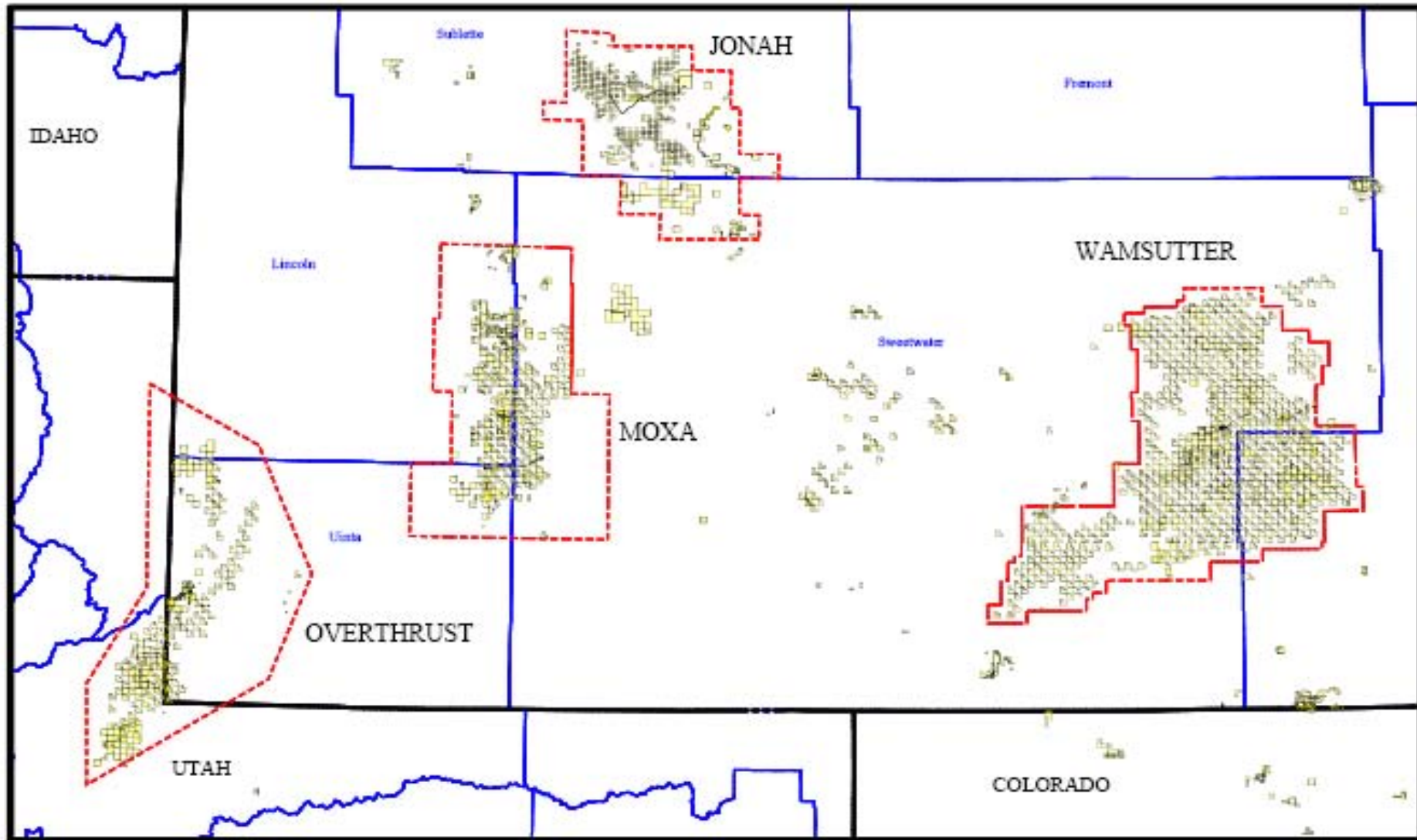
- What is a Micro-turbine?
  - Small, flex-fuel electrical generator capable of providing standalone or “on grid” power
  - Low emissions
  - Air Cooled
  - Minimal servicing
  - Small footprint
  - No liquid lubricants
  - Minimum moving parts
- Micro-turbine Goals
  - “Self-funding” Economics
  - Highly Reliable – “Start and Forget” Operation
  - Waste Gas Fuel - Low Emissions
  - Tolerance to Harsh Conditions



# Micro-Turbine Pilot

- 2007 Pilot Installed in US Remote Field (Jonah)
- Pilot Results
  - Operating 24/7 for over 14 months, 3 days downtime (99%)
  - Successful flash/waste gas test = decreased emissions & better economics
  - Elimination of site solar panel/battery costs
  - Capstone Brand
    - C30 model
    - 96,000 RPM
    - 30kw (20kw @ elevation) generation – Load following
    - Low fuel gas usage (4scfm at full load, 1800btu gas)
    - 360VAC – 520VAC output
  - Achievements
    - Reduced GHG emissions
    - Eliminated pneumatic pumps
    - Lower operational costs
    - Monetize otherwise vent/combusted gas





**Jonah Geographic Location**

# Severe Winter Conditions

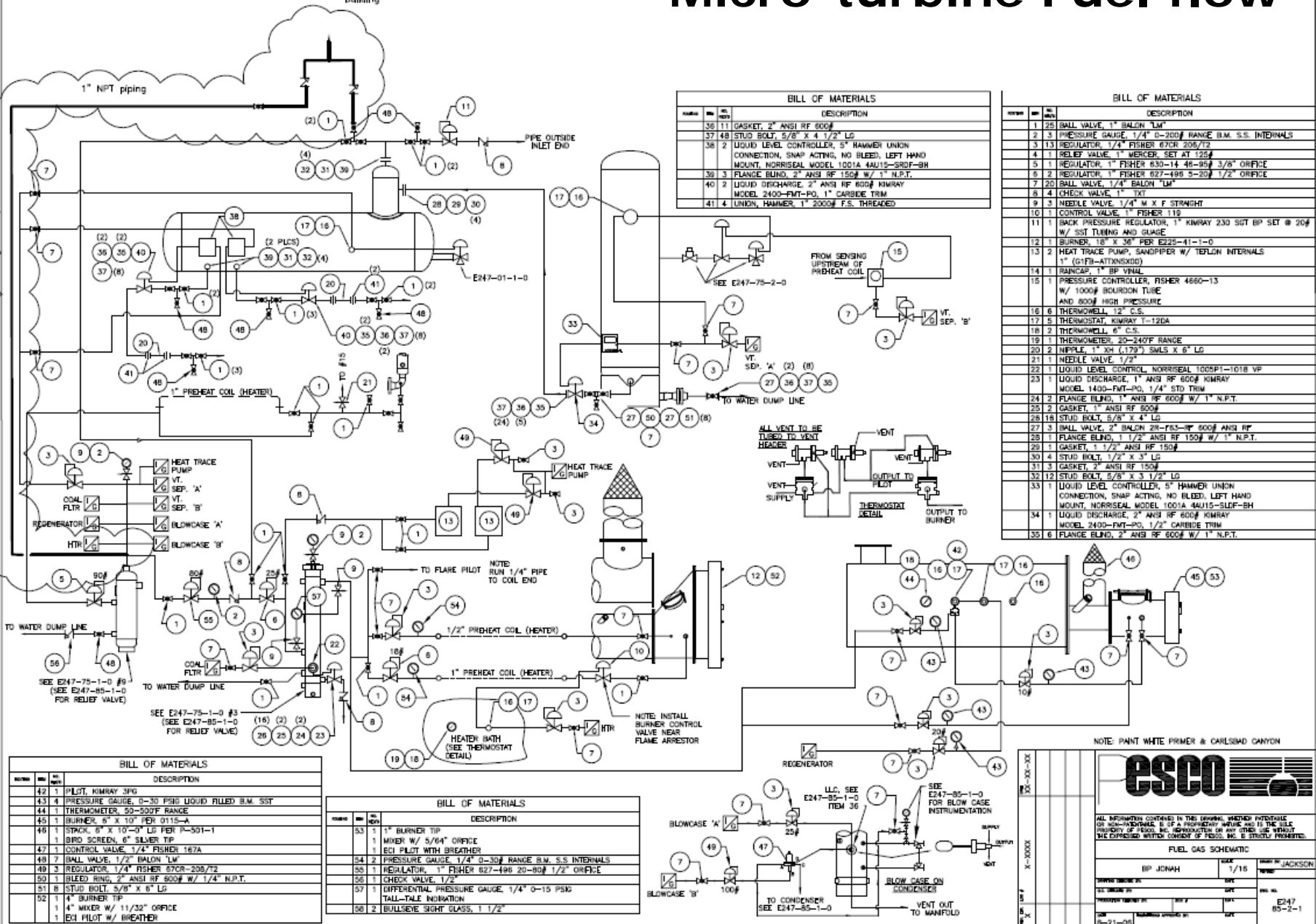


# Jonah Field Conditions



# Micro-turbine Fuel flow

>70psi fuel to microturbine building



QTY	NO.	DESCRIPTION
36	11	GASKET, 2" ANSI RF 600#
37	48	STUD BOLT, 5/8" X 4 1/2" LG
38	2	LIQUID LEVEL CONTROLLER, 5" HAMMER UNION CONNECTION, SNAP ACTING, NO BLEED, LEFT HAND MOUNT, NORRISSEL MODEL 1001A 4AU15-SLDF-BH
39	3	FLANGE BLIND, 2" ANSI RF 150# W/ 1" N.P.T.
40	2	LIQUID DISCHARGE, 2" ANSI RF 600# KIMRAY MODEL 2400-FMT-PO, 1" CARBIDE TRIM
41	4	UNION, HAMMER, 1" 2000# F.S. THREADED

QTY	NO.	DESCRIPTION
1	25	BALL VALVE, 1" BALON LM
2	3	PRESSURE GAUGE, 0-30 PSIG LIQUID FILLED B.M. SST
3	13	REGULATOR, 1/4" FISHER 87CR 205/72
4	1	RELIEF VALVE, 1" MERCER, SET AT 125#
5	1	REGULATOR, 1" FISHER 8330-14 46-85# 3/8" ORIFICE
6	2	REGULATOR, 1" FISHER 827-498 5-20# 1/2" ORIFICE
7	20	BALL VALVE, 1/4" BALON LM
8	4	CHECK VALVE, 1" TIT
9	3	NEEDLE VALVE, 1/4" M X F STRAIGHT
10	1	CONTROL VALVE, 1" FISHER 119
11	1	BACK PRESSURE REGULATOR, 1" KIMRAY 230 SGT BP SET @ 20#
12	1	W/ SGT TURNING AND CLAMP
13	2	HEAT TRACE PUMP, SANDPIPER W/ TEFLOON INTERNALS 1" (G1FI-ATTXNSX00)
14	1	RAINCAP, 1" BF VINYL
15	1	PRESSURE CONTROLLER, FISHER 4660-13 W/ 1000# BOURDON TUBE AND 600# HIGH PRESSURE
16	6	THERMOWELL, 12" C.S.
17	5	THERMOSTAT, KIMRAY T-12DA
18	2	THERMOWELL, 6" C.S.
19	1	THERMOMETER, 20-240F RANGE
20	2	NEEDLE, 1" SH (1.79") SMLS X 8" LG
21	1	NEEDLE VALVE, 1/2"
22	1	LIQUID LEVEL CONTROL, NORRISSEL 100CP1-1018 VP
23	1	LIQUID DISCHARGE, 1" ANSI RF 600# KIMRAY MODEL 1400-FMT-PO, 1/4" STD TRIM
24	2	FLANGE BLIND, 1" ANSI RF 600# W/ 1" N.P.T.
25	2	GASKET, 1" ANSI RF 600#
26	18	STUD BOLT, 5/8" X 4" LG
27	3	BALL VALVE, 2" BALON 28-FAS-RF 600# ANSI RF
28	1	FLANGE BLIND, 1 1/2" ANSI RF 150# W/ 1" N.P.T.
29	1	GASKET, 1 1/2" ANSI RF 150#
30	4	STUD BOLT, 1/2" X 3" LG
31	3	GASKET, 2" ANSI RF 150#
32	12	STUD BOLT, 5/8" X 3 1/2" LG
33	1	LIQUID LEVEL CONTROLLER, 5" HAMMER UNION CONNECTION, SNAP ACTING, NO BLEED, LEFT HAND MOUNT, NORRISSEL MODEL 1001A 4AU15-SLDF-BH
34	1	LIQUID DISCHARGE, 2" ANSI RF 600# KIMRAY MODEL 2400-FMT-PO, 1/2" CARBIDE TRIM
35	6	FLANGE BLIND, 2" ANSI RF 600# W/ 1" N.P.T.

QTY	NO.	DESCRIPTION
42	1	PILOT KIMRAY 3PG
43	4	PRESSURE GAUGE, 0-30 PSIG LIQUID FILLED B.M. SST
44	1	THERMOMETER, 50-500F RANGE
45	1	BURNER, 6" X 10" PER 0115-A
46	1	STACK, 6" X 10"-0" LG PER P-301-1
47	1	BIRD SCREEN, 6" SILVER TIP
48	1	CONTROL VALVE, 1/4" FISHER 167A
49	7	BALL VALVE, 1/2" BALON LM
50	3	REGULATOR, 1/4" FISHER 87CR-205/72
51	8	BLEED RING, 2" ANSI RF 600# W/ 1/4" N.P.T.
52	1	STUD BOLT, 5/8" X 6" LG
53	1	4" BURNER TIP
54	1	4" MIXER W/ 11/32" ORIFICE
55	1	EQ PILOT W/ BREATHER

QTY	NO.	DESCRIPTION
53	1	1" BURNER TIP
54	1	MIXER W/ 5/64" ORIFICE
55	1	EQ PILOT WITH BREATHER
56	2	PRESSURE GAUGE, 1/4" 0-30# RANGE B.M. S.S. INTERNALS
57	1	REGULATOR, 1" FISHER 827-498 20-80# 1/2" ORIFICE
58	1	CHECK VALVE, 1/2"
59	1	DIFFERENTIAL PRESSURE GAUGE, 1/4" 0-15 PSIG TALL-TALE INDICATION
60	2	BULLSEYE SIGHT GLASS, 1 1/2"

NOTE PAINT WHITE PRIMER & CARLSBAD CANYON

ALL INFORMATION CONTAINED IN THIS ORIGINAL SHEETED INSTRUMENT IS UNCLASSIFIED EXCEPT WHERE SHOWN OTHERWISE AND IS THE PROPERTY OF ESCO, INC. REPRODUCTION OR ANY OTHER USE WITHOUT THE CONSENT OF ESCO, INC. IS STRICTLY PROHIBITED.

FUEL GAS SCHEMATIC

PROJECT NO.	DATE	REVISED BY	DATE
BY JONAH	1/15	BY JACKSON	
DATE	DATE	DATE	DATE
DATE	DATE	DATE	DATE

ESC-21-08

# Micro-turbine Deployment

- Three deployed; One scheduled; Five budgeted (09)
- 2008 Installations
  - Power large production pads w/ a single Micro-turbine
  - 3 sites, 9 production units, 23 wells
  - Lower installation costs through efficiency and experience



<b>Economics</b>		
	<b>3 Unit Pad</b>	<b>3 Pads (3 Units ea.)</b>
<b>Installation Costs (Loaded)</b>	<b>\$300,00 (US)</b>	<b>\$900,000 (US)</b>
<b>Net Gas Savings (mmscf/yr)</b>	<b>18.4</b>	<b>55.3</b>
<b>Revenue @ \$6 Gas</b>	<b>\$110,502</b>	<b>\$331,506</b>
<b>Revenue @ \$10 Gas</b>	<b>\$184,170</b>	<b>\$552,511</b>

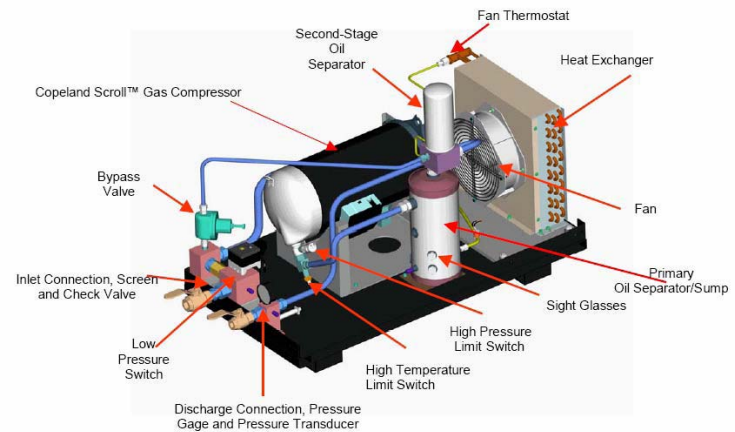


# Micro-Turbine Future

- Future Plans
  - Test VRU/scroll compressor to recover flash gas
  - Utilize air compressor system to eliminate instrument gas
  - Test waste heat recovery to supplement glycol heat bath
  - Standardize micro-turbines on new production pads
  - Continue to reduce installation costs
  - Construct micro-turbine engineering, installation, and operations technology pack – broaden deployment



Vapor Recovery Unit – To reduce/eliminate tank flash emissions





G L O B A L F O R U M

**On Flaring and Venting Reduction  
and Natural Gas Utilisation**

# Questions