



Annex 51

Acoustic Signatures of Heat Pumps

Final Report – Part 14

7.2 Workshop material and
conference contributions

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Preface

This project was carried out within the Technology Collaboration Programme on Heat Pumping Technologies (HPT TCP), which is a Technology Collaboration Programme within the International Energy Agency, IEA.

The IEA

The IEA was established in 1974 within the framework of the Organization for Economic Cooperation and Development (OECD) to implement an International Energy Programme. A basic aim of the IEA is to foster cooperation among the IEA participating countries to increase energy security through energy conservation, development of alternative energy sources, new energy technology and research and development (R&D). This is achieved, in part, through a programme of energy technology and R&D collaboration, currently within the framework of nearly 40 Technology Collaboration Programmes.

The Technology Collaboration Programme on Heat Pumping Technologies (HPT TCP)

The Technology Collaboration Programme on Heat Pumping Technologies (HPT TCP) forms the legal basis for the implementing agreement for a programme of research, development, demonstration, and promotion of heat pumping technologies. Signatories of the TCP are either governments or organizations designated by their respective governments to conduct programmes in the field of energy conservation.

Under the TCP, collaborative tasks, or "Annexes", in the field of heat pumps are undertaken. These tasks are conducted on a cost-sharing and/or task-sharing basis by the participating countries. An Annex is in general coordinated by one country which acts as the Operating Agent (manager). Annexes have specific topics and work plans and operate for a specified period, usually several years. The objectives vary from information exchange to the development and implementation of technology. This report presents the results of one Annex.

The Programme is governed by an Executive Committee, which monitors existing projects and identifies new areas where collaborative effort may be beneficial.

Disclaimer

The HPT TCP is part of a network of autonomous collaborative partnerships focused on a wide range of energy technologies known as Technology Collaboration Programmes or TCPs. The TCPs are organized under the auspices of the International Energy Agency (IEA), but the TCPs are functionally and legally autonomous. Views, findings and publications of the HPT TCP do not necessarily represent the views or policies of the IEA Secretariat or its individual member countries.

The Heat Pump Centre

A central role within the HPT TCP is played by the Heat Pump Centre (HPC).

Consistent with the overall objective of the HPT TCP, the HPC seeks to accelerate the implementation of heat pump technologies and thereby optimize the use of energy resources for the benefit of the environment. This is achieved by offering a worldwide information service to support all those who can play a part in the implementation of heat pumping technology including researchers, engineers, manufacturers, installers, equipment users, and energy policy makers in utilities, government offices and other organizations. Activities of the HPC include the production of a Magazine with an additional newsletter 3 times per year, the HPT TCP webpage, the organization of workshops, an inquiry service and a promotion programme. The HPC also publishes selected results from other Annexes, and this publication is one result of this activity.

For further information about the Technology Collaboration Programme on Heat Pumping Technologies (HPT TCP) and for inquiries on heat pump issues in general contact the Heat Pump Centre at the following address:

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Acoustic Signatures of Heat Pumps

IEA HPT

Annex **51**

7.2: Workshop material and conference contributions



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1 Introduction

This document lists all workshop presentations, the various conference presentations, contains the links to the webinar video and concludes with a list of publications which have been prepared by the Annex 51 partners throughout the Annex 51 duration.

After this introduction, a tabular list of all workshop and conference presentations is organized in a table.

The concluding webinar “Acoustic Signatures of Heat Pumps” is listed with the links to the presentations as well as a link to the webinar for review.

A list of meetings of the IEA HPT team is given with dates and locations.

A list of publications is organized in a year-by-year format.

All deliveries, which can be downloaded from the IEA HPT Annex 51 website are listed together with their download links.

The contributions to the IEA HPT Heat Pump Magazine are listed.

Finally, further dissemination events and documents with links are stated at the end.



2 Tabular List of Workshop/Conference presentations

Workshop/conference name	Date	Presenter	Title of presentation
Joint Annual Meeting of the Swiss Physical Society and Austrian Physical Society Geneva, Switzerland	Thursday, August 24th, 2017	Christoph Reichl	Experimental and numerical methods for the fluid dynamic and acoustic characterisation of heat exchanger icing
European Heat Pump Summit 2017 Nuremberg, Germany	Tuesday, October, 24th 2017	Christoph Reichl	HPT TCP Annex 51: Reduction of Air-to-Water Heat Pump Sound Emissions
IEA Heat Pump Conference Rotterdam 2017+	Thursday, May 18, 2017	Christoph Reichl	Transient Acoustic signatures of the GreenHP with special focus on icing and defrosting
IEA Heat Pump Conference Rotterdam 2017+	Thursday, May 18, 2017	Caroline Hagelund-Stignor	Improved measurement method for heat pump noise
68th Annual Meeting of the Austrian Physical Society	September, 13th 2018	Christoph Reichl	MicLocator - Determining multiple microphones' positions using sound wave delay and trilateration
68th Annual Meeting of the Austrian Physical Society	September, 13th 2018	Simon Hinterseer	Determining the Influence of the Operating Point on Noise Emissions of Air Source Heat Pumps
Chillventa 2018, Nuremberg, Germany	15.10.2018	Ch. Reichl	Akustische Emissionen von Wärmepumpen
11de Waermetomp Symposium, Gent, Belgium	10.10.2018	Ch. Reichl	International research: acoustic signatures of heat pumps
68th Annual Meeting of the Austrian Physical Society, Graz, Austria	11.09.2018	Ch. Reichl J. Emhofer P. Wimberger	MicLocator - Determine multiple microphones' positions using sound wave delay and trilateration
68th Annual Meeting of the Austrian Physical Society, Graz, Austria	11.09.2018	Simon Hinterseer	Noise Emissions of Air Source Heat Pumps – Defrosting Cycle
DAGA 2019, 45. Jahrestagung für Akustik, Rostock,	18.-21.03.2019	A. Troll T. Gindre	Charakterisierung der Geräusch-entwicklung einer Wärmepumpe
EHPA Sound Workshop, Vienna	10.10.2019	Ch. Reichl	Presentation on the Annex 51 and Experiences
Acoustics of Heat Pumps, Workshop at ICR2019	29.10.2019	T. Fleckl	Acoustic Signatures of Heat Pumps in the framework of the International, Energy Agency Technology Collaboration Programme on Heat Pumping Technologies (IEA HPT TCP)
Acoustics of Heat Pumps, Workshop at ICR2019	29.10.2019	P. Wagner	Acoustic Regulations of Heat Pumps
Acoustics of Heat Pumps, Workshop at ICR2019	29.10.2019	J. Emhofer	1D modelling of heat pumps including acoustics



Acoustics of Heat Pumps, Workshop at ICR2019	29.10.2019	Ch. Vering	Simultaneous energy efficiency and acoustic evaluation of heat pump systems using dynamic simulation models
Acoustics of Heat Pumps, Workshop at ICR2019	29.10.2019	Ch. Reichl	Acoustic Emissions and Noise Abatement of Air to Water Heat Pumps
Acoustics of Heat Pumps, Workshop at ICR2019	29.10.2019	S. Braungardt	Testing campaign on the energetical and acoustical behaviour of a heat pump
Acoustics of Heat Pumps, Workshop at ICR2019	29.10.2019	C. Stignor	Heat pump noise – operation dependence and seasonal averaging
Forum Acusticum, Lyon, France	April 20-24, 2020*	C.H. Kasess	Perception Rating of the Acoustic Emissions of Heat Pumps
DAGA 2020, 46. Jahrestagung für Akustik	16.-19. März 2020, Hannover, Deutschland**	C.H. Kasess	Beurteilung der Wahrnehmung der Schallemission von Wärmepumpen
ICSV27, 27th International Congress on Sound and Vibration	Pargue, July 12th-16th, 2020***	Blank-Landeshammer Brigitte	Noise Propagation Modelling and Mapping using Augmented Reality for HVAC Sound Sources
26. Tagung des BFE-Forschungsprogramms „Wärmepumpen und Kälte“, BFH Burgdorf	24.06.2020	Ch. Reichl et. al.	Akustische Optimierung von Wärmepumpen (IEA HPT Annex 51)
The perception of sound and heat pumps - the essence of heat pump series (EHPA)	02.02.2020	Ch. Reichl et. al.	Acoustic behaviour and placement of heat pumps
Chillventa eSpecial Congress 2020 (online)	13.11.2020	Ch. Reichl et. al.	Acoustics of heat pumps with special focus on icing, defrosting and placement

* postponed to December, 7th-11th, 2020

** online proceedings due to cancellation of event due to COVID19

*** postponed to July 2021

+ presentations given at the 2017 IEA Heat Pump Conference in Rotterdam, which contain material of Sweden's and Austria's contributions to the framework of IEA HPT Annex 51.



3 Webinar Annex 51 Webinar “Acoustic Signatures of Heat Pumps”

The webinar consisted of one Introduction, a panel discussion and 7 technical contributions. The presentations are available for download at the IEA HPT Annex 51 website.

- [*Introduction Annex 51 webinar*](#) – Caroline Haglund Stignor (*Heat Pump Centre*)
- [*Annex 51 overview*](#) – Christoph Reichl (*AIT, Austria*)
- [*European Standards and Legislation*](#) – Roberto Fumagalli (*Polimi, Italy*)
- [*Noise and seasonal variations based on interlaboratory results*](#) – Francois Bessac (*CETIAT, France*), Thomas Gindre (*ISE, Germany*)
- [*Effect of different heat sinks and operation modes on acoustic emissions*](#) – Kamal Arumugam (*DTI, Denmark*)
- [*\(Transient\) Noise of Heat Pumps*](#) – Thore Oltersdorf (*Fraunhofer ISE, Germany*)
- [*Heat pump installation and effects on surrounding environment*](#) – Christoph Reichl (*AIT, Austria*)
- [*Annoyance rating and psychoacoustical analysis of heat pump sound*](#) – Henrik Hellgren (*RI.SE, Sweden*)

The Webinar “Acoustic Signature of Heat Pumps” is available for re-viewing online at <https://heatpumpingtechnologies.org/annex51/watch-the-webinar-for-annex-51-acoustic-signature-of-heat-pumps/>



4 Meetings of the IEA HPT Annex 51 team with dates and locations

- Kickoff-Meeting: AIT – Austrian Institute of Technology in Vienna, Austria. June 20 –21, 2017. Setup of the Annex structure (task- and subtaskleads) and communication, definition of roadmap to Task 1 and Task 2.
- 2nd Working Meeting at Centre Technique des Industries Aéronautiques et Thermiques (CETIAT), France, January 16 – 17, 2018. Finalisation of task- and subtaskleads, discussions on Task 1 and Task 2, definition of roadmap to Task 3 – Task 7.
- 3rd Working Meeting at RI.SE, Borås, Sweden, June 27 – 28, 2018. Discussions of task 1 and task 2, selection heat pumps for round robin test, discussions on Task 3 – Task 7.
- 4th Working Meeting at DTI, Aarhus, Denmark, January 22 – 23, 2019. Finalisation of task 1, result discussions in task 2, discussions on Task 3 – Task 7, discussions on workshops at ICR2019 and MCE2020
- 5th Working Meeting at Fraunhofer ISE, Freiburg, Germany, October 17-18, 2019. Result discussions and comparisons in task 2, discussions on Task 3 – Task 7.
- 6th Working Meeting online, March 18-19, 2020. Planning roadmap to the final deliverables of Annex 51, further discussions on Task 3 – Task 7, final preparation and realization of the workshop at the MCE2020.
- 7th Working Meeting online, September 9-10, 2020. Discussion on final deliverables of Annex 51, further discussions on Task 6, preparation of the webinar in December.
- Webinar planning meeting on November, 27th 2020
- Webinar on November, 30th 2020, 14:00-16:00



5 List of Publications

This section contains the publications listed in order of years.

5.1 Publications in the year 2017

- E. Wasinger, *Sound field simulations of air-water heat pumps in a terraced housing estate*, Bachelor Thesis, Austria 2017, translated to English

5.2 Publications in the year 2018

- Ch. Reichl, J. Emhofer, M. Popovac, G. Drexler-Schmid, P. Wimberger, F. Linhardt, K. Alten, T. Fleckl, International Research: Acoustic Signatures of Heat Pumps, 11de Warmtepomp Synposium, Communicatiehuis, Gent, Belgium, October 10th, 2018
- Ch. Reichl, J. Emhofer, M. Popovac, G. Drexler-Schmid, P. Wimberger, F. Linhardt, K. Alten, T. Fleckl, *Akustische Emissionen von Wärmepumpen*, Chillventa Congress 2018, 5. Innovationstag Kältetechnik, Messe Nürnberg, October 14th, 2018
- P. Wimberger, J. Emhofer, C. Reichl, *MicLocator - Determine multiple microphones' positions using sound wave delay and trilateration*, 68th Annual Meeting of the Austrian Physical Society, TU Graz; September 11th-13th, 2018
- S. Hinterseer, T. Bednar, *Determining the Influence of the Operating Point on Noise Emissions of Air Source Heat Pumps*, 68th Annual Meeting of the Austrian Physical Society, TU Graz; September 11th-13th, 2018



5.3 Publications in the year 2019

- Christoph Reichl, Johann Emhofer, *SilentAirHP - Advanced methods for evaluating and developing noise reduction measures for air heat pumps*, final report of Austrian research project, 21.08.2019
- Ch. Reichl, Presentation on the Annex 51 and Experiences, EHPA Sound Workshop, Vienna, 10.10.2019
- Thomas Fleckl, Christoph Reichl, *Annex 51 "Acoustic Signatures of Heat Pumps" in the framework of the International Energy Agency Technology Collaboration Programme on Heat Pumping Technologies (IEA HPT)*, Acoustics of Heat Pumps, Workshop at ICR2019, Montreal, Canada
- Johann Emhofer, Christoph Reichl, *1D modelling of heat pumps including acoustics*, Acoustics of Heat Pumps, Workshop at ICR2019, Montreal, Canada
- Christian Vering, Jonas Klingebiel, Markus Nürenberg, Dirk Müller, *Simultaneous energy efficiency and acoustic evaluation of heat pump systems using dynamic simulation models*, Acoustics of Heat Pumps, Workshop at ICR2019, Montreal, Canada
- Christoph Reichl, Peter Wimberger, Felix Linhardt, Johann Emhofer, *Acoustic Emissions and Noise Abatement of Air to Water Heat Pumps*, Acoustics of Heat Pumps, Workshop at ICR2019, Montreal, Canada
- Karlheinz Bay, Simon Braungardt, Thomas Gindre, Thore Oltersdorf, Jens Rohlfing, Lena Schnabel, Agostino Troll, *Testing campaign on the energetical and acoustical behaviour of a heat pump*, Acoustics of Heat Pumps, Workshop at ICR2019, Montreal, Canada
- Ola Gustafsson, Henrik Hellgren, Caroline Haglund Stignor, *Heat pump noise – operation dependence and seasonal averaging*, Acoustics of Heat Pumps, Workshop at ICR2019, Montreal, Canada
- Troll, T. Gindre, *Charakterisierung der Geräuschentwicklung einer Wärmepumpe*, DAGA 2019 - 45. Jahrestagung für Akustik, Rostock, March 18th-21st 2019



5.4 Publications in the year 2020

- C.H. Kasess, C. Reichl, H. Waubke, P. Majdak, *Perception Rating of the Acoustic Emissions of Heat Pumps*, e Forum Acusticum, Lyon, France, December 7-11, 2020
- Christian H. Kasess, Christoph Reichl, Holger Waubke, Piotr Majdak, *Beurteilung der Wahrnehmung der Schallemission von Wärmepumpen*, submitted to DAGA 2020, 46. Jahrestagung für Akustik, online 2020, Hannover, Deutschland
- Christoph Reichl, Johann Emhofer, Peter Wimberger, Felix Linhardt, Norbert Schmidbauer, Gerwin H.S. Drexler-Schmid, Brigitte Blank-Landeshammer, Andreas Sporr, Christian Köfinger, Thomas Fleckl, *Akustische Optimierung von Wärmepumpen (IEA HPT Annex 51)*, 26. Tagung des BFE-Forschungsprogramms «Wärmepumpen und Kälte», online BFH Burgdorf, 24.06.2020
- Christoph Reichl, Brigitte Blank-Landeshammer, Andreas Sporr, Gerwin Drexler-Schmid, Johann Emhofer, Mirza Popovac, Peter Wimberger, Camilla Sandström, Christian Köfinger, Andreas Zottl, Thomas Fleckl, *Acoustics of heat pumps with special focus on icing, defrosting and placement*, Chillventa eSpecial Congress, online, 13.11.2020
- Christoph Reichl, Johann Emhofer, G. Drexler-Schmid, Peter Wimberger, Felix Linhardt, Brigitte Blank-Landeshammer, Andreas Sporr, Thomas Fleckl, *Acoustic behaviour and placement of heat pumps*, The perception of sound and heat pumps” in The Essence of Heat Pumps Series, EHPA Webinar, 02.09.2020
- Blank-Landeshammer Brigitte, Sporr Andreas, Drexler-Schmid Gerwin, Kasess Christian, Köfinger Christian, Emhofer Johann, Waubke Holger, Reichl Christoph, *Noise Propagation Modelling and Mapping using Augmented Reality for HVAC Sound Sources*, submitted to ICSV27, 27th International Congress on Sound and Vibration, Prague, July 12th-16th, 2020, accepted, postponed



5.5 Publications in the year 2021

- François Bessac, Roberto Fumagalli, Henrik Hellgren, Thore Oltersdorf, Svend Pedersen, Thomas Fleckl, Christoph Reichl, *Acoustic Characterisation of an Air-To-Water Heat Pump for Different Operating Conditions: Inter-laboratory Results*, submitted to the 13th IEA HPC, Jeju Island, South Korea, April 26-29, 2021
- Gerwin H.S. Drexler-Schmid, Christian H. Kasess, Brigitte Blank-Landeshammer, Christian Köfinger, Johann Emhofer, Holger Waubke, Christoph Reichl, *Augmented reality acoustics of air heat pumps – App development and methods*, submitted to the 13th IEA HPC, Jeju Island, South Korea, April 26-29, 2021
- Christian Vering, Jonas Klingebiel, Christoph Reichl, Johann Emhofer, Markus Nürenberg, Dirk Müller, *Simultaneous energy efficiency and acoustic evaluation of heat pump systems using dynamic simulation models*, submitted to the 13th IEA HPC, Jeju Island, South Korea, April 26-29, 2021



6 Task documents available for download at the IEA HPT Annex 51 website

The following documents are available for free download on the IEA HPT Annex 51 website:

- **IEA HPT Annex 51 Executive Summary and Document Guide** - [IEA HPT Annex 51 Executive Summary and Document Guide](#)
- **IEA HPT Annex 51 Umbrella Report** - [IEA HPT Annex 51 Umbrella Report](#)
- Deliverable 1.0 - **Introduction** - [IEA HPT Annex 51 D1.0](#)
- Deliverable 1.1 - **Measurement Techniques** - [IEA HPT Annex 51 D1.1](#)
- Deliverable 1.2 - **Regulations - Countries overview** - [IEA HPT Annex 51 D1.2](#)
- Deliverable 1.3 - **Regulations - Synthesis** - [IEA HPT Annex 51 D1.3](#)
- Deliverable 2.1 - **Selection of Heat Pumps for Round Robin Tests** - Market figures - [IEA HPT Annex 51 D2.1](#)
- Deliverable 2.2 - **Round Robin Tests - Air-to-Water Heat Pump** - Heat Pump Water Heater - [IEA HPT Annex 51 D2.2](#)
- Deliverable 2.3 - **Seasonal Sound Power Level** - Air-to-Water Heat Pump - [IEA HPT Annex 51 D2.3](#)
- Deliverable 3 - **Overview on Heat Pump Component Noise and Noise Control Techniques** - [IEA HPT Annex 51 D3](#)
- Deliverable 4 - **Analysis of the Effect of Operating Conditions of Heat Pumps on Acoustic Behaviour** - [IEA HPT Annex 51 D4](#)
- Deliverable 5.1 - **Report on heat pump installation with special focus on acoustic impact** - [IEA HPT Annex 51 D5](#)
- Deliverable 6.1 - **Annoyance rating and psychoacoustical analysis of heat pump sound** - [IEA HPT Annex 51 D6](#)
- Deliverable 7.1 - **Educational material on acoustics of heat pumps** - [IEA HPT Annex 51 D7.1](#)
- Deliverable 7.2 - **Workshop material and conference contributions** - [IEA HPT Annex 51 D7.2](#)



7 Dissemination workshops in Montreal, Canada, August 2019

A dissemination workshop “Acoustics of Heat Pumps” has been organized by the Annex 51 team in the framework of the 25th IIR International Congress of Refrigeration in Montreal, Canada, August 2019. The presentations are available on the IEA HPT Annex 51 website for download. There have been 6 presentations of Annex 51 partners and a panel discussion.

- Thomas Fleckl, Christoph Reichl, [Annex 51 "Acoustic Signatures of Heat Pumps" in the framework of the International Energy Agency Technology Collaboration Programme on Heat Pumping Technologies \(IEA HPT\)](#), AIT Austrian Institute of Technology

Roberto Fumagalli, [Acoustic Regulations of Heat Pumps](#), Polimi, Italy

- Johann Emhofer, Christoph Reichl, [1D modelling of heat pumps including acoustics](#), AIT Austrian Institute of Technology

- Christian Vering, Jonas Klingebiel, Markus Nürenberg, Dirk Müller, [Simultaneous energy efficiency and acoustic evaluation of heat pump systems using dynamic simulation models](#), RWTH Aachen

- Christoph Reichl, Peter Wimberger, Felix Linhardt, Johann Emhofer, [Acoustic Emissions and Noise Abatement of Air to Water Heat Pumps](#), AIT Austrian Institute of Technology, ([part1](#)) ([part2](#))

- Karlheinz Bay, Simon Braungardt, Thomas Gindre, Thore Oltersdorf, Jens Rohlfing, Lena Schnabel, Agostino Troll, [Testing campaign on the energetical and acoustical behaviour of a heat pump](#), Fraunhofer ISE/IBP ([part1](#)) ([part2](#))

- Ola Gustafsson, Henrik Hellgren, Caroline Haglund Stignor, [Heat pump noise – operation dependence and seasonal averaging](#), RISE Research Institutes of Sweden



8 IEA HPT Heat Pump Magazine

In the course of the IEA HPT Annex 51, 5 contributions for the Heat Pump Magazine have been compiled:

- Heat Pump Magazine 3-2018
- Heat Pump Magazine 1-2019
- Heat Pump Magazine 1-2020
- Heat Pump Magazine 3-2020
- Heat Pump Magazine 1-2021

9 Further Dissimination and Documents

- Dissemination through two webinar for Austrian installers, planners and manufacturers (September, 30th 2020 & October, 28th 2020).
- Final report of the national Austrian Project “SilentAirHP” (in english and german language)
 - [SilentAirHP Endbericht](#)
 - [SilentAirHP final report](#)
- Bachelor work “Sound field simulations of air-water heat pumps in a terraced housing estate”
 - [Sound Field Simulations](#)
 - [Appendix to Sound Field Simulations](#)
- Additional documents for deliverable 7.1 in original language
 - [AFPAC FICHE ACOUSTIQUE n1](#)
 - [AFPAC FICHE ACOUSTIQUE n2](#)
 - [AFPAC FICHE ACOUSTIQUE n3](#)
 - [vejledningen stoejberegner](#)
- Furthermore, the following documents from the Austrian national IEA HPT Annex 51 project are available for download:
 - [IEA HPT Annex 51_D1.1_Gesetzes-und-Normenlage](#)
 - [IEA HPT Annex 51_D1.2_Messtechnik-und-Standards](#)



- [IEA HPT Annex 51 D1.3-Zertifikations-Schemata](#)
- [IEA HPT Annex 51 D2.1 Liste-Waermepumpenmodelle](#)
- [IEA HPT Annex 51 D3.1 Ueberblick-ueber Schallemissionen-von-Komponenten-und-Waermepumpeneinheiten](#)
- [IEA HPT Annex 51 D3.2 Ueberblick ueber aktive Stoerschall-unterdrueckung](#)
- [IEA HPT Annex 51 D3.3 Resultate-der-Transmissionsmessungen-an-Waermetauschern](#)
- [IEA HPT Annex 51 D4.1 Bericht-ueber-den-Einfluss-des-gewaehlten-Betriebspunktes-auf-das-akustische-Verhalten](#)
- [IEA HPT Annex 51 D4.2 Bericht-zur-Untersuchung-der-Schall-emissionen-transienter-Prozesse](#)
- [IEA HPT Annex 51 D5.1 Bericht-ueber-Waermepumpen-installationen-mit-speziellem-Fokus-auf-akustischen-Emissionen](#)
- [IEA HPT Annex 51 D5.2 Bericht-mit-den-Ergebnissen-aus-Subtask-5](#)
- [IEA HPT Annex 51 D6.1 Bericht-ueber-zukuenftige-Optionen-zur-Beschreibung-der-akustischen-Performanz](#)
- [IEA HPT Annex 51 D6.2 Psychoakustischer-Bewertungsindex-fuer-die-Beschreibung-von-Waermepumpengeraeuschen](#)
- [IEA HPT Annex 51 D7.1 Bericht-ueber-durchgefuehrte-und-besuchte-Veranstaltungen](#)
- [IEA HPT Annex 51 D7.2 Bericht ueber Veroeffentlichungen](#)
- [IEA HPT Annex 51 D7.3 Bericht-mit Schulungsunterlagen-sowie-den-durchgefuehrten-Schulungsmasnahmen](#)
- [IEA HPT Annex 51 D7.4 Bericht-mit-den-Ergebnissen-aus-Subtask-7 PW](#)



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