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A Universal Certification System for India's Refrigeration and Air-conditioning Servicing Sector

Shikha Bhasin, Apurupa Gorthi, and Vaibhav Chaturvedi

Issue Brief | July 2020

Currently low, the residential air conditioning demand is expected to see a massive growth in India in the coming decades and with it, the need for trained service technicians.

Image: Rajesh Mallik, RASSS.

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Mr Jamshyd Godrej, who is the Chairman and Managing Director of Godrej & Boyce Manufacturing Co. Ltd., is also a member of the Board of Trustees at CEEW. It is clarified that Mr Godrej was not involved in any capacity in the preparation of this report.

Cover image: iStock.

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The Council on Energy, Environment and Water (CEEW) is one of South Asia's leading not-for-profit policy research institutions. **The Council uses data, integrated analysis, and strategic outreach to explain – and change – the use, reuse, and misuse of resources**. The Council addresses pressing global challenges through an integrated and internationally focused approach. It prides itself on the independence of its high-quality research; develops partnerships with public and private institutions; and engages with the wider public.

In 2020, CEEW once again featured extensively across nine categories in the *2019 Global Go To Think Tank Index Report*, including being ranked as **South Asia's top think tank (15th globally) with an annual operating budget of less than USD 5 million for the seventh year in a row**. CEEW has also been ranked as South Asia's top energy and resource policy think tank in these rankings for the second year running. Further, it has consistently featured among the world's best managed and independent think tanks. In 2013, 2014 and 2016 CEEW was ranked among the world's 20 best climate think tanks.

In over nine years of operations, The Council has engaged in over 230 research projects, published over 160 peer-reviewed books, policy reports and papers, advised governments around the world nearly 530 times, promoted bilateral and multilateral initiatives between governments on 80 occasions, and organised nearly 300 seminars and conferences. In July 2019, the CEEW Centre for Energy Finance was launched by H.E. Mr Dharmendra Pradhan and H.E. Dr Fatih Birol.

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The Council's Board is currently chaired by Mr Jamshyd Godrej. Some of our other illustrious board members include Mr Tarun Das, Dr Anil Kakodkar, Mr S. Ramadorai, Mr Montek Singh Ahluwalia and Dr Naushad Forbes. The nearly 80-member strong executive team is led by Dr Arunabha Ghosh.

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"The Government of India has enshrined commendable goals of regulating and improving the status of all those who work in India's servicing sector. This study showcases ways to realise these ambitions, while ensuring wellbeing of the technicians, consumers and the environment."

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Apurupa Gorthi worked as a Research Analyst at CEEW in the Technology, Finance and Trade team. She has contributed to The Council's work to address India's cooling needs and phase-down of hydrofluorocarbon (HFC). Her research interests broadly encompass climate change adaptation and mitigation policies.

"Certification is an essential requirement to create a servicing sector that is technically skilled, environmentally conscious and gainfully employed. Through this study we hope to contribute to such a certification system for India's servicing sector."

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Vaibhav Chaturvedi, a Research Fellow at the CEEW, leads the Council's 'Low Carbon Pathways' research. Previously, he was a postdoctoral research associate at the Joint Global Change Research Institute/ Pacific Northwest National Laboratory, USA. His research focuses on Indian and global climate change mitigation policy issues through the integrated assessment modelling framework of Global Change Assessment Model (GCAM). Vaibhav has a doctorate in economics from the Indian Institute of Management Ahmedabad and a master's degree in forest management from the Indian Institute of Forest Management, Bhopal.

"Quality training is a critical intervention needed to enhance the quality of human capital engaged in the air-conditioning servicing sector in India. With the servicing sector being a key focus of the India Cooling Action Plan (ICAP), standardisation of training is a must."

Image: iStock

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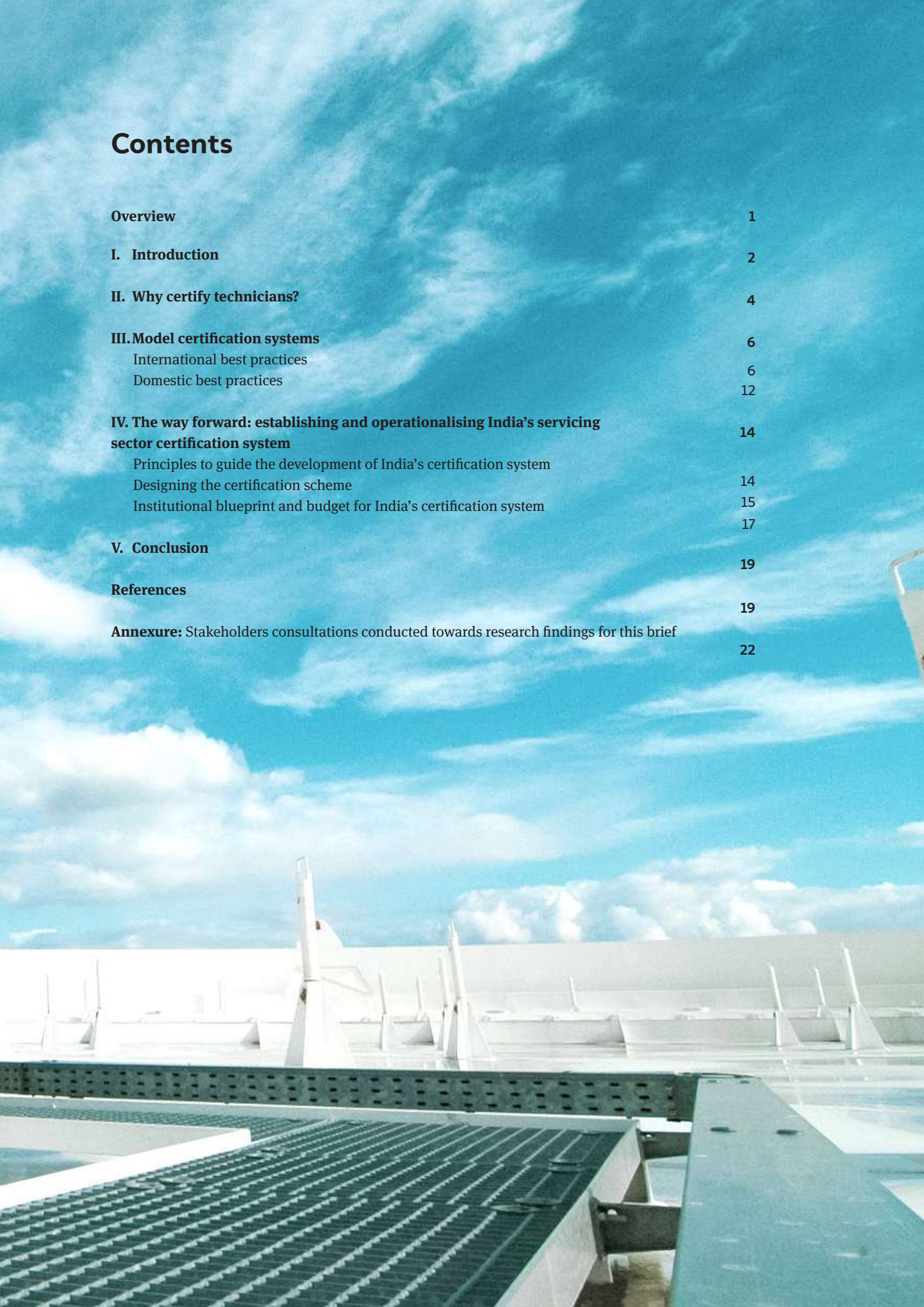


Tables

Acronyms

ASHRAE	American Society of Heating, Refrigeration, and Air-Conditioning Engineers
CAC	commercial air-conditioning
CBSE	Central Board for Secondary Education
CR	commercial refrigeration
EC	European Commission
EPA	Environment Protection Agency
ESIC	Employees State Insurance Card
ESSCI	Electronics Sector Skills Council of India
EU	European Union
EU F-Gas	European Union Fluorinated Gas
GWP	Global Warming Potential
HC	hydrocarbon
HCFC	hydrochlorofluorocarbon
HFC	hydrofluorocarbon
HFO	hydrofluoroolefin
HPMP II	Hydrochlorofluorocarbon Phase-out Management Programme Stage II
HVAC	Heating, Ventilation and Air-conditioning
ICAP	India Cooling Action Plan
INCERT	Installations Certifiering i Stockholm AB
MAC	mobile air-conditioning
MoEF&CC	Ministry of Environment, Forests and Climate Change
MSDE	Ministry of Skill Development and Entrepreneurship
NATE	North American Technician Excellence
NITC	National Inspection Testing Certification
RAC	refrigeration and air-conditioning
RPL	Recognition of Prior Learning
RTO	Regional Transport Office
STEK	Stichting Emissie Koudetechniek
UK	United Kingdom
UNEP	United Nations Environment Programme
US	United States

The servicing sector alone accounts for almost 40 per cent of refrigerant usage, and the efficiency of equipment and units remains largely dependent on installation and servicing practices.

Image: iStock

Overview

As India readies to embark on the next phase of refrigerant transition in its heating, ventilation and air-conditioning (HVAC) sector, the servicing sector is a key market area requiring significant and crucial effort. Operating and maintaining refrigerator and air-conditioning units, under the purview of the servicing sector, contributes to 40 per cent of refrigerant consumption. Optimising this usage while ensuring environmental and energy preservation are important yet difficult mandates to achieve, especially as the servicing sector in India remains largely informal.[1] Initiating and establishing a universal certification system based on minimum criteria holds the key not only to the effective management of servicing practices, servicing quality regulations, and underlying training but also to enhanced growth in jobs for those already in the sector, providing recognition and social welfare for technicians as well as ensuring their safety and that of those in the vicinity of such servicing. This brief details such benefits as well as the architecture that can enable the Government of India to implement such a certification system in line with its policy mandate as enshrined in the *India Cooling Action Plan* (ICAP).

According to OzonAction, the Secretariat of the Montreal Protocol, "certification is the means by which a person (or enterprise), as a result of training, education, external review, and assessment, receives official approval of being able to competently complete a job or task. Certification can be a legal requirement or a measure undertaken voluntarily for professional advantage. Certification schemes which are mandatory by legislation have the advantage of providing a strong incentive for technicians and enterprises to comply" (OzonAction 2015). These relate to formalisation, enhanced safety and wellbeing, training, skills, and improved livelihoods for the technicians as well as environmental, economic, safety, and competitive gains for the country as a whole.

A major goal underlying these gains is to enable a universal certification system for servicing technicians so as to regulate this workforce as one that is formally recognised and carries an assurance of a minimum level of qualification and training.

> **The *India Cooling Action Plan* aims to train and certify 100,000 servicing sector technicians by year 2022-23, and achieve universal and mandatory certification of technicians over the next two decades.**

Until the ICAP was launched, efforts to start a certification system in India were limited to trainings undertaken as part of the *Hydrochlorofluorocarbons Phase Out Management Plan* (HPMP) *programmes*. These focussed on training and skill development for technicians to be able to undertake servicing with new classes of refrigerants (see, for example, Agarwal et al. 2005; Agarwal 2004). The Electronic Skill Sector Council of India's (ESSCI's) ongoing Recognition of Prior Learning (RPL) programme is a welcome start to testing a system that will have to be scaled and differentiated significantly, given the currently informal nature of the sector as well as the anticipated growth in various cooling-related sectors. As a first, the ICAP is focussed on the establishment of a 'voluntary certification scheme through a single government entity under a single framework', and the ESSCI is managing this task, aiming to reach 100,000 refrigeration and air-conditioning (RAC)[2] technicians by 2022. However, this number is set to increase at least ten-fold over the next two decades. The next two decades will also see an influx of new refrigerants and associated technologies. Thus, a systematic formalisation and validation of technicians and their knowledge is paramount. This is no mean task for the government to manage alone. The private sector will have to rise to the occasion and not only partake in this transition from the perspective of product diversification but also be more responsive in readying the servicing sector to this end.

This brief highlights the institutional setup (with public and private actors) needed to effectively manage the certification system, where the latter is

1. Definition for the formal and informal sector is based on Sridhar and Chaturvedi (2017). They considered formal sector as service centres authorised by manufacturers (provide services under warranty or have access to official spare parts) and multi-brand centres which are registered enterprises (not authorised by manufacturers). They further clarify that self-employed individuals and own-account or unregistered enterprises constitute the informal sector.

2. In a previous CEEW publication, residential air-conditioning was abbreviated to RAC. However, as per the ICAP, RAC refers to refrigeration and air-conditioning sector. The ICAP definition of RAC has been used in this brief.

independent of the training centres in the long term, and puts forward core principles that the design and functionality of this certification system must reflect, including but not limited to, equity, preservation of the environment and safety, improved job opportunities and growth, and easier access to social welfare programmes. Only when these qualifiers are met will the success of a certification system be realised.

I. Introduction

India is one of the largest economies in the world today. As it develops and grows, its populations' access to energy, income, and standards of living as a result of that development are also expected to increase. Given the heat stress and climatic conditions to which several million Indians are exposed, the demand for thermal comfort in general, along with a surge in RAC, are poised for significant growth. According to Government of India estimates, RAC demand is set to grow over eleven-fold in the next two decades, from a meagre 8 per cent penetration rate of household use today (Ozone Cell 2019). This anticipated growth is a welcome harbinger for the general wellbeing, health, and productivity of the population as well as for sustaining industrial growth and competitiveness in India.

However, as the effects of climate change and heat stress become increasingly pronounced and the timeline to scale climate actions retracts, it is paramount that this growth be met in as sustainable a fashion as technology and markets can allow. Given that much of India's existing cooling still relies on older generations of refrigerants that contribute directly to climate change, and energy demand is already pressed by the minimal air conditioners in use in the country today, India must take the lead in championing cooling access for its populations—across a range of sectors that include households, industry, cold chain, transport, commercial buildings and others—all with the aim of promulgating less global warming.

Two key factors can impede this cooling-induced warming in a business-as-usual format.[3] One relates directly to the energy usage and efficiency of the equipment; the other requires a shift to low-global warming potential (GWP) refrigerants that are also ozone-friendly. India has already made considerable strides in affecting consumer preferences for higher efficiency equipment and has an energy efficiency labelling programme that is both successful and ambitious.[4] Moreover, it has successfully negotiated and committed to a global timeline to transition to these refrigerants.

Image: Pramod Pungaonkar, ISHRAE

3. Business-as-usual does not account for other not-in-kind cooling technologies that may emerge on the market.
4. For more details, please refer to CEEW 2020, Energy efficiency/household RCT report.

Source: CEEW Roundtable (2019)

"Manufacturers have a predetermined sales target. Hence, they give free services with the product. But that compromises the quality of installation and servicing practices."

Pramod Pungaonkar, State President Maharashtra, RASSS

However, a common and critical factor that needs to be readied to truly bring out energy savings and refrigerant transitions' success lies in the installation, operation, and maintenance of these systems. Commonly addressed under the purview of the 'servicing sector', these practices are crucial for realising efficiency gains and successfully incorporating refrigerant management and transition targets for India.

The ICAP, a seminal policy document which provides an 'integrated vision towards cooling across sectors' while simultaneously lowering cooling demand, facilitating refrigerant transition, enhancing energy efficiency, and promoting technologies over the next twenty years, reiterates the significance and criticality of the servicing sector. With an entire section of the ICAP dedicated to this end, several intertwined and simultaneous goals have been set forth. These relate to formalisation, enhanced safety and wellbeing, training and skill ability, and improved livelihoods for the technicians as well as environmental, economic, safety, and competitive gains for the country as a whole. A major goal underlying these enlisted gains is to enable a universal certification system for servicing technicians so as to regulate this workforce as one that is formally recognised and carries an assurance of a minimum level of qualification and training.

A major goal to achieve the gains from India's servicing sector is to enable a universal certification system to regulate this workforce as one that is formally recognised and carries an assurance of a minimum level of qualification and training; wellbeing and safety.

According to OzonAction, the Secretariat of the Montreal Protocol, "certification is the means by which a person (or enterprise), as a result of training, education, external review, and assessment, receives official approval of being able to competently complete a job or task. Certification can be a legal requirement or a measure undertaken voluntarily for professional advantage. Certification schemes which are mandatory by legislation have the advantage of providing a strong incentive for technicians and enterprises to comply" (OzonAction 2015).

Based on extensive desk research and in-depth stakeholder consultations across government agencies and industry as well as servicing sector associations, non-governmental implementing

Source: Pramod Pungaonkar, ISHRAE

agencies and training partners, as well as nodal agencies operating relevant training and certification programmes in India's servicing sector currently, this issue brief outlines the benefits, criteria, and a way forward to establishing and executing a universal certification system in India for servicing technicians as a goal enshrined in *India's Cooling Action Plan*.[5]

The following section makes a case for establishing a certification system that recognises the skills and qualifications of servicing technicians such that their safety and wellbeing is ensured, environmental preservation is made a priority, and the increase in jobs and associated qualifications expected this sector can be regulated. Section 3 offers lessons and examples of model certification systems that exist globally in the servicing sector, as well as domestic best-case practices that have been implemented in India so far. Finally, drawing on these lessons and the current status of the sector at large in India, Section 4 highlights principles and the blueprint for designing a certification system in India.

"The government cannot keep subsidising skill development and recognition. India is a consumer-driven industry as opposed to the manufacturer driven industry in the US. Where is the business case for the training and certification centres? What is model that we can come up with?"

Mr Vikram Murthy, past President, ISHRAE

II. Why certify technicians?

The current servicing sector in India is largely informal, and several thousand servicing technicians remain unrecognised. The Government of India estimated there to be approximately 200,000 stationary air conditioner servicing technicians in 2018, while the industry estimates over ten times this amount. Attempting a certification system will, first and foremost, enable these job-holders to be identified and ultimately provided with formal recognition of being qualified for this industry. This is paramount, given that the servicing sector alone accounts for almost 40 per cent of refrigerant usage, and the efficiency of equipment and units remains largely dependent on installation and servicing practices. While no such estimate exists for India, global studies indicate efficiency sub-optimisation of up to 60 per cent, contingent on equipment not being properly maintained and servicing poorly implemented (Frankel, Heater, and Heller 2012). Moreover, as the refrigerant transition takes hold of industry dynamics in India, the servicing sector must be ready to identify and work with a suite of gases and ensure safe handling and proper leak prevention so as to minimise emissions directly resulting from refrigerant leakage and venting as well as ensure safety and on-job security.

The benefits of enabling a universal certification system for servicing sector technicians would include addressing these concerns, but also several others as noted below.

First, as the demand for cooling increases, so will the number of jobs in the servicing sector. On the shy side of estimates, these are to grow ten-fold to over two million. This is a sizeable labour force and will require training and skill development to ensure that this demand is met and jobs are optimised. Establishing a certification system will allow licensed, recognised technicians to benefit from job enhancements and will optimise the need for underlying training and qualifications to benefit servicing quality and effectiveness.[6]

5. Annexure 1 lists all the stakeholder consulted for developing this brief.

6. CEEW, as part of this project, has also researched and published a study on enhancing the training curricula for servicing sector technicians. This can be accessed at https://www.ceew.in/publications/safety-upskilling-and-good-servicing-practices-cooling.

As the refrigerant transition takes hold of industry dynamics in India, the servicing sector must be ready to identify and work with a suite of gases and ensure safe handling and proper leak prevention so as to minimise emissions directly resulting from refrigerant leakage and venting as well as ensure safety and on-job security.


Image: Rajesh Mallik, RASSS

Second, several in-kind alternatives to hydrochlorofluorocarbons (HCFCs) and high-GWP hydrofluorocarbons (HFCs) are essentially hydrocarbons (HCs) and other natural refrigerants or synthetic substitute hydrofluoroolefins (HFOs), all of which have a different range of toxicity and flammability and operate at different pressures. Alternatives and lower-GWP variants of HFCs are already making inroads into the Indian market, as internationally. Proper handling of these refrigerants is therefore crucial for the wellbeing of the technician but also for those in the servicing vicinity. Certifying and recognising technicians according to the refrigerants they are able to handle has thus been recognised as a necessity in the HVAC servicing sector in India, as in many countries around the world. A licensing or certification system that validates a technician as able to handle different types and classes of refrigerants (and associated with that, the type of oil and other necessary precautions) will be an extensive, important measure to ensure safety for those on the job as well as those exposed to the servicing practices in their houses/offices.

Third, from a technical perspective, it is well established that servicing practices hold the key to energy efficiency as well as environment-friendly handling and maintenance of HVAC units (Ozone Cell 2017; GIZ 2019). As already highlighted above, this consensus has largely escaped general servicing sector technicians in their substantial role herein (Sridhar and Chaturvedi 2017), as well as consumers who are paying for such servicing in India.[7] Thus, enabling a certification system which tests for such practices will enhance the training and due given to these. Such practices include proper handling and disposal of refrigerants, better management of recycling and reusing of gases instead of direct release into the air, and several other practices that optimise the unit for enhanced energy efficiency.[8] If India's certification system for servicing sector technicians is rolled out in conjunction with a mass awareness programme, it may also encourage the consumer to check for specific servicing practices being undertaken to enhance the optimisation of their AC units for cooling and efficiency as well as the environment.

Establishing a universal certification system will benefit the servicing sector as a whole.

- Regulating and addressing the increase in servicing sector jobs
- Enhancing environmental best-case practices and preservation
- Ensuring safety in servicing provision (new refrigerants)
- Formalisation of the servicing sector, and enhanced social security

7. CEEW-Shakti forthcoming: add details of baseline RCT study here.
8. CEEW-Shakti forthcoming: add details of training issue brief here.

Fourth, given the information asymmetry that consumers are faced with today will also benefit from a certification system: it will not just qualify gases and associated qualification systems that consumers- private and commercials- should look for when hiring servicing technicians, but also benefit optimising of energy usage of the product and raise awareness of the environmental implications of the products that consumers are buying.

Finally, establishing a certification system would enable not just a regulatory overview of servicing sector technicians but also a way to gradually assimilate these technicians into the formal economy. Having access to these technicians may enable different agencies, as the government nominates, to contact them for regular upskilling programmes and enhance their learning for better livelihood opportunities. It will also facilitate the technicians' access to different social security programmes and regulatory mandates such as on-job insurance schemes, minimum wages, personal and family health insurance, and other welfare schemes that the government initiates which may target members of the servicing sector by way of demography but may not be easily accessible or targeted to those still in the informal economy, for example, the *Pradhan Mantri Suraksha Bima Yojana*, the *Employee State Insurance Card* (ESIC), *Ayushman Bharat*, and others.[9]

III. Model certification systems

A robust set of regulations and standards is imperative to build a comprehensive certification infrastructure. One such example is that of Regulation (EU) No 517/2014 (hereafter EU 517/2014), or the European Union (EU) Fluorinated Gas (F-Gas) Regulation. This sub-section highlights key lessons for India from various implemented policies within Europe and discusses two large certification and licensing systems at play in India for driver's licences and school certifications.

International best practices

A detailed set of certification requirements was defined in EU 517/2014 (European Commission 2018a).[10] This document laid out the functions of certification and evaluation bodies for procedures on certificate issuance and minimum requirements for examinations (European Commission 2018a). All EU member countries and others, like Norway, have adopted these regulations to create a certification system (see Table 1). It is further evident that the EU certification system undergoes periodic updates (for instance, European Commission (EC) 842/2006, which was later repealed, preceded EU 517/2014). Such revisions also address the limitations of the preceding system in defining the new set of regulations.

Another interesting feature of the EU certification system is that it is decentralised; therefore, member countries are responsible to implement F-gas regulations. Thus, training and procedures under certification in the EU are implemented in the languages most preferred by Member States. Further, each country has either integrated Regulation (EU) No 2015/2067 (hereafter EU 2015/2067) into its existing system or has adopted additional requirements to support its implementation. For example, the United Kingdom (UK)[11] has a robust government-


gaonkar, ISHRAE

9. This is a part of CEEW's ongoing research, and may be accessed here: APG blog on social welfare schemes.
10. Specific certification mandates can be found under (EU) No 2015/2067.
11. While the UK is no longer part of the EU, obligations under its commitment to the Montreal Protocol and F-gas regulation continue to be implemented. Further information on this can be found in REFCOM (2019).

Certification categories under the EU F-Gas Regulation	
Category I	performing leakage tests, refrigerant recovery, installation, maintenance, or servicing of the equipment.
Category II	performing leak checks without breaking into the refrigeration circuit as well as recovery, installation, and servicing activities on equipment with a charge size of less than 3 kg or for hermitically sealed equipment of less than 6 kg charge of fluorinated refrigerant gases.
Category III	recovery of refrigerant
Category IV	leakage checking

and industry-led training infrastructure (Gluckman Consulting 2014). While EU 2015/2067 lays out the minimum requirements for certification, the UK has additional training modules for personnel who want to acquire advanced training (Gluckman Consulting 2014).

The decentralised implementation also allows for consideration of a general level of qualification among technicians based on existing skills in the country. Germany, for example, has training courses specifically designed for personnel with technical training in other domains who are interested in working in the RAC sector (EIA et al. 2018). Germany also mandates training in order to qualify for certification (EIA et al. 2018).

Another key feature of the EU's certification system is the issuance of certification to servicing technicians or personnel and certification for companies or enterprises that handle refrigerant gases. Further, four categories of certification are offered depending on the different functions that the servicing technician performs. These are specified under "Article 2 – Scope" in the European Commission (2018a). Technician certification is necessary for everyone handling refrigerant gases in the capacity of leak checking, recovery, installation, repair, maintenance or servicing, and decommissioning equipment containing fluorinated greenhouse gases (European Commission 2018a). Company certification is required for companies that carry out installation, repair, maintenance, servicing, and decommissioning of station refrigeration, air-conditioning, and heat pump equipment for other parties (European Commission 2018a). Each member country specifies the duration and process involved in obtaining this certification, as presented in Table 1 below.

Table 1 Unique features of certification systems in EU countries and key insights for India*

FRANCE 	**Summary of the certification system** The certification system was implemented based on the EU F-Gas Regulation. There are stringent reporting requirements imposed with quantities of F-gas acquired, charged, recovered, and reused. **Unique feature** Certification for companies needs to be renewed every five years; however, for personnel, it is valid for life. **Learning outcome** Certifications for personnel and companies vary in length of validity.
ITALY 	**Summary of the certification system** EU 517/ 2014 was adopted in 2019, replacing a Presidential decree. The certification and evaluation systems are based on EU 2015/2067. **Unique feature** Companies must register with the national F-gas registry of certified persons and companies. Registration is necessary to obtain certification from an accredited certification body. **Learning outcome** A national registry is used to enrol all servicing technicians, collating information on them such as skill level and status of certification.
GERMANY 	**Summary of the certification system** Germany has adopted EU F-Gas Regulation, and its certification system is based on EU 2015/2067, utilising an industry-government partnership. The guild association of the refrigeration construction sector defined the guidelines for knowledge and exam format as per EU 2015/ 2067. Training is compulsory to qualify for certification examinations. **Unique feature** For personnel without formal training in refrigeration and related subjects, training is offered to prepare for the certification exams. **Learning outcome** Create a training curriculum for personnel from other technical fields (e.g. electrical, home appliance repairs, etc.) and integrating them into the RAC servicing sector through the certification system. Certification should facilitate lateral transfer of personnel from other technical fields.

UNITED KINGDOM (UK)

Summary of the certification system
Despite Brexit, UK continues to employ EU 517/2014 and EU2015/2067 for certification of servicing technicians and personnel. The UK has seamlessly integrated the EU F-Gas Regulation requirements into its existing training and certification infrastructure. A government-industry partnership is followed in the implementation of this system.

Unique feature
Four bodies facilitate servicing technician certification and qualification guidelines: City & Guilds, Construction Industry Training Board, Building Engineering Services Associated and Logic Certification Ltd.

For company certification, three bodies offer certification: Bureau Veritas, Quidos and Refcom.

Learning outcome
Separate certification bodies are used for companies and personnel.

NETHERLANDS

Summary of the certification system
A nodal agency, Stichting Emissie Koudetechniek (STEK), was created to oversee the certification and testing of companies and servicing technicians. STEK is responsible for a host of activities under implementation of certification in the servicing sector.

Unique feature
The government established STEK in 1992 to oversee evaluation and certification of companies and personnel.

Learning outcome
A nodal agency is appointed to oversee certification.

NORWAY

Summary of the certification system
Norway adopted the EU F-Gas Regulation for certification in 2019. A national body called Isovator is responsible for certification procedures under the F-gas regulation. The regulations are stringent, with no technician allowed to service refrigerant-charged equipment above specified sizes without certification.

Unique feature
Personnel certification must be renewed every five years.

Learning outcome
Periodic certificate renewal for servicing technicians is mandated.

SWEDEN

Summary of the certification system
The EU F-Gas Regulation was implemented in Sweden with some additional requirements specified; for example, the accreditation requirement of the certification body is per ISO/IEC 17024:2012, which is not part of EU 517/2014 or EU 2015/2067. The Installations Certifiering i Stockholm AB (INCERT) that oversees certification has been accredited in this manner. Various requirements for examinations (first-time certification and recertification) and reporting have been clearly specified.

Unique feature
No professional experience is required for first-time certification.

Recertification through examination is required every five years.

Certified technicians have to meet specific requirements for professional activities, including the submission of annual reports.

Certification body is not responsible for providing training to servicing technicians.

Learning outcome
Recertification through examination can ensure continuous knowledge and skill upgrade for servicing technicians.

Entry-level technicians are certified through specific knowledge and practical skill requirements.

Technician outputs are monitored through annual report mandates.

Source: Authors' compilation based on IIR (2015); EIA et al. (2018); "F-GAS: Fluorinated Greenhouse Gases - Mariel" (n.d.); Gluckman Consulting (2014); StiftelsenReturGass (2019); Bhasin et al. (2019)

**This is not an exhaustive list.*

In the **United States** (US), the Environmental Protection Agency (EPA) oversees certification implementation (US EPA 2016). EPA-approved companies conduct the examination, and upon passing the exam, the servicing technician receives an identification card as proof of certification. The identification card must include the person's name, certification type, name of the certifying programme, the date they received EPA approval, and a unique identification number (Various 2016). While EPA certification is valid country-wide, most states have prescribed additional requirements for certification, as per Nguyen (2015).

US-EPA certification types

Type I	for servicing small appliances.
Type II	for servicing and disposing of high- or very high-pressure appliances.
Type III	for servicing or disposing of low-pressure appliances.
Universal certification	for servicing all types of equipment.

In the US, industry associations are also actively involved in certifying servicing technicians through the creation of various certifications for specialising in specific types of HVAC equipment or different levels of knowledge (Nguyen 2015). The American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE) supports one such certification provider, the North American Technician Excellence (NATE) (Zander Buel 2018). NATE provides two certifications catering to entry-level and experienced technicians (Zander Buel 2018). In a similar manner, three other institutes offer certification. HVAC's Excellence Specialty Certification recognises technicians who receive vocational training. The National Inspection Testing Certification (NITC) offers certification to experienced technicians in systems such as air handling units, ductwork, refrigeration piping, and process piping and cooling (Nguyen 2017). The Refrigeration Servicing Engineers Society offers certification in handling refrigerant HFC 410a. This EPA-prescribed certification has four types, each designed for handling different functions and sizes of refrigerant-based equipment. All available certifications are accepted as servicing technician qualification. The choice of certification is typically a function of the technician's specific career objective.

Canada requires technicians to hold a valid certificate in the province in which they work, and the certification must be recognised by at least three provincial governments (HRAI n.d.). Unlike the US, this certification is not proof of technical qualification. Instead, the exam for the certification tests the technician's understanding of Federal Halocarbon Regulations and awareness related to the refrigerants' environmental impacts (HRAI n.d.). This certification is therefore evidence of the technician's awareness on the Refrigerant Code of Practice that clearly prescribes good practices to be followed in servicing (HRAI n.d.). Aspiring technicians must have a degree in RAC prior to appearing for the aforementioned certification (Environment Canada, 2013). The availability of or requirements for company certification were not found for the US or Canada.

Australia and New Zealand follow a licensing scheme instead of certification for servicing technicians, as done in the EU and other developed countries. The OzonAction (2015) (UNEP) elucidates the difference between certification and licensing as follows:

Certification does not refer to a state of legally being able to work in a profession. That is normally achieved by licensing. Licences are administered by a governmental entity primarily for public protection purposes, and professional associations administer certification schemes. Licensing and certification are similar in that they both require the demonstration of a certain level of knowledge or ability.

Australia prescribes over thirteen licences, with separate licences for working professionals and trainees (ARC n.d.). Trainee licences are available for classroom handling of refrigerants as well as for apprenticeships (ARC n.d.). For current professionals, four licence levels exist for different types of equipment (ARC n.d.). In addition to servicing technician licences, companies must acquire a licence to handle refrigerant-based equipment. An assessment by Expert Group (2015) notes the impact of the licensing scheme in Australia in terms of the goal to reduce direct emissions 58 Mt CO_2 by 2030. New Zealand caters to most categories defined by Australia with half as many licence types in addition to licence for handling flammable refrigerants. However, New Zealand does not specify licensing requirements for companies.

An overview of certification types and their modalities have been summarised in the infographic ahead. These highlight levels of independence between training and certification agencies, roles of the public and private sectors, levels of certification, entry barriers for prospective technicians, and the cost involved to acquire these servicing licences/ certifications.

Global certification systems for the servicing sector

	Training requirements	Certification levels/types	Certifying agencies: private/ governmental/accredited/etc.
EUROPEAN UNION (EU) **Regulation** EU "F-Gas" Regulation No. 517/ 2014 EU 2015/ 2067 for certification and training of technical personnel and enterprises	The regulation defines specific training requirements that all EU member states should make available to obtain certification. In some countries like Germany, training is mandated for technicians without a formal degree in refrigeration. Required for personnel	Category I, II, III and IV Certifications	Government accredited body
UNITED KINGDOM (UK) **Regulation** EU "F-Gas" Regulation No. 517/ 2014 EU 2015/ 2067 for certification and training of technical personnel and enterprises	Required Required for personnel working in the company	Four as per the EU 2015/2067	Government and Government approved Industry organisations **Implementation organisations:** City & Guilds Construction Industry Training Board Building Engineering Servicings Associated Logic Certification Ltd Government and Government approved Industry organisations **Implementation organisations:** Refcom Ltd F-gas Register (Quidos) Bureau Veritas UK Ltd.
NORWAY **Regulation** EU "F-Gas" Regulation No. 517/ 2014 EU 2015/ 2067 for certification and training of technical personnel and enterprises	Self-determined None	Four as per the EU 2015/2067	Government **Nodal organisation:** Isovator AS
UNITED STATES OF AMERICA (USA) **Regulation** USA 40 CFR Part 82, Subpart F, Section 608	Self-determined	Type I, II, III and Universal Certifications	Government accredited private agencies **Nodal organisation:** Environment Protection Agency
CANADA **Regulation** Canadian Environmental Protection Act, 1999 (CEPA) Ozone depleting substances and halocarbons alternatives regulations (2016)	Environmental awareness training required for certification in addition to technical qualifications of the technician.	One certification that ensures that the technician is aware of the Federal Halocarbons Regulations, 2003 and provincial ozone-depleting regulations.	Federal and provincial government institutes and partner organisations. **Nodal organisation:** The Heating, Refrigeration and Air Conditioning Institute of Canada
AUSTRALIA **Regulation** Ozone Protection and Synthetic Greenhouse Gas Management regulations 1995/ Act 1989	Mandatory (Refrigerant Handling License) Not specified (Refrigerant Trading Authorisation)	Thirteen licenses distributed under four categories One	Government-Industry partnership **Nodal organisation:** Australian Refrigeration Council
NEW ZEALAND **Regulation** Health and Safety at Work (Hazardous Substances) Regulations 2017	Mandatory the first time	Six types of licences exist catering to refrigerant filling and handling as well as specific licences for flammable refrigerants.	Private industry association and approved training partners **Nodal organisation:** Refrigerant Licence New Zealand
JAPAN **Regulation** Not specified		Three categories depending on equipment type	Government-industry partnership; decentralised implementation with involvement of Prefectural Governments

Technicians Companies For technicians only For company only For both technicians and company

Certification validity	Evaluation type	Certification cost to the servicing technician
Country specific, some offer lifetime certification (e.g. France), whereas, some mandate periodic renewal of certificates (e.g. Sweden)	Theoretical and Practical evaluations are conducted on the following topics (paraphrased): Basic thermodynamics, Environmental awareness, checks for leakage and maintenance, good servicing practices, component knowledge and repair and alternate technology.	~ USD 200 to 900, depending on the region and category of certification. Category I is generally more expensive than the others.
Country specific	Companies meeting the following criteria are given certification: i. Employ certified technicians for carrying out activities needing certification in sufficient number to carry out all projects. ii. Proof of possession of sufficient tools and procedures for the certified technicians.	Not specified
Lifetime	The UK government has seamlessly integrated the EU 2015/2067 into its existing training and certification system. Each of the institutions awarding certifications have a different title for the certification. The government however has matched each of these with the EU 2015/ 2067 categories. However, in addition to these mandatory certifications, other levels of certifications are available to help gain various specialisations.	
Three years	Awarded upon meeting EU 2015/2067 requirements	~USD 152 (sole trader) to ~USD 868 (50+ employees)
Five years	A computer-based theoretical examination needs to be passed by the technician to obtain the certification. The exam tests technician's knowledge as per EU 2015/ 2067. Company certification is awarded as per the EU 2015/2067.	
Lifetime	Tests typically cover evaluation on "core" and "application specific" knowledge. The 'core' component covers aspects such as environmental awareness, regulations, refrigerant type and safety, among others. Specific to each application, evaluation is related to knowledge on leak detection, repair, recovery and safety are covered. Universal certification can be obtained by passing tests of all four components mentioned above. Only theoretical exams are conducted for certification. Online test is available for Type I certification alone.	USD 25 (Type I) USD 25 – 50 (Type II and III)
Lifetime, except Ontario where certificate renewal is required every five years.	The certificate is proof of having completed an environmental awareness course in halocarbon (CFC, HCFC, and HFC) recycling, recovery and handling requirements as stated by the Refrigerants codes of practice specified by the Federal and provincial governments. This certification complements the technical qualification of the technician in installation and maintenance of refrigerant-based equipment. However, the certificate itself is not a sufficient qualification. The environment awareness training is a 1-day programme that covers topics: "Science of ozone depletion, leak detection methods, system charging procedures, special maintenance provisions, and refrigerant recovery, reuse, recycle and reclamation equipment." The training and certification exam are entirely theoretical.	~ USD 226
Up to three years	Qualification criteria defined for each license type have to be met with appropriate documents for proof to apply for a license. Recognition of Prior Learning is available for technicians with substantial experience. The following details need to be furnished to obtain the authorisation: Refrigerant records, Equipment list, Risk management plan, Equipment Maintenance Records, Cylinder leak test and cylinder test date records, Staff list, RTA number on advertising.	USD 900
Five years	An approved filler license is provided upon completing the training for this. The course covers aspects such as regulations, standards and codes of practice, safety, cylinders and valves and recovery and filling of refrigerants. Various short quizzes and activities are embedded into the training modules to ensure proper learning. Assessments for this course are both theoretical and practical. An additional specialised certification needs to be obtained for ammonia in addition to the basic approved filler licence. After a period of five years, the technician can apply for a renewal of licence which can be done online.	USD 312

Sources: CEEW Analysis 2020 based on: (US EPA 2015) (HRAI n.d.; Environment Canada 2013) (AREA 2016; European Commission 2018a; 2018b) (Gluckman Consulting 2014)(Isovator 2019; Miljo-Direktoratet 2019) (ARC n.d.; n.d.) ("Refrigerant Licence New Zealand" n.d.) (IIR 2015; Navigant Consulting Inc. 2016)

Domestic best practices

India's driver licensing system is a unique pan-India certification system that essentially allows for individuals to attain licences to drive different vehicle types for personal use, transportation needs, and/or towards professional servicings.

Mandated under the *Motor Vehicle Act* (1988, 2019), the driver licensing system spans the entire nation and is accessible to all. The Government of India institutes Regional Transport Offices (RTOs) that are responsible for maintaining databases of drivers and vehicles for various states in India. These are spread across the nation and act as testing centres to grant driving licences to people. Authorised employees of the RTO conduct these tests, which enable any person to drive vehicles for which they have successfully tested in any public area. Persons without licences are not permitted to drive. There are several types of licences, ranging from two-wheelers to heavy commercial vehicles, and separate tests are taken for each. There are two licence levels. The first is a learner's licence that is based on a written test only and remains valid for six months; it allows an individual to drive but only with a licensed driver in the vehicle. The second is a permanent licence which can received after a practical test is taken within six months of getting a learner's licence.

While the government recognises several registered driving training centres, training centres and driving teachers operate independently. Only officials of the RTO, however, can conduct the testing. The Government of India, through the RTO, approves and grants the licence upon the individual's successful written and practical test. ***This stark separation in trainers and certification authorities, and independence in their authority and work, is a key point in how the licensing system has been designed to ensure the quality control and validity of granted licences.***

In contrast, in India's **Central Board for Secondary Education (CBSE) schooling system**, trainers are usually government-recognised, as are the institutions that provide training to students; these may be privately held and operated, government-run, or partially government-aided. These institutions provide the platform through which students are automatically registered for secondary education, at both grade 10 and grade 12 levels. However, students can also appear for examinations through an open schooling system where a simple registration with the CBSE Open School system allows them access to appear for examinations.

Types of driving licences, as per the *Motor Vehicles Act of 1988*, India, are tested according to vehicle type:

- Motorcycle without gear
- Motorcycle with gear
- Invalid carriage
- Light motor vehicle (NT)
- Transport vehicles
- Road roller
- Motor vehicles of a specified description

To appear for an examination to attempt certification and clearing of secondary education, pupils must have a permit that only recognised/CBSE-affiliated schools or the CBSE directly can grant. The Board conducts the test, and only accredited and recognised teachers evaluate the test. This implies that only the government grants this certification; however, the government does not always employ the teachers/individuals evaluating the exams.

With regard to the **Kigali Amendment commitments** specifically, the Government of India recently launched a reskilling and certification scheme dedicated to servicing sector technicians under the *RPL Programme* instituted within the ESSCI, the Ministry of Skill Development and Entrepreneurship (MSDE) in partnership with the Ozone Cell, and the Ministry of Environment, Forests & Climate Change (MoEF&CC). This aims to generate by 2021 a recognised, (re)trained, and certified workforce of the 100,000 technicians already employed in the RAC segment since its inception in 2019. The ESSCI

updated the curriculum or 'qualification pack' with industry and Ozone Cell inputs to include the alternative refrigerant HC 290 that is both ozone and climate friendly, as well as environmental and safety best practices. The ESSCI partnered with several existing (private) servicing centres and retail outfits which had the necessary equipment to undertake extensive training across different regions in India. When the three-day training has been completed, participating technicians take a certification test; upon successful completion, the ESSCI directly issues a certificate with the training centre logo on it stating so. The ESSCI offers a separate training for trainers, after which they switch between the role of trainers and evaluators, albeit, according to the ESSCI, not at the same training centres.

Table 2 Institutional independence between agencies of teaching and evaluation in India's certification systems

Certification systems in India	Curricula	Trainers	Entry barrier to testing	Evaluators	Certification body/agents
Driver's Licence	Government-developed, available publicly.	May/may not be government-recognised/ accredited/ authorised.	Anyone can apply for a licence, regardless of prior training affiliation.	Government-recognised; hired by government RTOs.	Government of India-instituted.
CBSE	Developed through an independent government-instated agency, and available publicly.	May/may not be government-recognised/ accredited/ authorised.	Every student must have a permit from a CBSE-recognised institution or directly from the CBSE to appear for examination.	Government-recognised and empanelled for evaluation; may be privately hired during non-evaluation time (in a private school, for example).	Government of India-instituted.
ESSCI's RPL programme	Government-developed; not available publicly yet.	All are trained and authorised as part of this scheme.	All evaluations are conducted at the same RPL programme training centre, in continuation of the latter.	Government-approved and empanelled for evaluation but hired privately otherwise.	Government of India-instituted.

Source: Authors' compilation

Across all the models of certification that have been studied, it is clear that training and evaluating agencies are quite separated from each other in that the same agency is not singularly responsible for implementing training and evaluating the technicians on their trained qualifications. This is in contrast to how the ESSCI is, so far, operationalising its reskilling programme—but a caveat is necessary here to establish the nascent and difficult state that the sector is in, as it lacks any other element of a certification system. However, as the government starts to initiate and establish a formal certification scheme, lessons and experiences will be crucial to understand and learn from.

IV. The way forward: establishing and operationalising India's servicing sector certification system

The ICAP recognises training and certification as a priority for servicing sector development (Ozone Cell 2019). It further draws a clear link between certification and training by highlighting the need to standardise training programmes and bring them in line with the latest technology in the cooling sector (Ozone Cell 2019). To this end, the ICAP further recommends a simultaneous formalisation of the servicing sector workforce through a regular, shorter, and more accessible training programme format (Ozone Cell 2019). It is a recognised policy goal for the Government of India to establish a universal certification system in India as a long-term strategy by 2038 at the latest.

The servicing sector in India is poised for significant growth in terms of jobs; on the smaller side, these are meant to jump from 200,000 recognised technicians to over 2,000,000 in the next two decades owing to increased demands across various applications. Assimilating these technicians into a certified, regulated workforce will require multiple agencies and actors to come together. Moreover, given India's largely informal workforce in the servicing sector, with the above-mentioned labour estimates and experiences that have been garnered from other countries in ensuring that such technicians are certified for their jobs and servicing provisions, business-as-usual will not suffice and will need complementarities for a more formal establishment that is not focussed simply on retraining but on new certifications as well. This section elaborates on the principles on which this system should be built, its institutional setup, and estimated cost.

Source: CEEW Roundtable (2019)

> "Certified technicians can also be given colour coded cards depending on their skill qualification, for example, yellow for installation and red for repairs. Cards can be colour coded and customers can be made aware of the codes."
>
> **Mr Rajesh Nagari**, Deputy Vice President Head – Services, Johnson Control Hitachi Airconditioning India Pvt Ltd.

Principles to guide the development of India's certification system

Equitable

The certification system should be designed so that it provides openings for enhanced livelihoods and opportunities to technicians who already work in this sector and new ones to enter it; it should be geographically and financially accessible to existing and prospective technicians. Moreover, the training and qualification packs for which the certification system will test should be easily accessible.

Independent

It is well recognised and various global agencies and practitioners, including the Ozone Secretariat of the Montreal Protocol and the UNEP,

have recommended that training and certification should remain independent of each other, institutionally at least, to ensure validity.

Safe and environmentally sound

Technician safety, as well as that of those affected by servicing practices—at the time and as a result of—should be one of the two pillars that is incorporated into servicing practices in India. Moreover, the certification system should establish environmental best practices that are incorporated as part of every technician's know-how and servicing provision. Both of these elements are crucial, keeping in mind the refrigerant transition and HFC phase-down to which India has committed. To meet these goals successfully, both safety and environmentally sound servicing practices must be mandated, and the certification system needs to play a critical role in internalising this for India.

Improved livelihoods

This certification system will play a huge role in formalising and recognising technicians who work in this sector. The validation of their knowledge and ability to provide servicing, as well as creating a layered approach to progress in their respective careers, will play a huge role in emancipating an entire workforce within the country.

Improved access to welfare

The certification system should be designed so as to also act as a vanguard for easier access to social welfare programmes for which technicians may be eligible. This would be particularly necessary, given that several technicians lack easy access to information about, or suffer bureaucratic hurdles—due to their informal roles—in benefitting from welfare programmes that the Indian state has established.

Designing the certification scheme

India's certification scheme, while imbibing the above principles, will need to be multi-focussed and achieve simultaneous goals of recognition, qualification validation, and skill upgrade facilitation. It will act as a registrar of qualified technicians, provide them with certification based on regularly conducted theoretical and practical tests, create a roster system for re-evaluation consistent with market changes in technologies every five years, and create a livelihood upgrade system to offer the following certification types:

Type 1. Basic certification for small units (refrigeration and air-conditioning units, including vehicles) having HFCs

Type 2. Basic certification for small units (refrigeration and air-conditioning units, including vehicles) using alternatives to HFCs (with clear markings of which refrigerant the technician is able to handle)

Type 3. Intermediate recycling certification for all small units

Type 4. High-level certification for servicing larger units based on charge size and pressure for different refrigerants - with clear markings of which refrigerant the technician is able to handle. Applications would include commercial refrigeration, reefer transport, and other larger vehicles/ transportation modes.

Type 5. Universal certification for servicing and recycling of small and larger units based on charge size and pressure for different refrigerants - with clear markings of which refrigerant the technician is able to handle. Applications would include small refrigeration and air-conditioning units, including vehicles, commercial refrigeration, reefer transport, other larger vehicles/ transportation modes.

In order to initiate such a programme, the ongoing training and larger servicing ecosystem will have to be calibrated and capitalised on to effectively achieve a universal certification system for India's servicing sector that encompasses all sectors including commercial refrigeration, mobile air-conditioning, and commercial air-conditioning, not just RAC.

As a first, a long-term target of mandating certification should be announced for 2030, with sectoral targets specified in between. For example, the timeline shown in Table 3 may be used as a starting point to nudge technicians and companies towards such a trajectory.

Table 3 Timeline for mandating technician certification in various cooling sectors

Year for mandatory certification for technicians	Sector/ Sub-sector	Level of certifications
2025	RAC	Type 1
2028	RAC	Type 2
2028	Mobile Air-conditioning (MAC)	Type 1
2030	Commercial Refrigeration (CR) and Commercial Air-conditioning (CAC)	Type 1, 2, 4 depending on charge size

Source: Authors' analysis

Source: CEEW Roundtable (2019)

"Certification is not the final step. Certification should assign different grades to technicians depending on their training. A further step should be taken by placing a label on the AC that mentions what grade of technician can service and repair the AC. With this, we can come full-circle in ensuring proper servicing."

Mr M P Aggarwal, Presidential Member, ISHRAE

However, for such targets to be met, in the interim of the next four years, the following actions need be considered and simultaneously implemented for the RAC servicing sector technicians, as an example, which has been listed as mandatorily certified from 2025:

- The ESSCI should partner with companies to send their technicians from company-run training centres and affiliated servicing partners to get certified under the RPL scheme.
- Companies must begin labelling the refrigerant gas clearly on, and within, the AC unit.
- Ozone Cell should request all companies to enlist or register their servicing technicians—those they directly employ or those who are affiliated through partner agencies with their companies—so as to initiate a roster of the existing labour force.
- An incentive scheme such as access to an ongoing insurance programme should be offered to all technicians volunteering to register with the Ozone Cell/ESSCI and undergo the RPL programme on offer.
- On the demand side, a parallel consumer awareness programme should be initiated for the RAC segment to shed light on the need to check for certification.
- Public procurement of servicing technicians for all government-led needs should warrant a preference for certified technicians.

As a critical mass of these technicians will have already accrued by 2021 as per the ESSCI, and if more momentum is not built to enlarge this pool year-on-year and broaden it to include servicing technicians from other sectors, the readiness target for India's Kigali Amendment commitments will be lost. Moreover, it is this larger group that would pave the way for others to want to be a part of a certified profession by way of social security access, valid recognition and dignity of their jobs, and a clear showcasing of movement to access enhanced livelihood opportunities down the line.

Institutional blueprint and budget to establish India's certification system

Given the setup of the current certification scheme and the laws mandating these responsibilities, the ESSCI would remain the nodal agency responsible for final certification of technicians under the aegis of the MSDE in the Government of India. Given the nature of the transition that this certification system will also facilitate, the nodal agency responsible for India's refrigerant transition and the actors implementing it, i.e. industries, should work closely to develop the curricula that the ESSCI tests on. This has been the case so far and should continue as such with expert technical and policy-relevant implications and insights even in the long term. In addition to supporting curriculum development, industries and industry associations can also provide third-party monitoring to ensure that certification regulations are implemented.

Moreover, in an attempt to allow for equitable access to these certifications on the basis of on-the-job as well as formal training, there should be no initial barrier to taking these certification tests. To maintain independence between trainers and evaluators, it has also been suggested that the ESSCI should recognise testing centres and evaluators in the long term as such, while trainers can remain out of the ESSCI's regulatory purview, offering short-, medium-, and long-term courses as per the current formats and allowing for new course offerings to come into the market. A more detailed overview of the training landscape in India has been evaluated in the CEEW-

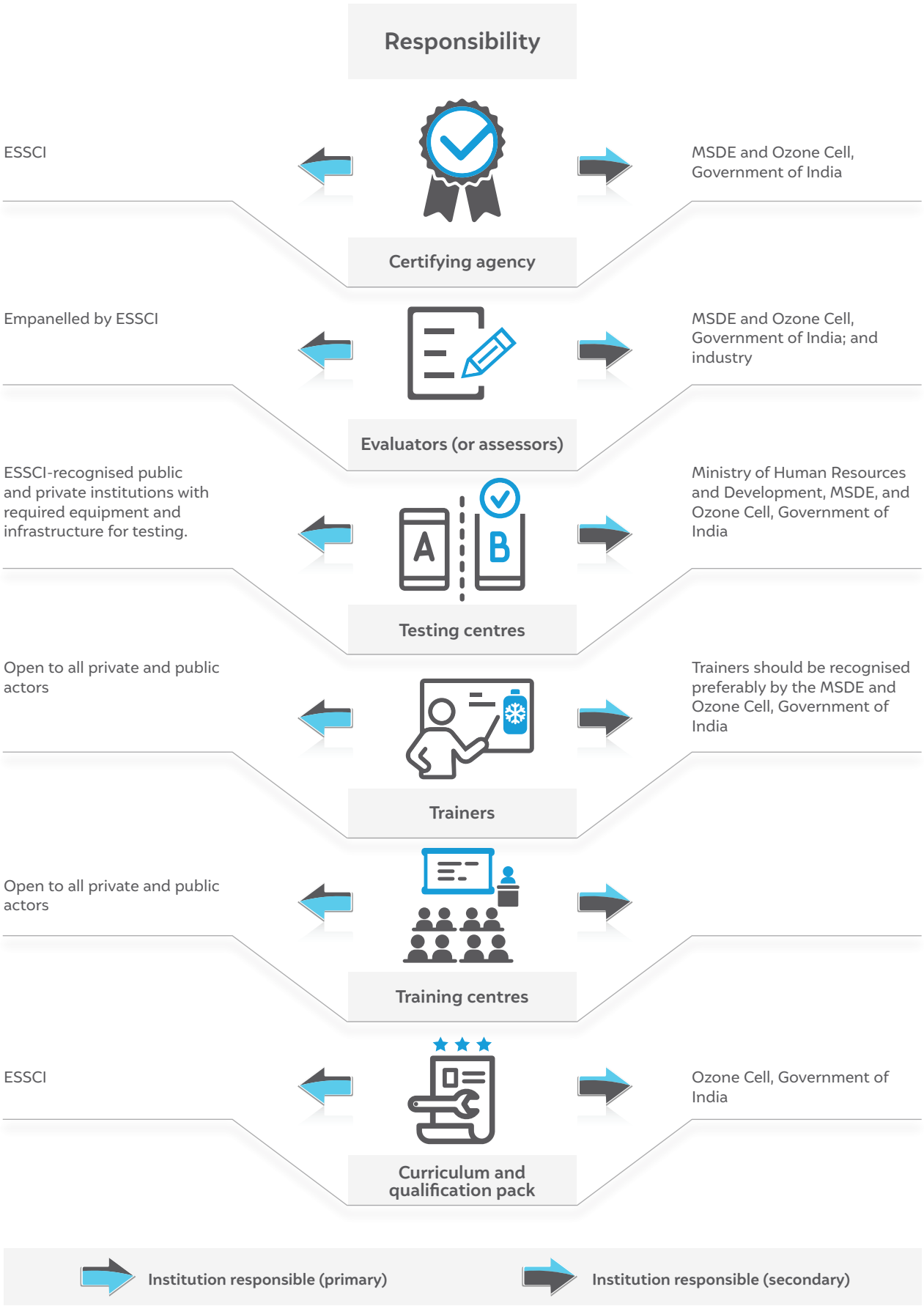

Image: CEEW

"For identifying technicians' qualification, the Government may provide a card that has a QR code with the certification. The credentials of a technician can be checked using the QR code."

Mr Saleem Ahmed, Vice President, ESSCI

Shakti 2020 study focussing on standardising curricula and undertaking training (training report details to be inserted here).
Table 4 presents a suggested institutional blueprint for India's medium- and long-term targets. It is built on the principles of updated curricula that speak to the targeted certification authority and scheme, independence in training, and evaluation, all broadly placed under the government aegis and given oversight from relevant ministries. Moreover, industry stakeholders, at a roundtable discussion where such ideas were whetted, clearly brought out the role for industry and a franchise model for training while keeping a distinct government-mandated certification system.

Table 4 Proposed institutional blueprint for India's servicing sector certification system



Source: Authors' analysis

Depending on the growth that the sector sees, the budgetary investments towards training, infrastructure, social security and welfare programmes, and the overarching certification architecture will change. Largely, based on India's experiences of the ESSCI RPL programme and the HPMP II budgetary allocations towards training, it is estimated that each training or testing centre with required infrastructure, to accommodate thirty technicians at a time, costs approximately INR 3.5 lakhs, and the ESSCI established and accredited 400 such centres. The human resource cost for skill programmes, according to ESSCI, that includes trainers, certification personnel, and evaluators amounts to approximately INR 116. 70/hour/ technician trained and certified over five days. The Ministry of Commerce and Industry, in tandem with Indian HVAC industry associations and Ozone Cell in the MoEF&CC, have recently evaluated these financing and investment numbers, and investigative recommendations towards budgetary allocations may be considered from this report. Given that these costs have been established for a programme targeting 100,000 servicing technicians over three years, taking infrastructure requirements to scale for at least 2,000,000 servicing technicians over the next 15 - 18 years would arrive at similar estimate but targeted for several more years and at scale. Industry estimates have pegged this budget at around INR 400 crore[12]. However, this may be significantly lowered if the onus of training shifts from the government to private players over time.

V. Conclusion

Until the ICAP was launched, experiences in enabling the start of a certification system for India were largely undertaken as part of the HPMP programmes. These focussed on training and reskilling technicians to provide servicing with new classes of refrigerants. The ESSCI's ongoing RPL programme is a welcome start to testing a system that will have to be scaled and differentiated significantly, given the sector's current informal nature as well as the anticipated growth in various cooling-related sectors. As a first, the ICAP is focussed on establishing a 'voluntary certification scheme through a single government entity under a single framework', and the ESSCI is managing this task, aiming to reach 100,000 RAC technicians by 2021. However, this number is set to increase at least eleven-fold over the next two decades. The next two decades will also see an influx of new refrigerants and associated technologies. Thus, a systematic formalisation and validation of technicians and their knowledge is paramount. This is no mean task for the government to manage alone. The private sector will have to rise to the occasion and not only partake in this transition from the perspective of product diversification but also be more responsive in readying the servicing sector to this end. This brief highlights the institutional setup (with public and private actors) required to effectively manage a certification system, where the latter is independent of the training centres in the long term, and puts forward core principles that the design and functionality of this certification system must reflect, including but not limited to, equity, preservation of environment and safety, improved job opportunities and growth, and easier access to social welfare programmes. It is only when these qualifiers are met that the success of a certification system will be realised.

References

Agarwal, R.S. 2004. "HIDECOR's Organization Vision for India." *ECO-COOL: The Quarterly Bulletin for Refrigeration Technicians*, December 2004. http://www.nccopp.com/newsletter.asp.

Agarwal, R.S, Surinder Batra, Stefan Kessler, Othmar Schwank, and Myriam Steinmann. 2005. "Human and Institution Development in Ecological Refrigeration (HIDECOR): Achievements and Experiences 2001-2004." Ozone Cell, MoEF, Government of India and Swiss Agency for Development & Cooperation, Government of Switzerland: A HIDECOR Publication.

ARC. n.d. "Licence Types | ARC Industry Site." Accessed October 15, 2019a. https://www.arctick.org/refrigerant-handling-licence/licence-types/.

12. Specific certification mandates can be found under (EU) No 2015/2067.

ARC. n.d. "Permit Condition Check (Audit) | ARC Industry Site." Accessed October 15, 2019b. https://www.arctick.org/refrigerant-trading-authorisation/permit-condition-check-audit/.

AREA. 2016. "AREA F-Gas Guide: A Practical Guide on Application of the New F-Gas Regulation to Refrigeration, Air Conditioning and Heat Pump Contractors." AREA.

Bhasin, Shikha, Apurupa Gorthi, Vaibhav Chaturvedi, and Torgrim Asphjell. 2019. "Acting on Many Fronts: Incentives and Regulations to Phase-down HFCs in India." New Delhi: CEEW - NEA. https://www.ceew.in/sites/default/files/CEEW-Incentives-and-Regulations-to-phase-down-HFCs-report-PDF-06Mar19.pdf.

EIA, Climate Advisers Network, ECOS, Legambiente, and Zero. 2018. "Recommendations for Making the EU F-Gas Regulation a Success."

Environment Canada. 2013. "Fact Sheet - Federal Halocarbon Regulations, 2003 : Information for Service Contractors Pertaining to Refrigeration and Air-Conditioning Systems." Government. Environment and Climate Change Canada. October 21, 2013. http://www.ec.gc.ca/ozone/default.asp?lang=En&n=D92F513E-1&pedisable=true.

European Commission. 2018a. "COMMISSION IMPLEMENTING REGULATION (EU) 2015/2067." *Official Journal of the European Union* 301 (28): 11.

European Commission. 2018b. "Regulation (EU) No 517/2014 of the European Parliament and of the Council of 16 April 2014 on Fluorinated Greenhouse Gases and Repealing Regulation (EC) No 842/2006." *Official Journal of the European Union* 301 (28): 36.

Expert Group. 2015. "Assessment of Environmental Impacts from the Ozone Protection and Synthetic Greenhouse Gas Management Act 1989." Prepared for the Department of the Environment. Australia. https://www.environment.gov.au/system/files/consultations/fe81135c-a55e-45b6-ae4b-efo2f1616ba2/files/ozone-acts-review-environmental-impact-analysis.pdf.

"F-GAS: Fluorinated Greenhouse Gases - Mariel." n.d. *Mariel S.r.l.* (blog). Accessed October 14, 2019. https://www.marielrefrigerants.com/en/f-gas-fluorinated-greenhouse-gases-mariel/.

Frankel, M, M Heater, and J Heller. 2012. "Sensitivity Analysis: Relative Impact of Design, Commissioning Maintenance and Operational Variables on the Energy Performance of Office Buildings." New Buildings Institute. http://docplayer.net/144567294-Sensitivity-analysis-relative-impact-of-design-commissioning-maintenance-and-operational-variables-on-the-energy-performance-of-office-buildings.html.

GIZ. 2019. "Energy Efficiency in Servicing - Impacts of HPMP Training and Future Potential." presented at the Open Ended Working Group 41, Bangkok, July 4. http://conf.montreal-protocol.org/meeting/oewg/oewg-41/publications/Observer%20Publications/OEWG41%20-%20GIZ%20Proklima%20-%20SE%20Energy%20efficiency%20in%20servicing.pdf.

Gluckman Consulting. 2014. "Information Sheet 21: Training and Certification Requirements for Refrigeration, Air-Conditioning and Heat Pumps." https://www.fluorocarbons.org/wp-content/uploads/2015/10/is-21-training-and-certification-rachp.pdf.

HRAI. n.d. "Canada's Ozone Layer Protection Awareness Program (ODP/ODS)." Accessed October 16, 2019. https://www.hrai.ca/odp-ods.

IIR. 2015. "28th Informatory Note on Refrigeration Technologies - Qualification and Certification of Refrigeration Technicians." IIR-IIF. http://www.iifiir.org/userfiles/file/publications/notes/NoteTech_28_EN.pdf.

Isovator. 2019. "New F-Gas Rules." Government. Returgass.No. 2019. https://www.returgass.no/nyheter/2019/revidertfgass-forordning/.

Miljo-Direktoratet. 2019. "Regulation on Fluorinated Greenhouse Gases - Relevant Legislation." Government. Tema.Miljodirektoratet.No. April 7, 2019. https://tema.miljodirektoratet.no/no/Tjenester-og-verktoy/Veileder/EU-forordningen-om-fluorholdige-klimagasser/Relevant-lovverk/.

Navigant Consulting Inc. 2016. "Review of Refrigerant Management Programs." AHRI Project 8018 Final Report. Burlington, MA: Navigant Consulting Inc.

Nguyen, Oanh. 2015. "Types of HVAC Certification | The Refrigeration School (RSI)." Refrigeration School, Inc. (RSI). April 30, 2015. https://www.refrigerationschool.com/blog/hvacr/types-of-hvac-certification/.

Nguyen, Oanh. 2017. "National Inspection Testing Certifications (NITC) for HVAC/R Techs." Refrigeration School, Inc. (RSI). December 5, 2017. https://www.refrigerationschool.com/blog/hvacr/national-inspection-testing-certifications-nitc-hvac-r-techs/.

OzonAction. 2015. "Certification of Refrigeration and Air Conditioning Service Technicians." UNEP.

Ozone Cell. 2017. "HCFC Phase-out Management Plan Stage - II." New Delhi: Ministry of Environment, Forest and Climate Change, Government of India. http://ozonecell.in/wp-content/themes/twentyseventeen-child/Documentation/assets/pdf/1492070012663-HPMP-STAGE-II-LAUNCH-2017-BOOK.pdf.

Ozone Cell. 2019. "India Cooling Action Plan." New Delhi: Ministry of Environment, Forest and Climate Change, Government of India. http://www.ozonecell.com/viewsection.jsp?lang=0&id=0,256,815.

REFCOM. 2019. "F-Gas and Brexit." Refcom.Org.Uk. October 1, 2019. https://www.refcom.org.uk/resources/f-gas-and-brexit/.

"Refrigerant Licence New Zealand." n.d. Accessed October 16, 2019. https://www.rlnz.org.nz/event-template/?eventtemplate=6-approved-filler&event=639.

Schwarz, W. 2011. "Preparatory Study for a Review of Regulation (EC) No 842/2006 on Certain Fluorinated Greenhouse Gases." *Final* ..., no. 842.

Sridhar, Lekha, and Vaibhav Chaturvedi. 2017. "Can India's Air Conditioning Service Sector Turn Climate Friendly? Evaluation the Skill Gap." New Delhi: Council on Energy, Environment and Water.

StiftelsenReturGass. 2019. "New F-Gas Rules." 2019. https://www.returgass.no/nyheter/2019/revidertfgass-forordning/.

US EPA, OAR. 2015. "Section 608 Technician Certification." Policies and Guidance. US EPA. October 14, 2015. https://www.epa.gov/section608/section-608-technician-certification-0.

US EPA, OAR. 2016. "Revised Section 608 Refrigerant Management Regulations." Policies and Guidance. US EPA. September 13, 2016. https://www.epa.gov/section608/revised-section-608-refrigerant-management-regulations.

Various. 2016. *Subpart F - Recycling and Emissions Reductions*. 58 FR 28712/1993. https://www.ecfr.gov/cgi-bin/text-idx?SID=085a41355598f2919b6655098a466757&mc=true&node=sp40.21.82.f&rgn=div6#se40.21.82_1161.

Zander Buel. 2018. "Guide to NATE Certification." Refrigeration School, Inc. (RSI). October 9, 2018. https://www.refrigerationschool.com/blog/hvacr/guide-to-nate-certification/.

Annexure

Stakeholders consultations conducted towards research findings for this brief

Purpose: To gain access to information on training curricula and their usefulness in imparting knowledge and skills to service technicians.

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Balamurugan	A	ESSCI
Vikram	Murthy	ISHRAE
Smita	Vichare	GIZ
Dr Amit	Love	Ozone Cell
R.S.	Agarwal	Ozone Cell
Pramod	Pungaonkar	Shanghai Baofeng Machinery Manufacturing Co. Ltd.
Rajesh	Malik	RASSS
Ashok Kumar	Matta	RASSS
Aman	Matta	RASSS
Saleem	Ahmed	ESSCI
P. K.	Jain	Birla Aircon
Vikram	Murthy	ISHRAE
M P	Agarwal	ISHRAE
Vikas	Mehta	Chemours
Pramod	Pungaonkar	Shanghai Baofeng Machinery Manufacturing Co. Ltd.
Ashwini	Mehra	ISHRAE
Shakeel Ahmed	Jamadar	Godrej
Kapil	Singhal	BP Refcool
Rajesh	Nagari	Johnson Controls

Source: Authors' compilation

Source: Pramod Pungaonkar, ISHRAE

In the years to come, India needs a servicing sector that is technically skilled, environmentally conscious and gainfully employed.

Source: Pramod Pungaonkar, ISHRAE

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