In-line cascade laser spectrometer for process control – iCspec

- Reference of the call: H2020-SPIRE-2014
- Start/end date: 01.04.2015 – 31.03.2018
Project Case Study

1. The EU/ SPIRE needs

Fast and direct systems for industrial process control to monitor multi-component gas compositions in a process stream.

The currently used technique is based on extractive gas chromatography with a delayed response of several minutes.

2. The Project Solution

Novel laser based analyzers will be developed and tested at a refinery site.

The iCspec solution is applicable for the entire hydrocarbon process industry.

3. Value to Customers

The new analyzer system of iCspec
- provides direct information from process and very short response time
- offers significant cost savings from improved process efficiency as well as total-cost-of-ownership
- is maintenance-free and avoids the use of consumables (carrier gases, calibration samples), which is not the case for currently used systems.

4. How will this happen?

The iCspec analyzers are based on innovative mid infrared laser technology to provide significant technological benefits and increase competitiveness for the users of the system.

Also, iCspec participants are active members within important industrial and standardization committees.
Key expected sustainability impacts

Baseline:
Currently available measurement technology especially comprises **Gas Chromatography (GC)** iCspec

For the targeted installation in a typical and representative refinery application, the following impacts are expected:

- Shorter response time of the analysis
  - Increase process efficiency
  - Optimize product quality and minimize waste
- Significant improvement of CO₂ emission equivalent per measuring point
- Decreased installation & operating cost – less hardware.
- Decreased risk – no handling with pressurized bottles & flammable gases

**Exact data on the expected impact concerning the above indicators is to be evaluated in the last year of project at a refinery site in Sweden.**

As the process set-up of refineries follows the same principle the impact achieved in the target installation can be leveraged worldwide.
What are the **key expected sustainability impacts** of *Project iCspec*

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Baseline</th>
<th>Expected Impact</th>
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<tbody>
<tr>
<td><strong>Global Warming Potential</strong></td>
<td>Worst case conventional Analyser &gt;150 t</td>
<td>Laser based Analyser ~5 t</td>
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<td>(mainly CO₂ emission equivalent per product during 15 years lifetime)*</td>
<td>Average Analyser ~21 t</td>
<td>Further evaluation in yr3 of project</td>
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<tr>
<td><strong>Total material consumption</strong>*</td>
<td>Process samples (hydrocarbons)- main contributor to CO₂ emission</td>
<td>Expect significant reduction &gt; 30%</td>
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<td>Products -no critical materials used currently</td>
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<tr>
<td></td>
<td>Plant – reduction of space (shelter) and system boundaries around measuring point</td>
<td>Further evaluation in yr3 of project</td>
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<td>(multiple effect due to simplification)</td>
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</table>

*Core SPIRE indicator
What outputs from iCspec could have value for other SPIRE projects here?

iCspec is starting with a refinery application
but there is a broad variety of analytical applications (and markets) which can benefit!

- Our solution is applicable for the entire hydrocarbon process industry
  from the refining of crude oil to the manufacturing of finished products like different types of plastics and chemicals.
  One example is the separation of different C4 isomers like Butadienes.

- Extension to other application areas as emission monitoring is possible
  Emission monitoring is a diverse field of application. With the new technology all the relevant flue gas components
  (NO, NO₂, CO, CO₂, SO₂, SO₃, H₂O and unburned HCs) from fossil power plants can be monitored with a single analyzer.

- iCspec has impact on various other technologies
  In the oil- and gas industry mud-logging is an established method for detecting the presence of gas-phase hydrocarbon
  reservoirs during the oil drilling process to obtain information about the composition of the oil- and gas field to be
  explored and to quickly predict dangerous blow out situations.
  Due to high drilling speed currently used GC based systems are too slow.
Dead time is the biggest enemy of process control - put iCspec in control!

Our novel laser based gas analyzers are THE enabling technology base providing enhanced process efficiency with reduced waste, resource and energy consumption.

Our target application: Multi-component monitoring of hydrocarbons in a refinery process stream (PREEM Sweden)

But: Broad analytical applications into different markets exist!
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