CARBON LIMITS

Methane emissions in Kazakhstan

….from measurements to inventory improvements

Stephanie Saunier

Project financed by ClimateWorks

Introduction on Kazakhstan

- Proven crude oil reserves: 30 thousand million barrels.
- Second largest reserves in Eurasia, and the twelfth largest in the world, just behind the United States.
- Production 1.70 million bbl/d in 2014
- Over the past decade, natural gas production has increased by 50%, up to 19.3 bcm in 2014.
- The volume of international gas transit through Kazakhstan 78.6 bcm

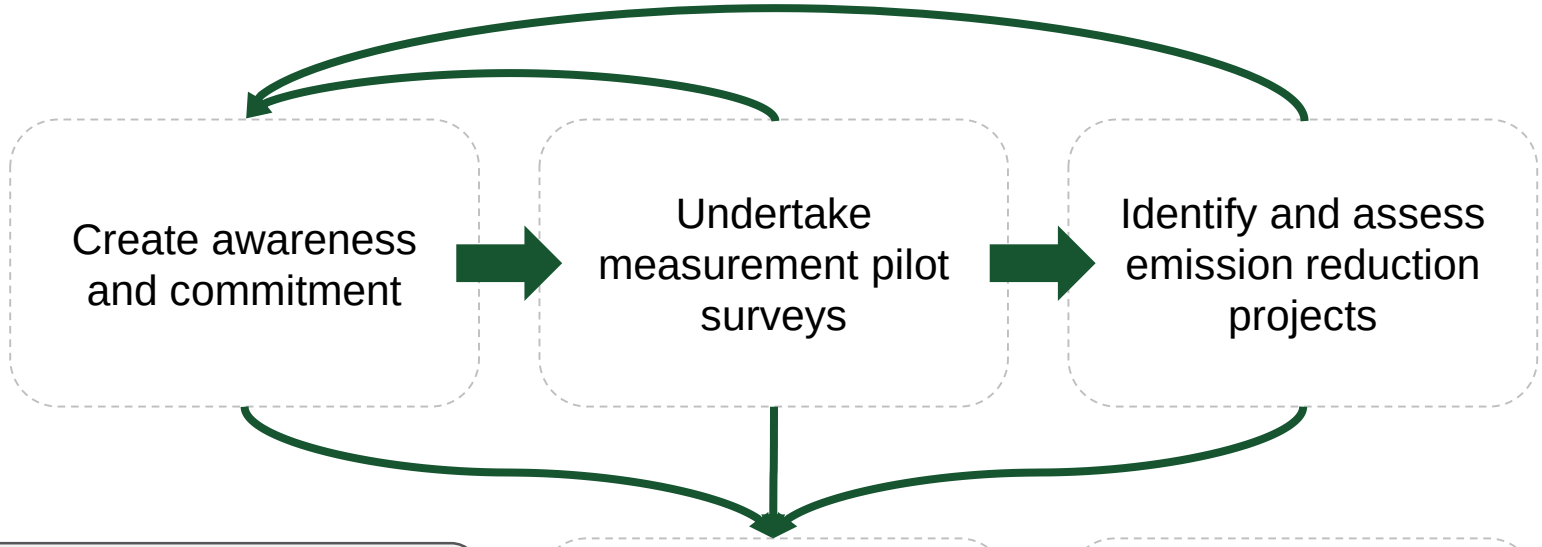
Kazakhstan is a regional leader on climate mitigation.

In January **2013**, the country launched an **ETS** covering CO2 emissions from the energy sector (including oil and gas) mining and chemical industry.

Methane emissions reduction projects can be used as **offset under the Kazakh ETS**

Methane program in Kazakhstan

Overview – Key objectives



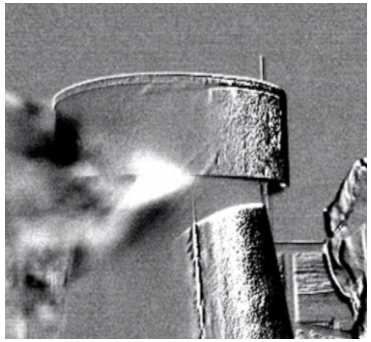
Programme co-initiator: Ministry of Energy

Cooperating companies: EmbaMunaiGas, KazTransGas - Intergas Central Asia, KazakhOil Aktobe, MangistauMunaiGas

Methane program in Kazakhstan

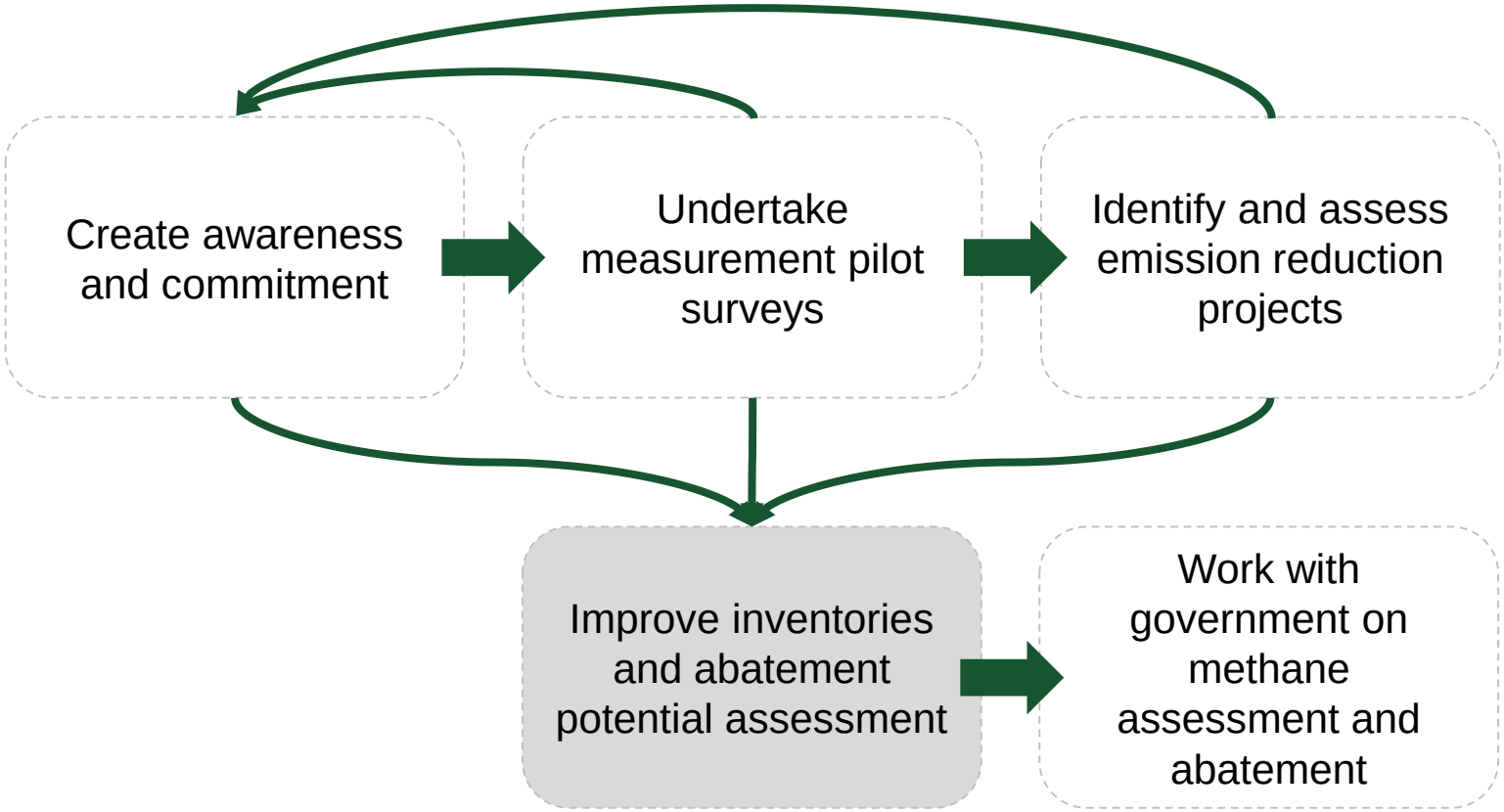
2015 Activities

- Workshops on methane emissions in the oil and gas sector.
- LDAR at three upstream facilities in Kazakhstan (September 2015)
- LDAR on natural gas transmission and distribution (November 2015)
- Identification and detailed assessment of methane emissions reduction projects



Methane program in Kazakhstan

Overview – Key objectives



Inventory and abatement potential assessment
Overview

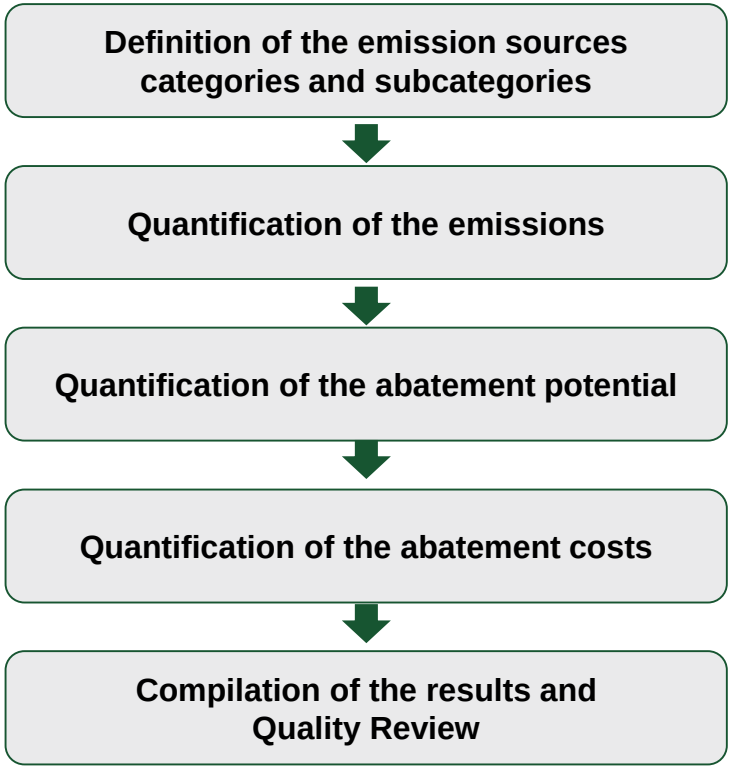
KEY OBJECTIVES

The work performed aims at providing estimates of:

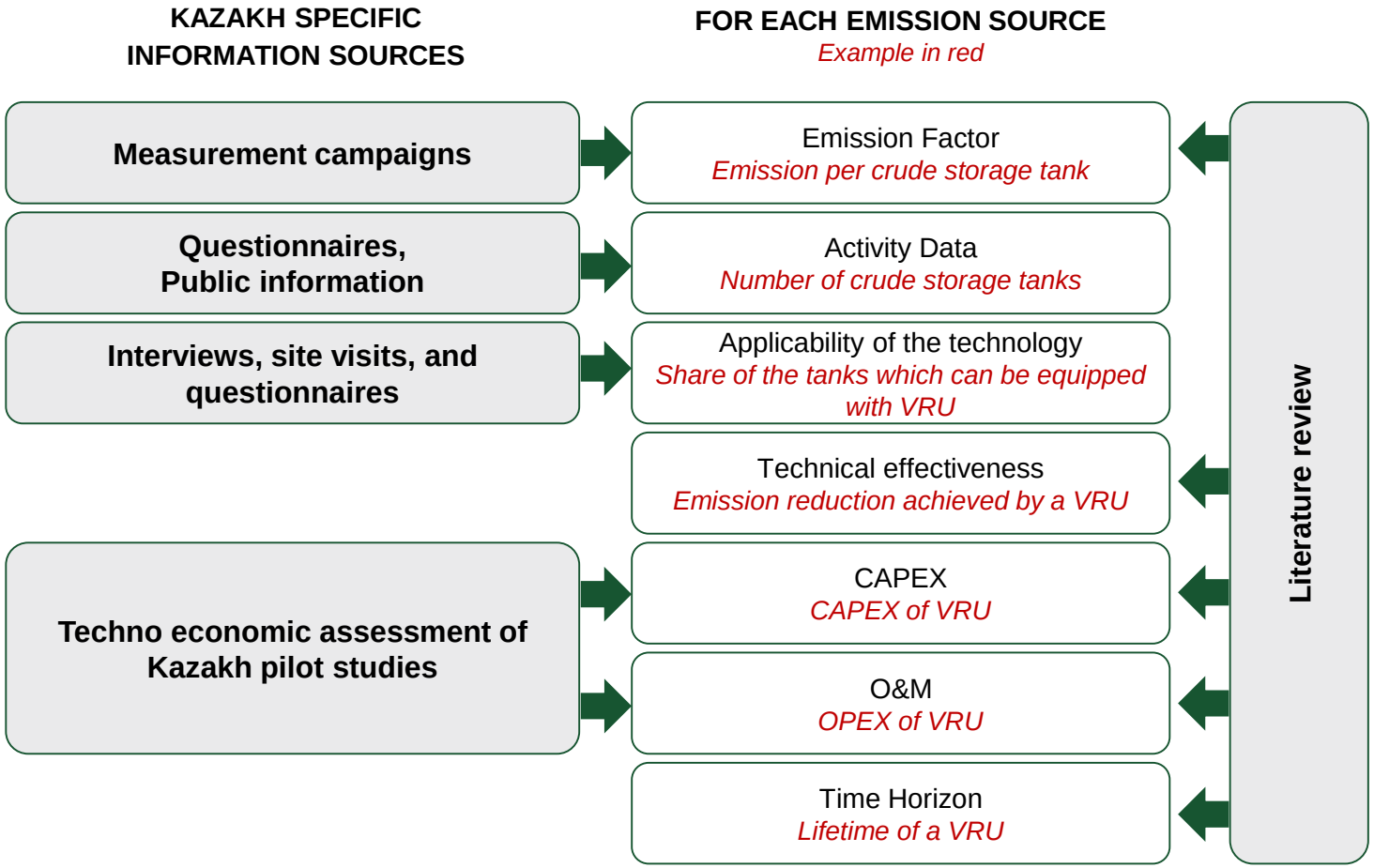
- Methane emissions from oil and gas system in Kazakhstan
- Methane abatement potential and costs

- Allow Kazakh companies and authorities to identify the most attractive abatement opportunities
- Contribute to an increased knowledge on the magnitude of emissions and on the abatement potential outside North America

APPROACH



Information sources



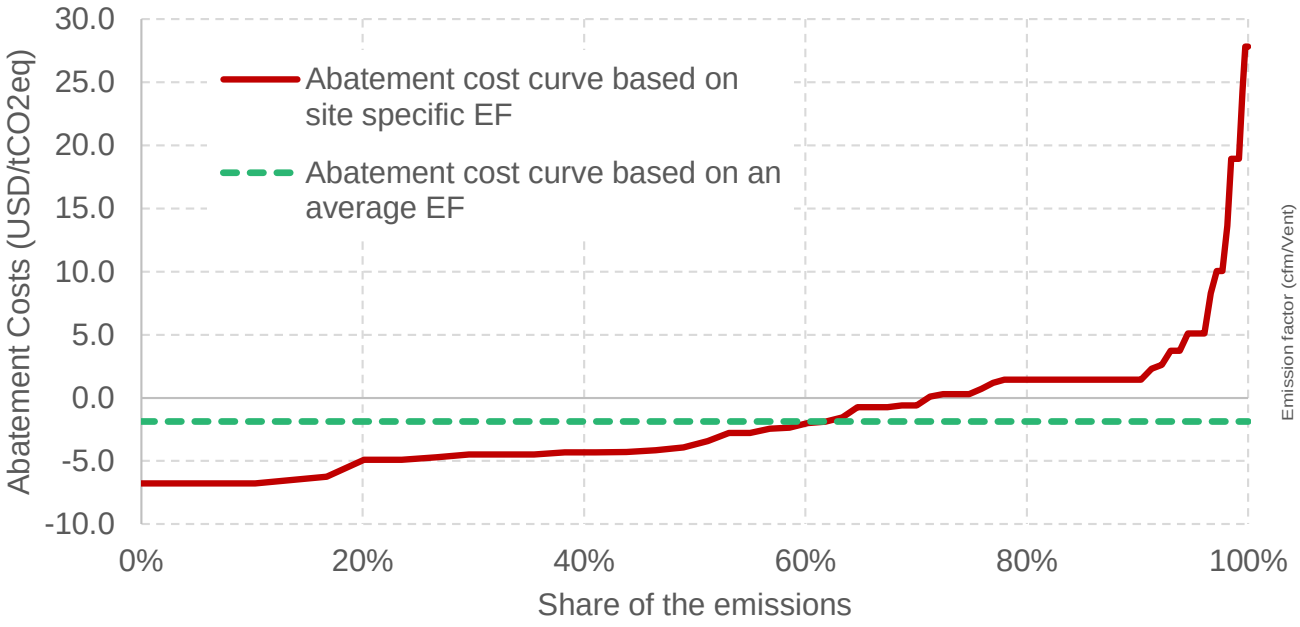
All assumptions….

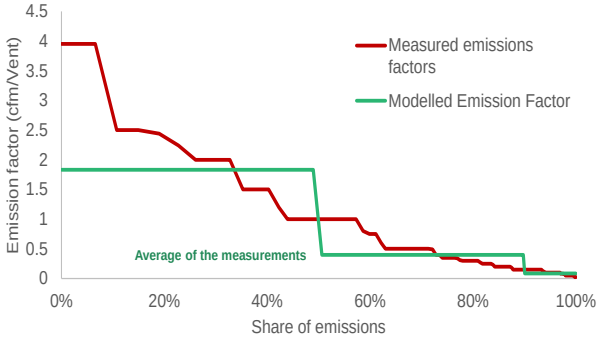
Category	Activity Factor	Activ
Flaring-Production	26045	
Cold-Venting	69	
Leaks_Product		
Leaks_Process		
Leaks_Compre		
Liquid storage		
Liquid storage		
Centrifugal Cor		
Centrifugal Cor		
Centrifugal Cor		
Small Gas Engi		
Reciprocating C		
Reciprocating C		
Reciprocating C		
Liquid_Unloadir		
Hydraulically Fr		
Hydraulically Fr		
Dehydrator Ve		
Dehydrator Ve		
Dehydrator Ve		
Dehydrator Ve		
Natural Gas Dr		
KimrayPumps (		
Blow down_ve		
Blow down_PR		
Blow down_rou		
Blow down_sta		
Blow down_GP		
Blow down_compressor_station_nonmitigated	56	
Blow down_natural_gas_trunklines_nonmitigated	6417	
Blow down_natural_gas_trunklines_mitigated	9625	
Large Gas Engines and Turbine non mitigated	66999	
Large Gas Engines and Turbine_mitigated	16750	

Category	Miti
Leaks_Production	LDA
Leaks_Processing	LDA
Leaks_Compressor Stations	LDA
Liquid storage tanks - non mitigated	Insta
Centrifugal Compressors with wet seal - upstream	Recl
Centrifugal Compressors with wet seal - Transmission and refi	Recl
Small Gas Engines and Turbine	Insta
Reciprocating Compressors upstream	Earl
Reciprocating Compressors Refineries	Earl
Reciprocating Compressors Transmissions	Earl
Liquid_Unloading	Insta
Hydraulically Fractured wells mitigated	Redi
Dehydrator Vent Processing non mitigated	Opti
Dehydrator Vent transmission non mitigated	Opti
Natural Gas Driven Chemical Injection Pumps	Repl
KimrayPumps (Glycol)	Repl
Blow down_vessels_nonmitigated	Con
Blow down_PRV_nonmitigated	Con
Blow down_routine_compressor_nonmitigated	Insta
Blow down_start_compressor_nonmitigated	Insta
Blow down_GPP_nonmitigated	Insta
Blow down_compressor_station_nonmitigated	Redi
Blow down_natural_gas_trunklines_nonmitigated	Pipe
Large Gas Engines and Turbine non mitigated	Insta

Category	Applicability of Central Emission factor	Applicability of the Low Emission factor	High Emission factor	Emission factor -Unit	Abatement efficiency - Emission factor - sou
Flaring-Production	2%	1%	5%	%	Source 9
Cold-Venting	100%	100%	100%	%	NA
Leaks_Production	0.00	0.00	0.00	MMscf/boe	Source 2 and 10
Leaks_Processing	0.190%	0.076%	0.380%	% of the Throughput	Source 2, 29 and 10
Leaks_Compressor Stations	0.76	0.25	8.31	MMscf/equipment/year	Source 2 and 10
Liquid storage tanks - non mitigated	3.50	1.00	9.00	MMscf of Ch4/tank/year	Source 2 and 10
Liquid storage tanks with VRU	0.88	0.25	2.25	MMscf of Ch4/tank/year	Source 2 and 10
Centrifugal Compressors with wet seal - upstream	6.00	4.00	17.58	MMscf/compressor/year	Source 23, 2 and 17
Centrifugal Compressors with wet seal - Transmission and	6.00	4.00	17.58	MMscf/compressor/year	Source 23, 2 and 17
Centrifugal Compressors with dry seal	1.50	0.90	3.00	MMscf/compressor/year	Source 23, 2 and 17
Small Gas Engines and Turbine	1%	1%	2%	%	Source 18 and 28
Reciprocating Compressors upstream	0.42	0.09	1.93	MMscf/year	Source 2, 10 and 23
Reciprocating Compressors Refineries	0.64	0.16	5.91	MMscf/year	Source 2, 10 and 23
Reciprocating Compressors Transmissions	1.45	0.22	10.00	MMscf/year	Source 2, 10 and 23
Liquid_Unloading	0.06	0.02	0.11	MMscf/event	Source 12
Hydraulically Fractured wells mitigated	0.85	0.41	10.77	MMscf/event	Source 20 and 21
Hydraulically Fractured wells non mitigated	0.08	0.04	1.08	MMscf/event	Source 20 and 21
Dehydrator Vent Processing non mitigated	0.00021	0.00007	0.00044	MMscf CH4/MMScf throughput	Source 23 and 10
Dehydrator Vent Processing mitigated	0.00007	0.00002	0.00014	MMscf CH4/MMScf throughput	Source 23 and 10
Dehydrator Vent transmission non mitigated	0.00009	0.00003	0.00020	MMscf CH4/MMScf throughput	Source 23 and 10
Dehydrator Vent transmission mitigated	0.00003	0.00001	0.00007	MMscf CH4/MMScf throughput	Source 23 and 10
Natural Gas Driven Chemical Injection Pumps	0.29	0.11	0.67	MMcfmethane/year	Source 10, 27
KimrayPumps (Glycol)	0.00106	0.00034	0.00228	MMcfmethane/MMScf	Source 23, 27
Blow down_vessels_nonmitigated	0.00	0.00	0.00	MMscf/Equipment count	Source 24
Blow down_PRV_nonmitigated	0.00	0.00	0.00	MMscf/Equipment count	Source 24
Blow down_routine_compressor_nonmitigated	0.00	0.00	0.01	MMscf/Equipment count	Source 24
Blow down_start_compressor_nonmitigated	0.01	0.01	0.01	MMscf/Equipment count	Source 24
Blow down_GPP_nonmitigated	4.06	1.55	10.64	MMscf/GPP	Source 1 and 24
Blow down_compressor_station_nonmitigated	8.83	0.64	11.65	MMscf/Compressors stations	Source 1 and 24
Blow down_natural_gas_trunklines_nonmitigated	0.06	0.01	0.08	MMscf/km	Source 25
Blow down_natural_gas_trunklines_mitigated	0.01	0.00	0.01	MMscf/km	Source 25
Large Gas Engines and Turbine non mitigated	1%	1%	2%	%	Source 18 and 28
Large Gas Engines and Turbine_mitigated	1%	0%	2%	%	Source 18 and 28

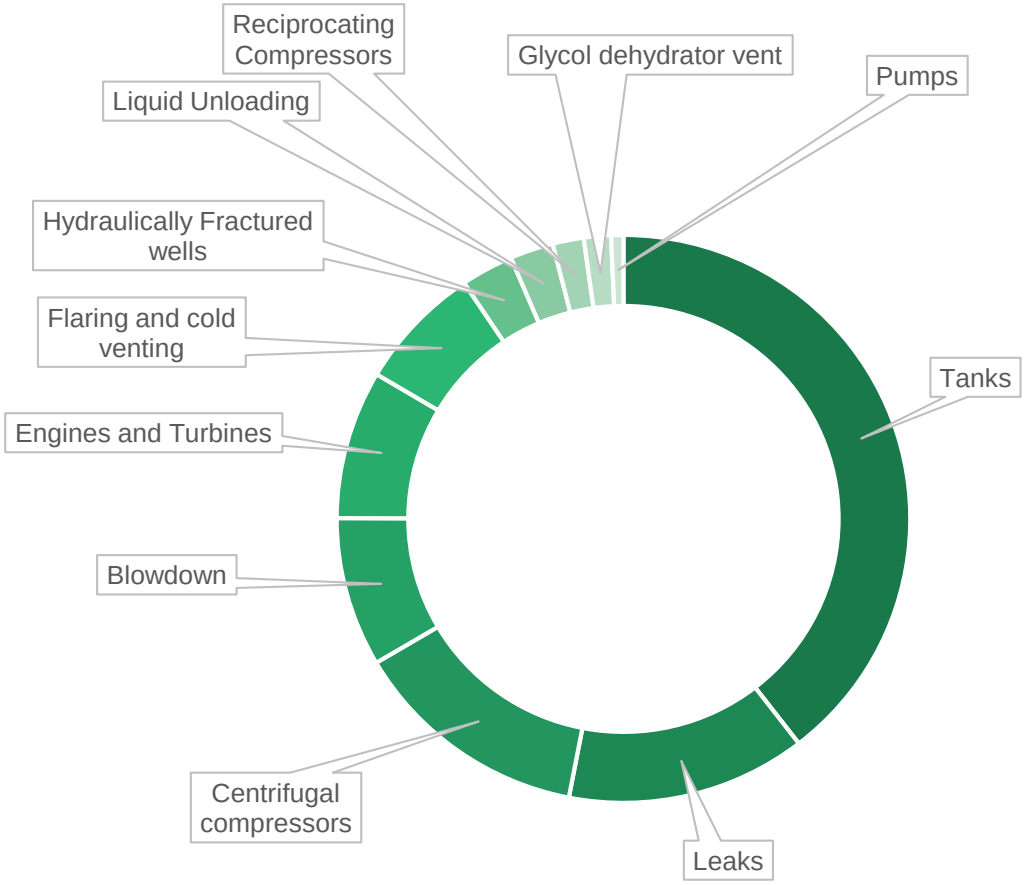
Abatement costs…. It is REALLY site dependant!



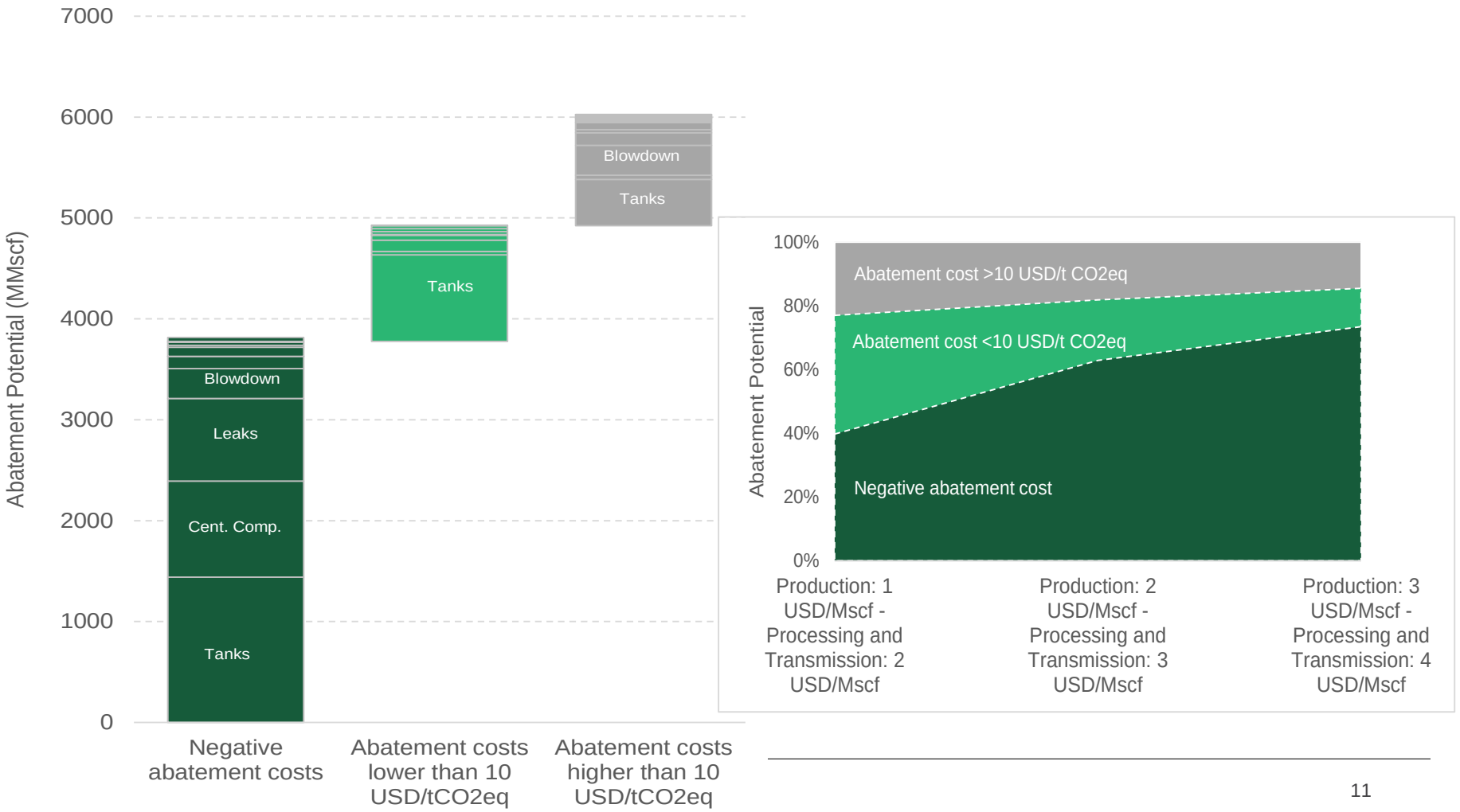


Main results:

Split of emissions by emissions categories



Main results:
Abatement potential and abatement costs estimates

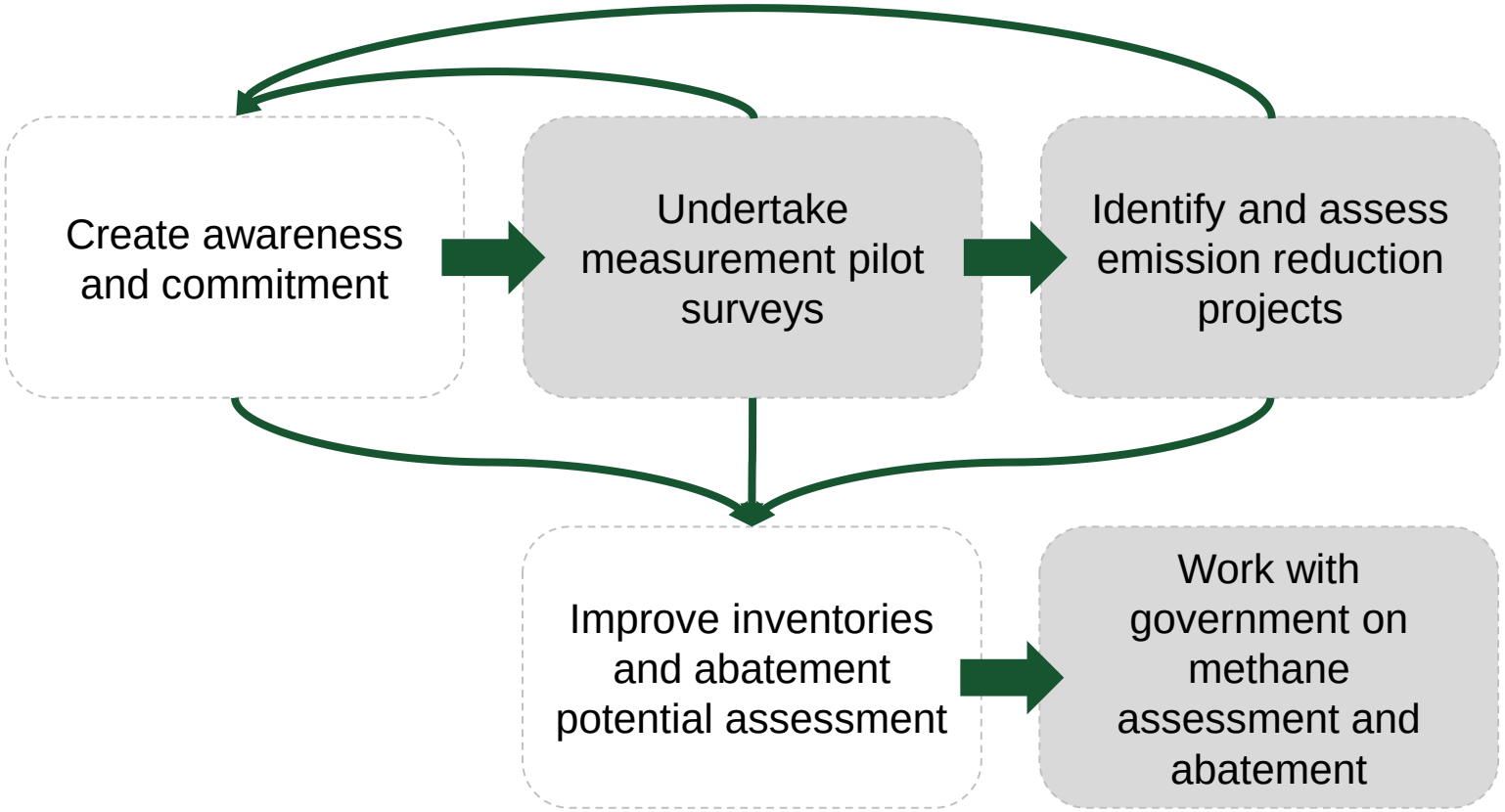


A few caveat and limitations

- The measurement performed does not allow a statistical utilization of the emission factors gathered
- Some EF were not measured during the measurement campaign, e.g. Liquid unloading
- A few emission sources have been excluded due to the lack of information available

Methane program in Kazakhstan

2016 plan



A few final thoughts….

- Understanding emissions and **mitigating** them goes hand in hand!
- Current published international estimates are uncertain…. But these estimates can be improved.
- **Current practices vary highly between countries** …. So does methane emissions!
- **Collaboration** was key …. Huge thanks to everybody in KMG !