Comments on the draft Short-Lived Climate Pollutant Strategy

submission by shecco

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shecco strongly supports Air Resources Board's plans to reduce F-gas emissions by 40% by 2030 in California. Comments on the draft Short-Lived Climate Pollutant Strategy reflect some of the key concerns for the natural refrigerant industry, especially, regarding the proposed HFC measures.

Given that already a large number of companies are already based in California (either with US headquarters or with manufacturing plants and sales offices), the State has the **potential to become a leader in cutting edge climate friendly refrigeration and air conditioning technology** using natural working fluids such as CO_2, ammonia, hydrocarbons, water and air. shecco has identified **at least 17 natural refrigerant companies**, including system, component manufacturers who have their US headquarters in California (see Annex 1 with more information). In addition, there are a large number of companies that have their offices and manufacturing facilities in California, while being headquartered in other U.S. States. This is a clear sign that **California is a hub for innovative, forward-looking companies**. Clear and ambitious regulatory environment would stimulate innovation while rewarding those that have already made the necessary steps in the right direction.

The natural refrigerant industry is facing a difficult situation with their customers who say that they do not need to make the transition because there is no regulation forcing them to do it or it is too expensive. This is where ARB could play an essential role by saying that it is possible, setting a deadline and helping companies to transition, partnering with training institutes and with utilities who will incentivize this transition.

COMMENTS SPECIFIC TO PROPOSED HFC MEASURES

The draft SLCP Strategy has identified 4 measures to address the emissions of HFCs. shecco supports the approach of combining several measures with the aim of reducing the use and emissions of f-gases.

HIGH GWP REFRIGERANT PROHIBITIONS IN NEW STATIONARY SYSTEMS

shecco supports ARB's plans to ban high GWP refrigerants in new stationary refrigeration and air conditioning systems. Bans on HFCs give industry clarity for their investments and allow for competition among innovative companies.

The table on **Natural Refrigerant Commercial Availability Across the USA** (2015-2030) (see Annex 2), which was submitted to ARB earlier in July 2015, outlines by application when HFC-free equipment can become commercially available in the U.S. The assumption for this evaluation, which has been done in cooperation with a number of industry experts, is that the HFC-free technology would be at least as energy efficient or more than conventional HFC equipment. According to industry experts, the technical feasibility of natural refrigerant-based systems in refrigeration and air-conditioning applications is not an issue. The commercial availability assessment outlines what the industry is capable of delivering provided that their actions are stimulated by the right legislative framework. The experience from other countries and regions shows that HFC bans with a specific deadline in the future are the most effective measure that stimulate the transition to HFC-free technology.

Introducing a **GWP threshold of 150 for HFC bans** would accelerate the market change towards climate friendly technologies, such as those using natural refrigerants, instead of introducing short-term or 'interim' solutions. Natural refrigerant technology is already available across a number of sectors in the United States, while innovation continues for sectors where the use of natural refrigerants is at early stages. shecco calls upon the ARB to be more ambitious on the GWP threshold as even much lower than 150 GWP would be feasible for the natural

refrigerant part of the industry.

Huge progress has been made in the refrigeration industry in the last few years. For example, manufacturers have been able to develop systems with very small ammonia charges, which address the concerns regarding ammonia toxicity. Moreover, this equipment is more energy efficient than conventional systems - it was suggested that the energy efficiency improvements are around 18%. Data collected by shecco indicates that there are already **22 low charge ammonia installations in the U.S.**, with 2 located in California. In addition, **10 CO_2 trancritical and 25 CO_2 cascade / secondary industrial refrigeration** installations already exist in the U.S.. Out of these 2 and 16 are located in California, respectively.

Commercial refrigeration is another sector, where the use of different natural refrigerants has matured in the U.S and other regions. According to data that shecco collected from system suppliers and end-users over **6,500 CO_2 transcritical supermarkets exist globally**, a large majority of which in Europe. This is a result of regulatory measures on HFCs that have pushed the industry in this direction. In the U.S, already 52 CO2-only installations exist. **California is the state with the highest share of CO_2 trancritical supermarkets today (20)**.

A comparison between a CO_2 transcritical store in Turner, Maine and an HFC-based one in Bradford shows relative parity between the energy consumption of the baseline and TC CO_2 stores, a reduction in climate impact and potential additional operating cost benefits attributable to the use of a TC CO_2 system. This suggests that TC CO_2 supermarket refrigeration systems is a viable alternative to HFC-refrigerant-based systems on a case by case basis when considering climate impacts, especially in cooler climates. The TC CO_2 booster system at the Turner supermarket showed month-to-month energy consumptions within +/-20% of the conventional HFC system at the Bradford store, and the Turner store exhibited a 15% overall reduction in climate impact compared to the baseline HFC store in Bradford. Additionally, the system showed no issues with reliability or utility when compared to legacy HFC systems such as that used in the Bradford store.[1]

Natural refrigerant technology is ready to take off in different applications, however, the industry needs regulatory measures, such as bans on high GWP refrigerant in new systems, to help them bring the technology faster to market.

FINANCIAL INCENTIVES

shecco highly supports ARB's measure to introduce financial incentives, such as loans and grants, for early adopters of low GWP refrigerants. **End-user acceptance of new technology is a barrier that the industry is facing when introducing new technology in the market**. The cost plays an important role in the selection of the technology from a consumer perspective. There is a risk that short-term solutions are adopted, which in the long-term do not provide the benefit of low GWP and high energy efficiency.

Companies working with natural refrigerants make huge investments into innovation. The new technology has usually higher cost than the conventional systems before it reaches higher production levels. The industry attracts a few early technology adopters but the most difficult step

[1] Navigant Consulting, Inc., Case Study: Transcritical Carbon Dioxide Supermarket Refrigeration Systems, http://energy.gov/sites/prod/files/2015/02/f19/Hannaford%20Study%20Report%201-22-2015_CLEAN.pdf

is to convince the rest of the market. Most of the time, customers and end-users, which approach manufacturers, try to get short-term solutions, just by looking at the acquisition costs.

Natural refrigerant technologies need to be supported in their early introduction in the market. It is especially small and medium- sized companies that require incentives. These could be tied to energy efficiency and low-GWP threshold limit, such as GWP of 150.

There is a need to **distinguish between natural refrigerants and other chemical low-GWP refrigerants**. These two groups of refrigerants are very different and the industry would like to see incentives that would explicitly create opportunities for natural refrigerants. Examples from other regions, such as Japan, show that direct support of natural refrigerant-based equipment has positive impact on the industry and the introduction of technology, which becomes more affordable over time as it reaches higher production volumes.

In Japan, the "Eco Cute" hot water heat pump using CO_2 as the refrigerant has been a run-away success over the past decade. It is estimated that four million units have been installed so far. Annual sales are now at 400-500,000 units per year, to reach a market share of 98% of all new residential hot water heaters in the country. This number is likely to reach 10 million units by 2020.

High-level government support has been a major factor in the success of Eco Cute CO_2 heat pump water heaters in Japan. In 2005, the government announced a target of 5.2 million units to be installed by 2010 under its "Kyoto Protocol Target Achievement Plan ". This national Plan also noted that local governments were expected to take initiative in introducing CO_2 heat pump water heaters in line with the "Law on Promoting Green Purchasing".

Not only were equipment manufacturers eligible to receive grants for technology R&D activities, a governmental subsidy scheme for buyers, which aimed to halve the cost difference of the price between an Eco Cute and a conventional boiler, was also established in 2002. Additional cost for customers was reduced by about $1,500 and customers could recover it in about 3 years. Each year, the amount of subsidy decreased in proportion to the price decrease of Eco Cute. After 2006, the subsidy scheme was changed to a fixed-amount support. The subsidy in 2006 amounted to about $500 and decreased gradually[2]. In 2010, subsidies for household and commercial entities buying Eco Cute heat pumps became available under the 'Eco-Point Programme', which was introduced back in 2009 as a time-limited measure for energy-efficient appliances. Eco Cute in residential use was subsidised with up to 40,000 Yen (~$330) while Eco Cute in commercial use could benefit from up to 830,000 Yen (~ $6,900), depending on the heating capacity.

PHASE DOWN IN SUPPLY OF HFCS

HFC phase down should be viewed as part of a package of measures for effectively reducing HFC emissions, and as such needs to be combined with other types of measures. HFC phase down alone does not give industry sufficient clarity on where the HFC use needs to be reduced (which sector, which manufacturer or end user).

[2] Sumi A., Fukushi K., Hiramatsu A. (2010). "Adaptation and Mitigation Strategies for Climate Change", Springer. 300-301 pp.

As a stakeholder closely involved in the EU F-Gas Regulation legislative process, shecco supports the possible establishment of a California HFC phase-down aligned with the European Union (EU) phase-down schedule. We assess that there could be room for making a national phase-down schedule proposal even more ambitious than the one agreed in the EU. Indeed during the EU legislative process, a more ambitious phase-down schedule was also considered, both in terms of the final reduction target but also the interim phase-down "steps". The final HFC phase down in the EU by 79% in 2030 represents a "compromise agreement" between the EU institutions, which takes into account the manifold regional, climatic, cultural and economic factors present in different EU Member States, ranging from those countries that are typically leaders in environmental protection and technologies to countries that pay less attention to this.

PROHIBITION ON THE SALE OF NEW REFRIGERANTS WITH VERY HIGH GWP

The prohibition on the sale of new refrigerants with very high GWP would go in line with the SNAP delisting of certain high GWP refrigerants in certain applications, but would have a more universal application on all refrigerants above a certain GWP across all sectors.

Nevertheless, a **follow-up ban on recycled and reclaimed very high GWP refrigerants**, especially in new systems should be considered to completely avoid using these HFCs.

The use of these very high GWP refrigerants (GWP > 1500) can be avoided already today, as an array of refrigerants exists with GWP below this limit to be used in different applications.

GENERAL COMMENTS

20-YEAR GWP METRIC IS MORE APPROPRIATE GIVEN THE SHORT LIFETIME OF SUBSTANCES

shecco supports the intentions to measure the global warming potential of refrigerants in 20-year horizon, which better reflects the climate impact and what can be achieved in the near-term by mitigation.

GWP metrics measure the potency of greenhouse gases (GHGs) over a specific period of time, relative to carbon dioxide (CO_2), which has a GWP of 1. The timescale chosen is particularly important due to variability in lifetime of different GHGs. The 20-year GWP index (GWP20) is better suited to reflecting the climate impact of HFCs, as the average lifetime of HFCs in use today is 21.7 years. "For the evaluation of short-term effects, a time horizon of a few decades could be taken […]", notes the first Assessment report by the Intergovernmental Panel on Climate Change (IPCC, 1990, p.58). "For the evaluation of sea-level rise, the commitment to greenhouse warming over a 100 year or longer time horizon may be appropriate". As an example, HFC32 has a GWP20 of 2,330 - which is actually higher than that for HFC410A or even HCFC22.

TRAINING ON NATURAL REFRIGERANTS NEEDS TO BE SUPPORTED

The lack of training, among others, is a key barrier for wider uptake of natural refrigerants. The industry representatives believe that training on natural refrigerants will take substantial time and support is needed.

Skilled personnel are essential in ensuring safe handling of natural refrigerants and smooth transition to the low-carbon economy. Natural refrigerants that will replace high-GWP substances have different characteristics, system layouts, components and servicing practices. **Lack of**

knowledge among technicians on how to handle these refrigerants poses a serious barrier to the market uptake of natural refrigerant technologies - the share of which is bound to rise.

Engineers are reluctant to take on new training unless they are requested by legal obligation or incentivized by public authorities or manufacturers. It is key to motivate the engineers and contractors to upgrade their training in order to ensure safe handling of new technologies and their smooth introduction in the market. There is especially a significant gap when it comes to practical training on natural refrigerants. **The government should take responsibility in incentivizing the industry in taking on a new training on natural refrigerants** through providing financial or non-financial incentives.

It is important that **promotion of NR product and promotion of training are implemented at the same time**. If there are no products in the market, the knowledge doesn't reach service people and engineers, and they don't have motivation to learn. On the other hand, if there are products in the market, but sellers like retailers and installers do not have the necessary knowledge, they do not sell those products.

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ANNEX 1

Companies working with natural refrigerants headquartered in California

Please note that the list below is not exhaustive and lists companies that have their U.S. headquarters in California. Many more have their offices and manufacturing plants located in California, while being headquartered in another U.S. State.

Amco Mechanical Inc
www.amcomechanical.com
Type of company: Engineering / Contractor
Sectors: Refrigeration-Commercial; Refrigeration-Industrial
Natural refrigerant: ammonia

Ammonia Safety & Training Institute
www.ammonia-safety.com
Type of company: Training
Natural refrigerant: ammonia

Applied Process Cooling Corporation (APCCO)
www.apcco.net
Type of company: Engineering / Contractor; Training
Sector: Refrigeration-Industrial
Natural refrigerant: ammonia

Axiom Engineers
www.axiomengineers.com
Type of company: Engineering / Contractor
Sectors: Heating – Commercial & Industrial; Refrigeration – Industrial; Air Conditioning – Commercial & Industrial
Natural refrigerant: ammonia, water

Azane
www.azane-inc.com
Type of company: System Manufacturer
Sector: Refrigeration – Industrial
Natural refrigerant: ammonia

C&L Refrigeration
www.clrefrigeration.com/
Type of company: Engineering / Contractor
Sectors: Heating – Commercial & Industrial; Refrigeration – Domestic; Refrigeration – Commercial; Refrigeration – Industrial; Air Conditioning – Commercial & Industrial
Natural refrigerant: CO2

Clipper Supply
www.clippersupply.com
Type of company: Refrigerant Supplier
Natural refrigerant: ammonia

Controlled Environments Construction (CEC)
www.controlledenvironments.com
Type of company: Engineering / Contractor
Sectors: Refrigeration – Industrial; Air Conditioning – Industrial & Commercial
Natural refrigerant: ammonia

EOS Climate
www.esoclimate.com
Type of company: Consultancy / Marketing
Natural refrigerant: CO2, ammonia, hydrocarbons

GF Piping Systems
www.gfps.com/
Type of company: Component supplier
Sector: Refrigeration – Industrial
Natural refrigerant: ammonia

Hench Control, Inc
www.henchcontrol.com
Type of company: Energy Management Systems
Sector: Refrigeration – Industrial
Natural refrigerant: ammonia

Innovative DisplayWorks
www.idw.global
Type of company: System Manufacturer
Sector: Refrigerant – Light Commercial
Natural refrigerant: hydrocarbons

NH3 Jobs
www.nh3jobs.com
Type of company: Training
Sector: Refrigeration – Industrial
Natural refrigerant: ammonia

Resource Compliance
www.resourcecompliance.com/
Type of company: Consulting / Marketing; Training
Sector: Refrigeration – Industrial
Natural refrigerant: CO2, ammonia, hydrocarbons

SCS Engineers
www.scsengineers.com
Type of company: Training; Process safety management programs; Risk management plans
Sector: Refrigeration – Industrial
Natural refrigerant: ammonia

Source Refrigeration
www.sourcerefrigeration.com
Type of company: Engineering / Contractor; Training
Sectors: Heating – Commercial & Industrial; Refrigeration – Commercial; Refrigeration – Industrial; Air Conditioning – Commercial & Industrial
Natural refrigerant: CO2, ammonia

VaCom Technologies
www.vacomtech.com
Type of company: Engineering / Contractor; Consultancy / Marketing
Sector: Refrigeration – Industrial
Natural refrigerant: ammonia

ANNEX 2

Commercial availability of natural refrigerants across refrigeration and AC sectors in the USA (2015-2030)

REFRIGERATION	2015-2020	2020-2025	2025-2030
Domestic Refrigeration	2016		
Light commercial Refrigeration (plug-in)	2017		
Commercial Refrigeration	2017		
Industrial refrigeration			
Road Transport Refrigeration	2018	2022	

AIR-CONDITIONING	2015-2020	2020-2025	2025-2030
Small room A/C (self-contained)	2016		
Multi-split / VRF A/C			
Chillers	2017		
Residential heat pumps for water heating	2017		
Residential heat pumps for space heating and cooling			
Commercial and industrial heat pumps			
Mobile air conditioning			

Legend:

	Wide commercial availability = several suppliers and sufficient production capacities
	Semi-commercial availability = few suppliers, low-volume production
	Not commercially available yet = technology in R&D or demonstration phase