D17.23 CORE Final report on phase one developments of the P&G demonstrator - summary

Executive summary

The P&G demo (T17.3) addresses product integrity issues in global supply chains; i.e. product quality and safety issues when exposed to extreme temperature variations during shipments. Hence, the P&G Demo aims at constructing and testing a novel device unit (ICECUBE) which will be loaded into normal standard shipping sea containers (called seatainers in this Living Lab). This new solution – called ICECUBE – is expected to reduce both the costs and energy footprints that are necessary to guarantee the product integrity of shipments. The trade lane of the Living Lab consists of the following legs:

- Road transport from P&G Mataro (Spain) to Barcelona port terminal (Spain).
- Sea shipment from Barcelona port terminal to Algeciras port terminal (sea feeder).
- Sea shipment from Algeciras port terminal to Durban (South Africa).
- Road transport from Durban terminal to P&G warehouse.

In addition, the definition of the preferred supply chain route was followed by sea shipment test design along with critical data recording as highlighted in tasks T17.3.1 and T17.3.2. The LL is expected to monitor effectiveness of the above novel solution throughout existing P&G supply chains. The final goal is to demonstrate that “ICECUBE solution” allows a reduction of 30-40% in the overall carbon footprint caused by commonly used diesel generators (the DoW has been amended from 50-70% target to 30-40%).

This M24 Living lab reports activities and results of the phase one development of the P&G demonstrator D17.23. It reports on the implementation of the solution and first results of the demonstration in the pilot phase. When needed, modifications to the initial targets, requirements, use cases, measurement approach and demonstrator configuration are made to feed into phase two.

This living lab reports all executed activities which occurred during the last 6 months from M18 delivery in November 2015, to M24, April 2016. Activities are related to tasks and subtasks linked with:

- T17.3.1 Technical Coordination.
- T17.3.2 Seatainers shipment and positioning.
- T17.3.3 Data collection and recording.

In order to understand the operating window of ICECUBE (technology used in T17.3), physical prototype tests were performed as reported in both D17.22 and D17.23 (this document). However additional performance tests were needed to evaluate how ICECUBE would perform in extreme temperature variations – assuming both normal and worst case scenario. As a consequence, during the last 6 months, the Living Lab has focused on “theoretical trade lane testing” and data collection and recording using modelling and simulation technique.

The impact of the technology in the trade lane has been assessed by means of agent-based simulation. As a result, the ICECUBE solution was concluded to successfully control the payload temperature, and to do so by using roughly 60% of its total thermal storage capacity.

Problem, ambition and goal of demonstrator

P&G has a large number of finished products and raw materials which do not normally require a temperature-controlled supply chain, but suffer from extreme drops in temperature in summer/winter. This leads to inefficiencies as product quality and integrity compromised.

Today, adequate and energy efficient solutions are lacking on the marketplace. Hence, we aim at demonstrating a much more efficient solution which can reduce both the cost and energy footprint related to guaranteeing product integrity by keeping mild temperature conditions in trucks and seatainers during shipments.

By monitoring above solution throughout existing supply chains, this demonstrator may provide green and agile supply chain solutions by allowing a reduction of 30-40% the overall carbon footprint caused by commonly used diesel generators (the DoW has been amended from 50-70% target to 30-40%).

Hence, the P&G Demo aims at constructing and testing a novel device unit (ICECUBE) which can be loaded into normal standard shipping sea containers (called seatainers in this Living Lab) and allow a passive and an on-demand cooling capability of the transported goods. This new solution – called ICECUBE – will demonstrate a much more efficient solution which will reduce both the cost and energy footprint related to guaranteeing product integrity by keeping mild temperature conditions at ±30°C.

Short description of scope of the demonstrator

The ICECUBE system is composed of an ICECUBE unit that holds cold brine solution. Through a pump (operated by battery), the brine is circulated through Thermoshields (blanket) that covers P&G pallets and evacuates the heat via a capillary heat exchange. The warm water goes back into the ICECUBE system to be cooled down. The LL will be used to monitor effectiveness of the ICECUBE solution throughout existing P&G supply chains. It will demonstrate agile and green supply chain solutions by ensuring that “ICECUBE solution” allows a reduction of 30-40% in the overall carbon footprint caused by commonly used diesel generators (the DoW has been amended from 50-70% target to 30-40%)..

The demonstration prototype will address various phases and the main objectives for this Living Lab are summarised as:

- Complete the design and construction of a lead prototype (based on Sunwell’s unique proprietary technology (ICECUBE). The prototypes will be deployed inside seatainers and trucks used on existing supply chain routes. This prototype will be used to monitor product integrity throughout the entire supply chain and against severe climatic conditions.
- Integrate and validate procedures and interfaces through real time seatainers and truck transport conditions during 3 years. This full scale trial will consist of using a similar P&G supply chain across at least 2 oceans and a comprehensive road distance to demonstrate the novel technology can achieve the expected success criteria in an existing supply chain.
- Allow real time data gathering and as a consequence generate solutions for design improvement for future prototypes.

The ICECUBE technology will be implemented in a standard dry container or standard (non-refrigerated) truck which will be monitored along the supply chain. This allows ensuring the entire integrity of the full load throughout the end-to-end supply chain. The track and location devices that can be provided by DHL will be used to gather important information such as temperature, geographical position, time, vibration levels etc. This is directly linked to one of the main CORE project objectives: Agile and green supply chain solutions offering a highly innovative approach to designing supply chains resilient (in real-time) to major and/or minor disturbances”.

The overall ambition matches the ambitions of the individual stakeholders of the Living Lab in the following manner:

- **For P&G** the project provides real-time, lean, agile, resilient, green, and optimised supply chain solutions. P&G will be able to reduce its transportation costs while reducing the CO_2 emissions and optimising the product integrity throughout the supply chain.
- **For MAERSK** the project provides potential business opportunity to offer a lower cost/lower carbon footprint sea transport solution for mild temperature across the global trade.
- **For SUNWELL** the project provides the perfect set up for the testing of patented solutions as well as valuable input to improve design towards a commercial model.
- **For DHL** the project provides potential business opportunity to offer a lower cost/lower carbon footprint inland transport solution for mild temperature across the global trade.
- **For ISL** this Living Lab provides a scenario for a simulation which offers us the opportunity to apply, validate and test a simulation environment and its application into a simulation tool. Furthermore, it provides valuable input for further scientific research and to improve the design of the environment for potential commercialisation.
- **For ILS** this Living Lab provides additional data to be used by CORE visibility/visualization tools such as (VT) developed in WP5, thereby strengthening the scope and the functionality of the tools and improving the marketability of its solution. The gathering of data and the expected improvements in the toolset will be performed during the second phase of the project.

Living lab methodology

To realise results with this demonstrator, a Living Lab methodology is applied, which follows a cyclical approach. Through this cyclical approach, several solutions can be tested and re-adjusted/improved to fit the needs of the real-life environment.

Summary of Set-up phase

In the first initial 18 months, the demonstrator has progressed in the following stages:

Technical Coordination (ST 17.3.1)

ICECUBE technology is set up to be implemented in a standard dry container or truck which will be monitored along the supply chain. This allows us to ensure the entire integrity of the full load throughout the end to end supply chain. The track and SMART sensors devices provided by DHL are planned to gather important information such as temperature, geographical position and time.

Prototype design coordination (ST 17.3.1.1)

In the last 6 months, the prototype design coordination has consisted of testing extensively a ½ scale prototype and mimic all conditions necessary to lead to a final prototype. The final prototype will be used through the real life supply chain where extreme climatic conditions can be met.

The design of such prototype was done taking into account not only the technical success criteria but also by analysis the environment and its system as shown in below table.

Additionally, the last 6 months were used to draft a business model and understand key indicators related to commercialization that ensures wide adoption of the technology (as opposed to technical KPI's described in D17.22).

Completed environment & system analysis

The PG demonstration consists of:	**Environment analysis**
Completing the design and construction of lead prototype (based on Sunwell unique proprietary technology (ICECUBE). This will be	The device design/construction and testing is based on agreed technical success criteria such temperature profile along the supply chain, trip

led by Sunwell along with P&G with in-depth collaboration with partners (Maersk/DHL). The prototype will be deployed inside 1 seatainer and/or truck and be used in existing supply chain routes.	duration, custom clearance duration and process. Above assumptions and hypothesis change would impact directly the readiness and demonstration phase. A very close collaboration with the key partners who provide and validate some of those hypothesis is needed to ensure those hypothesis are always up to date and communicated timely among partners.
The demo integrates and validates procedures and interfaces through real time seatainers and truck transport conditions during CORE lifetime. This full scale trial will consists of using P&G supply chain with the lead of DHL and MAERSK in transporting and validating the technology against established KPI	This LL integrated existing procedures and interfaces. Should any change in procedure/interface occur the demonstration will be impacted directly. The demonstration relies on full readiness of ICECUBE technology + smart Sensors from DHL along with MAERSK proprietary IT systems currently used in its ships. In addition this demonstration will be used to understand what are the new procedures and interfaces needed on the entire supply chain – including reverse supply chain.
This Living Lab might allow real time data gathering and validation report against agreed KPI as well as additional data recording during the reverse logistics supply chain.	This demonstration allows collection of data such as temperature profile, humidity, position, etc. Collecting above data is critical as it allows to assess CO2 impact along with other including technical performance. Any failure or lack of data collection system will directly impact assessment of system performance.

Table 2-1. Environment and system analysis

Business model assessment

A draft business model was shared in D17.22 report as shown below.

<table>
<tr>
<td rowspan="2">Key Partners
• Third Party Owner
• Forwarder (DHL/MAERSK)
• SUNWELL</td>
<td>Key activities
• P&G loads ICECUBE in dry container
• P&G loads consumer goods in a more sustainable and lower cost manner</td>
<td rowspan="2">Value proposition
• Maintain goods at mild temperatures on entire supply chain while delivering Low carbon footprint at low cost</td>
<td>Customer relationship
• Active relationship via marketing activities
• Frequent connections with TPO
• Frequent connections with forwarders</td>
<td rowspan="2">Customer segments
• Mild temperature control supply chains
• Mild temperature operation</td>
</tr>
<tr>
<td>Key Resources
• ICECUBE
• Consumer goods
• Standard transport technologies (e.g. dry containers)</td>
<td>Channels
• Distribution via direct contact to the suppliers (TPO and forwarder)</td>
</tr>
<tr>
<td colspan="3">Cost structure
• Goods transport cost
• ICECUBE renting cost
• Manpower (Operating ICECUBE)</td>
<td colspan="2">Revenue Streams
• Revenue from delta cost of current Reefers systems versus ICECUBE.
• Assumes ICECUBE is significantly cheaper than current best alternative (Reefers)</td>
</tr>
</table>

Table 2-2. Initial P&G business model

To make ICECUBE commercially attractive, a certain number of success criteria had to be met. In the last 6 months, we have partnered with INNVENTURE, a business venture specialized company, to evaluate the below success criteria and proposed option to increase the overall business values:

<u>Re-usable ICECUBE & reverse supply chain</u>

The original supply chain involved the ICECUBE system to be loaded into the containers with P&G products, thereafter transport both products (P&G and ICECUBE) to final location and unload both systems and return empty ICECUBE to original sending location via a third party partner. This supply chain was found to drive a high transport cost – resulting in a negative Net Present Value.

The revised supply chain – which increases the business value, assumes a filled Container+ICECUBE during the reverse supply chain, via a third part operation. In other words, ICECUBE technology would be used to chill products on both going and return legs. This would ensure that the overall cost of ICECUBE remains competitive vs today's reefers cost.

Life time > 10 years
The total value of ICECUBE can be evaluated on cost per trip– which is highly dependent on the number of trips each system can undergo. Evaluation of such lifetime has been taken into account to estimate the unit cost which generates positive net project value. Due to the novelty aspect of such technology, there is a risk related to the estimated lifetime versus observed lifetime. The new business model with reverse supply chain increases the value proposal – even with the same lifetime as it gives the opportunities for the cube to be fully utilized. ICECUBE technology efficiency increases with the possibility to be used in both legs. In fact an unused ICECUBE system (on return leg) increases operational cost while not delivering any value.

Prototype design test (ST17.3.1.3)

Completed set up with physical concept (prototype)

During the last 6 months, a 1/2 scale prototype was designed, constructed and tested from both a thermodynamic and operability point of view (in a new-to-the-world type of development there are several steps foreseen: modelling and simulation, 1/10 scale or lab prototype, 1/2 prototype, full scale prototype which in our case will be the demonstration prototype). The first test validated the concept efficiency in cooling P&G loads over a long period of time. The second test focused on user case of operability and validated the “easy to use” concept of the prototype. Some improvements are needed to make the concept light and easier to use.

In addition, the key performance indicators related to this LL are:

- Lower cost versus reefer containers (leading to positive NPV)
- Lower carbon footprint emission.

Besides there are some technical performance indicators – highlighted in D17.22 but they are considered less important than the above key performance indicators.

With regards to the lower carbon footprint emission, an initial estimate measurement of the baseline data for carbon footprint was performed in accordance with the terms and conditions of Sustainable Development Technology Canada (SDTC) funding and of the System of Measurement and Reporting for Technologies (SMART)* guidelines (confidential reports), this SMART report was developed to evaluate greenhouse gas (GHG) and environmental impacts mitigation potential of Sunwell’s Deepchill Thermo Battery Wrap technology used in context of P&G shipment of 250 trips per year from Europe (France to South Africa).

For the demonstration project, the GHG reductions achieved by the Sunwell technology have been projected to be reduced by 44% (from baseline of 70,539kg/year to 39,359 kg/year).

Technical testing of ½ scale prototype.

A construction and testing of ½ scale prototype was done. 15 additional tests of the same prototype were carried out by Sunwell in order to have a complete statistical set of results and refine analysis. Consequently, additional tests were also used to troubleshoot some of the physical and mechanical minor issues found during the initial prototype tests. The additional tests concluded that the heat exchange coefficient value is within the target range with a confidence level of 85%.

Current status of the demonstrator in the Living Lab methodology

The current status of the Living Lab has reached the implementation and evaluation phase of the 2nd cycle.

The first 18 months focused on understanding and designing technical solutions related to T17.3. Emphasis was on solving technical challenges related to heat transfer, operability etc. However, during the last 6 months, the Living Lab has focused on “theoretical trade lane testing” and data collection and recording using modelling and simulation technique.

Actions performed since last report– Data collection and recording (using Modelling and simulation)

The development of the simulation has been an iterative process. In this M24 deliverable, the current status of the implementation process is described, including restrictions and assumptions on the simulation components and the used data. In order to simulate the P&G scenario two components are used:

- CORE-SE (CORE Simulation Environment)
- D^3 Heat Transfer model

The D17.22 report highlighted important technical tests done on the prototype along with the environmental analysis. The last 6 months actions involved mainly the simulation of the trade lane along with its risks in order to better plan for the real life demonstration phase.

Over the last 6 months, Sunwell, P&G and ISL have been collaborating to introduce new functionality to the D^3 heat transfer model. In the past, to provide reasonable ambient condition inputs to the D^3 model, Sunwell had collected data from various sources and provided this as an input. To increase the integrity of the ambient condition inputs, ISL has constructed a computer-aided model that calculates all relevant ambient conditions throughout a shipment as a function of the container’s location and the time of year based on historical data. Sunwell and ISL have done some preliminary work to integrate these two models together, such that the outputs of ISL’s model become inputs to Sunwell’s D^3 heat transfer model.

Decisions made since last report

WHEN	Technology related	Project management related
22 SEP 2015 Face to face meeting (Spain):	• P&G shared early results of the ½ scale prototype testing. Positive results (thermodynamic + operability scope) and minor modification needed to comply with operability success criteria	• The Customs issue is still open. There is ongoing collaboration with DHL for the use of smart sensors. P&G shared the needs for help in (a) scaling-up the solution; (b) resolving the Customs/cross-border issues; and (c) finalizing the technical specifications for the full-scale solution. • Updated the D17.22 report with partners.
		• Bilateral meetings with Nick D. ESC: two bilateral meetings took place to discuss with some of the WP15 and WP17 partners their management of confidential data as well as to discuss their answers to the questionnaire that is part of the data collection required for the CORE demonstrator based requirements analysis.
17 Nov 2015: Internal meeting with P&G high	• We reviewed technical results of the prototype tests and showed mutual interest in solving the	• P&G and Sunwell agreed to bring in a third party and define a commercial strategy with the 3rd partner. We also agreed that it would make sense to ask the 3rd party

management and Sunwell (Phone conference):	reminder minor issues related to operability.	to help with some of the mass trials ahead of market.
18 Dec 2015: P&G / Sunwell face to face meeting with Innventure:		• Innventure presentation • P&G/Sunwell and project introduction • Presentation of work done over 18 months + alignment on key KPI to assess the technology on • Innventure commitment to assess the technology global commercial strategy over 14 success criteria and provide results by April'16
9 Feb 2016 WP17.3 video Core conference call:	• P&G shared additional prototype testing data to validate statistically initial performance value – P&G concluded there is a probability of >85% to reach the set value during the physical ICECUBE testing on real demonstration	• P&G shared the collaboration with a venture capital company to evaluate ICECUBE business model and propose a concept which includes all big global players to facilitate ICECUBE adoption worldwide • Partners discussed about the set-up of the demo from a modelling and simulation point of view. ISL/Sunwell shared initial draft scope of simulation and requested help to gather some of the data • P&G shared the potential change in the trade lane due to the P&G operation (Mataro plant) being sold. CORE amendment to reflect this change was initiated by ZLC.
18 Mar 2016 WP17.3 video core conference call:	• Rainer ISL presents the simulation of the P&G trade lane. Disturbances in the supply chains can be simulated by the simulation tool. The goal is to simulate worst case situations and related performance of the ICECUBE unit. • ISL simulation tool, in the future, could also try to catch the effect of reefers heating each other when they are placed close.	• Partners agreed the simulation model done for M24 is a first step. The end goal consists of an integrated model which predicts performance based on trip duration and location. This could serve for shipping containers with or without ICECUBE. No timeline was agreed yet. • Partners engaged in discussion on how the simulation tool can be integrated with some of the simulations done in other WP. CORE SE can be simulated and the outcomes passed to Inlecom's visibility tool.

Table 3-3. Decisions made since last report.

The ambition scope, way of execution and solution direction have not changed since M18

Dissemination activities performed during past months

Over the last 6 months, most of the dissemination activities have been kept internally or among WP17.3 partners mainly due to:

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- The focus on developing the prototyping along with modelling and simulation.
- The Confidentiality aspect of the new to the world technology,

With regards to P&G, the project has had regular project reviews with P&G higher management as detailed below:

- October 2015 – Review with R&D Vice President Home Care
- January 2016 – Review with R&D Director + review with external venture capital company INNVETURE
- February 2016 – Internal project update via P&G online channel.

However, some of the scope of the project will be disseminated in the near future. Additionally, we are planning to publish internal newsletters and publish articles in professional magazines as soon as we have done the activities highlighted in ST17.3.2.2 Sea shipment.

Qualitative description of the demonstrator results

Initial results from Modelling and simulation

Introduction

The simulation model has been validated. In particular, the weather data have been validated by the ERA-Interim climate data and the transport flow have been validated with schedules and routing algorithms.

In total, 4 simulation runs have been made which are covering two different time periods and two different settings concerning the loading time. The different periods have been selected in order to simulate worst case scenario and have maximum temperatures as depicted in existing trade lane between Spain and South Africa.. The different loading times (2 days and 5 days) have been selected in order to model disturbance in ports (e.g. strike in port):

While multiple trials were conducted throughout this development, one scenario was chosen specifically for a deeper assessment, as is conducted below. In this scenario, a 40’ dry container using the D^3 system is shipped from Mataro, Spain to Durban, South Africa. The simulated shipment departs on July 9, 2016, and arrives on August 21, 2016. It is assumed that there are delays in the outbound port resulting in a relatively long duration of shipment. As it can be noticed ground temperature spikes more than air temperature. This is normal, since ground normally is more reactive to solar radiation than air. Respectively, they are plots of the ambient temperatures and solar radiation incident on a horizontal surface versus time. Respectively, they are a plot of the container and product temperatures and Deepchill mass expiry versus time, and a map containing labelled positions indicating the remaining thermal battery charge level for 5 specific days during the journey.

Discussion of Results

Within the scope of this simulation, there are 2 objectives. The first is to develop a simulation tool that can reliably evaluate the performance of the D^3 system. This reliability starts with the use of realistic inputs (ambient conditions) and extends to an accurate evaluation of the D^3 system's performance based on these inputs. The second objective is to evaluate the D^3 system's performance for one specific case in which products are shipped on one of P&G's trade lanes. Both of these objectives are discussed below.

The successful integration of ISL's ambient-condition simulator with Sunwell's D^3 model allows us to achieve the first objective. ISL's model calculates ambient conditions based on real data recorded for recent years. From a brief glance at these values, it is clear that they appear to be realistic. Sunwell's recent refinement of the D^3 model allows these inputs to be translated to useful outputs consistent with the trends observed in real test data. That these 2 models have indeed been successfully integrated into a simulation tool able to assess the performance and limits of the D^3 system is evident by the meaningful results shown above.

Concerning our second objective, we seek to answer 2 questions. These questions are:

- (1) Does the D^3 system protect the payload from thermal damage?
- (2) Is there sufficient thermal energy available in the D^3 to do so during the entire shipment?

It is seen that the product temperature starts at 25 °C on the first day, and during the 7th day, this temperature has increased to 30 °C. At this point, the D^3 system begins actively using the stored thermal energy to cool the payload, as is visible from the increase in the data series "m,Deepchill,active". Over the course of the journey, roughly 180 kg of Deepchill are calculated to expire as a result of this active cooling. It can be seen that the products are successfully maintained below their critical temperature of 35 °C.

Figure 4-4 (in the full report) provides a visual representation of the thermal energy charge level available in the D^3 system. This figure accounts for Deepchill expired as a result of both active cooling and passive heat gained by the D^3 thermal battery (note that Figure 4-3 shows that only for active cooling). It is seen in figure 4-4 (in the full report) that a substantial proportion of Deepchill expiry occurs by Day 23, which reflects the fact that the D^3 system is only active between the 7th and 17th days of the shipment, as seen in figure 4-4. On the final day of shipment (Day 44), roughly 40% of the thermal energy is seen to remain. Therefore, we conclude that there is indeed sufficient thermal energy stored in the D^3 system to protect the payload from experiencing thermal damage.

Conclusions and Next Steps

The objective of the modelling and simulation practice was to evaluate the performance of the ICECUBE in the designated supply chain area. In order to evaluate this, 2 models were developed and combined into a single model. The 2 subsequent actions were to first develop a simulation tool that can reliably evaluate the performance of the D^3 system. This was accomplished by successfully performing a preliminary integration between ISL's ambient condition calculation model with the D^3 model. The second action was to use this tool to perform one such evaluation for a shipment of products from Spain to South Africa. This was completed, and the D^3 system was concluded to successfully control the payload temperature, and to do so by using roughly 60% of its total thermal storage capacity.

From this simulation we can conclude that we have some confidence that the total ICECUBE load is sufficient to undergo severe climatic conditions from Spain-South Africa while keeping the product temperature at set value. Next steps include combining both models into a user friendly model and expanding it to the full global trade lane matrix. Such model would be able to predict for any duration and any goods what would be the performance of ICECUBE in normal shipping container.

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Next steps (next 12 months)

Modelling and simulation – combining both CORE-SE and D3 heat exchange model

In this LL, 2 models are being used to simulate one identified trade lane. D3 heat exchange model used input from the CORE-SE model. The ideal model should be a combination of the 2 models which simulation all possible trade lanes in order to predict the performance of ICECUBE and its needed payload.

Hence next steps include combining both models into a user friendly model and expanding it to the full global trade lane matrix. Such model would be able to predict for any duration and any goods what would be the performance of ICECUBE in normal shipping container.

Technical testing ahead of full scale demonstration on existing trade lane

There are a number of steps and tests required to complete the design/testing of the prototype. Those steps are necessary and lead to a full scale demo. Those steps consist of:

- Full scale Prototype re-design based on learning from ½ scale prototype testing.
- Full scale prototype testing at manufacturer.
- Demonstration plan + pre-testing (at manufacturer) success criteria definition.

Real life demonstration test – using existing trade lane

Phase 1 of this demonstration focused on developing a very performing prototype according to the set KPI, the second phase of the project aims at performing a full scale on the agreed trade lane as highlighted in tasks T17.3.2 (Sea Shipment and positioning)

This test will be used to confirm initial tests as well as validating the modelling and simulation results.

Environment risk analysis and mitigation plan

As highlighted in D17.22, there are some risks related to the custom clearance procedure of a new-to-the-world technology. Such risks are unknown at this stage.

The next steps involve linking with both Spanish and South African customs (not part of the consortium) in order to understand the required procedure for customs clearance. In the meantime, investigation will focus on how to make ICECUBE meet the temporary export clearance in order to avoid paying tax and duties for each export.