D10.4 – Training plan

Project Information

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Project Coordinator	Andreas Sapalidis (NCSR)
Project Website	https://www.intelwatt.eu

Deliverable Information

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Deliverable title	Training plan
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WP Leader	WG
Contributing Partners	All partners
Nature	Report
Authors	Josipa Lisičar Vukušić (THK)
Contributors	All partners
Reviewers	Stéphan Barbe (THK), Andreas Sapalidis (NCSR)
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Dissemination Level

PU	Public	✓
PP	Restricted to other programme participants (incl. Commission Services)	
RE	Restricted to a group specified by the consortium (incl. Commission Services)	
CO	Confidential, only for the members of the consortium (incl. Commission Services)	

Document Log

Version	Date	Author	Description of Change
V1.0	19/05/2021	Josipa Lisičar Vukušić	First release

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V2.0	23/06/2021	Josipa Lisičar Vukušić	Final draft (Training plans added)
V3.0	12/07/2021	TH Köln	Review of the final draft
V4.0	31/08/2021	TH Köln and A. Sapalidis	Review of the final draft
V4.0	29/09/2021	Andreas Sapalidis	Final document

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1 Executive Summary

This document corresponds to the deliverable D10.4 “Training plan”.

All participants involved in intelWATT project will be involved in training activities, which in terms will contribute to professional development not only through advanced training of researches and industrial executives, but also to all the potential users of knowledge generated by the project.

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2 Introduction

Training plan is one of the activities related to WP10 dealing with Dissemination and Training. The participants offered their training plan, which they will carry out during the course of the project. These plans involve various presentations and practical courses about the expertise each participant is bringing into the project. The goal is not only to educate the employees, industrial experts, students and the interested public, but also the knowledge transfer between the participants.

Training activities will contribute to professional development through advanced training of researchers and other key staff, research managers, industrial executives, and potential users of knowledge generated by the project. In intelWATT, training is envisaged as that given by and for personnel working in the project.

Different training approaches will be adopted:

a) Organisation of one or more training events ("intelWATT school") integrated in existing curricula and modules for high-degree students and young researchers of the institutions involved (both academia and enterprises) with well-defined focus in line with the progress of activities. At the beginning of the project, a training plan will be prepared in collaboration with WH and shared with the partners. Scientific coordination of such "schools" will be carried out at NCSRD and be supported by WH for organizational activities. Training costs will cover the salary costs of those providing the training (if in conformity with Article II.14 of ECGA) but not the salary costs of those being trained as mentioned in Article II.16.6 of ECGA.
b) Staff exchange between partner's institutions, especially of young researchers. This (short) mobility plan includes in particular personnel exchange between involved academia/research institutes and enterprises; this will facilitate extensive transfer of knowledge and technology transfer at later stages. This will open job opportunities for young trained students (PhD, post-docs) in the industry.
c) Periodic technical meetings will be also an opportunity of training, cross-fertilization. Organization of a final workshop conference will be held in Athens at month 36.

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3 Training plans

Training plans are divided by their nature into several categories and presented in the following chapters. Furthermore, the topics and research of the intelWATT project will be integrated into the curriculum of master courses of Applied Chemistry at Technische Hochschule Köln.

3.1 Lectures and Workshops

3.1.1 IHE-Delft Institute for Water Education

General training information

Organisation name	IHE Delft
Training topic or course	Fouling and scaling in membrane systems
Date	M21/M22
Duration	2 days (online; 4 hours each day), 3 days (if organized in Delft)
Place	Online (can be hosted in Delft if Covid allows)
Training coordinator	Nirajan Dhakal
Number of trainees	Max 20
Costs	3-4 k€ (time input +materials) + to be added other costs (accommodation, travel, field trip) if we do the training in Delft

Training description

The training is aimed to provide the lecture/workshop on membrane fouling and scaling, pre-treatment needed and cleaning of the membranes.

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3.1.2 Technische Hochschule Köln

General training information

Organisation name	Technische Hochschule Köln (THK)
Training topic or course	Summer School intelWATT
Date	M33/M35
Duration	5 days
Place	THK, Campus Deutz (Cologne), Germany
Training coordinator	Josipa Lisičar Vukušić
Number of trainees	Up to 30 PhD students
Costs	To be determined

Training description

Summer School IntelWatt offers students the opportunity to interact with professionals and scientists involved in intelWATT project. Inspiring lectures combined with workshops will be held by experienced researches. Topics of Summer School will be membrane technology, wastewater treatment, reverse osmosis and plastic electroplating.

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3.1.3 University of Birmingham

General training information

Organisation name	University of Birmingham
Training topic or course	Higher Recovery Reverse Osmosis for Metals and Water Recovery
Date	To be determined
Duration	1 day
Place	To be determined
Training coordinator	Somayeh Karimi
Number of trainees	Up to 20
Costs	To be determined

Training description

Many industries face challenges of managing effluents and recovering valuable resources from them. The metal plating industry is a good example, as it typically produces effluents containing valuable metals that may be toxic to the environment. The intelWATT project has been developing processes for treatment of rinse water from electroplating baths of metals such as chromium, nickel, copper. A very desirable goal of such recovery processes is the reconcentration of these effluents, ideally to restore the initial concentration needed by the electroplating process. High Recovery Reverse Osmosis (HRRO) is an approach that can help achieve such reconcentration at only modest energy cost. The overall aim of the training will be to familiarise the participants with the HRRO process, and to enable them to specify and design the process in practical applications.

Learning outcomes: At the end of the training, participants should be able to:

- Explain the fundamental working principles of pressure driven separation processes especially reverse osmosis and nanofiltration
- Distinguish among the different type of membranes available for use in HRRO
- Compare the various RO systems configurations including batch, semi-batch and continuous RO, making reference to key performance parameters of energy consumption, recovery and concentration factor
- Carry out concept design of such systems for use in effluent treatment and recovery
- Understand the limitations of the HRRO process and thus the requirements of pre- and post-treatment processes steps

Method of delivery: the training will be delivered through presentations with exercises to be worked through individually or in groups.

Assessment: the training will be assessed through an on-line quiz that will be linked to the presentations and exercises.

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Target audience and prerequisites: the training is targeted at experts and practitioners in the relevant industries wishing to extend their knowledge in the scientific area of separation and purification technologies. It may also be of interest to academic researchers and postgraduate students wishing to develop knowledge in this area. University-level understanding of basic chemical engineering concepts will be assumed.

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3.1.4 University of Jordan

General training information

Organisation name	The University of Jordan
Training topic or course	Wastewater treatment in Jordan
Date	M18/M19
Duration	4 days
Place	The University of Jordan
Training coordinator	Dr. Rund Abu-Zurayk
Number of trainees	20
Costs	Approximately 2000 €

Training description

This training workshop will target undergraduate students (final year), fresh graduates and postgraduates who has interests in water treatment.

The course will cover the following subjects:

1. Types of wastewater in Jordan
2. Toxicity in wastewater
3. Methods of wastewater treatment
4. Case study – (industrial wastewater including field visit).

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3.1.5 Warrant HUB

General training information

Organisation name	Warrant HUB
Training topic or course	Targeting Intelligent Water Treatment Technologies
Date	M36/M42
Duration	5 days
Place	Italy – Due to Covid emergency a hybrid event could be appointed
Training coordinator	Scientific coordination of such "schools" will be carried out at NCSRD and be supported by WH for organizational activities.
Number of trainees	40 (in presence) – additional on-line
Costs	A fee will be requested only to cover direct costs (subsistence and rending of rooms) Training costs will cover the salary costs of those providing the training (if in conformity with Article II.14 of ECGA) but not the salary costs of those being trained as mentioned in Article II.16.6 of ECGA.

Training description

The "intelWATT school" will be organized in the framework of the project for high-degree students and young researchers of the involved institutions (both academia and enterprises) with well-defined focus which is in line with the progress of activities.

The Rationale of the School Program will be organized balancing the school effort during the morning and dedicating the second half of the day to study visits. The programme will be organized in 5 days and each day has a main highlight.

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3.1.6 NCSR Demokritos (Event 1)

General training information

Organisation name	NCSR "DEMOKRITOS"
Training topic or course	Membrane based water treatment technologies
Date	The exact days will be determined (during NCSRD's summer schools in July of 2022 and July of 2023, two courses)
Duration	2 days each
Place	Athens, Greece
Training coordinator	Andreas Sapalidis
Number of trainees	15-20
Costs	1500 €

Training description

These events will offer pre/post graduate students and young researchers the opportunity to visit the lab facilities and interact with professionals and scientists involved in IntelWatt project. The above training courses will focus mainly in membrane based technologies for water treatment and recycling in energy intensive industrial applications. The session will include an introduction in membrane materials, types and modules that are currently commercial available, the application area of each membrane type and limitations, the design aspects of membrane based systems, training on the most popular engineering software packages and finally basic characteristics regarding the process control of such systems.

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3.1.7 NCSR Demokritos (Event 2)

General training information

Organisation name	NCSR "DEMOKRITOS"
Training topic or course	intelWATT's final workshop
Date	M36 (will be determined, possibly September 2023)
Duration	1-2 days
Place	Athens, Greece
Training coordinator	Andreas Sapalidis
Number of trainees	100-150
Costs	10,000-15,000 Euros

Training description

The workshop will be dedicated to the presentation and demonstration the intelWATT's innovative technologies.The workshop targeting to experts and practitioners in the relevant fields, researchers, high-degree students, industrial executives, academics and in general to all the potential users of knowledge generated by the project. Dedicated actions will be organised in parallel with the workshop targeting to the awareness of the general public on water related and artificial intelligence aspects.

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3.1.8 NCSR Demokritos (Event 3)

General training information

Organisation name	NCSR "DEMOKRITOS"
Training topic or course	Practical courses (during summer school event(s))
Date	Will be determined (2022-2024)
Duration	1 month per person
Place	Athens, Greece
Training coordinator	Iosif Scoullos
Number of trainees	5-6
Costs	2500 €

Training description

The above training sessions will focus mainly to the training of under graduate students in the intelWATT lab facilities and technologies. In addition the students will be familiarized with the most common water analysis methods (like ion chromatography, photometry and atomic absorption) as well as to techniques regarding the study of membranes' microbiological and fouling behaviour.

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3.1.9 National Research Council- Institute on Membrane Technology (ITM-CNR)

General training information

Organisation name	CNR-ITM
Training topic or course	Sustainable approach in membrane fabrication
Date	To be determined
Duration	1 days (online; 2 hours)
Place	Online
Training coordinator	Alberto Figoli
Number of trainees	To be determined
Costs	Free registration

Training description

Environmental protection and climate change are current issues at the heart of global economic growth. The awareness of the real risks connected with industrial membrane production sector has been the push towards the search of new, more sustainable, solvents and raw materials. In this context, the lecture will aim to present the use of green solvents and bio-based polymer material for sustainable membrane fabrication.

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3.2 Public events

3.2.1 Technische Hochschule Köln (Event 1)

General training information

Organisation name	Technische Hochschule Köln (THK)
Training topic or course	Kölner Kinder Uni
Date	M20/M21 –M30/M31
Duration	1 day
Place	THK, Chempark (Leverkusen), Germany
Training coordinator	Sven Johann Bohr
Number of trainees	Up to 15 (children aged 8-14)
Costs	No fee for the attendees

Training description

Young researchers will have the opportunity to take a look behind the scenes at Technische Hochschule Köln. This event is aimed at children between the ages of 8 and 14. The course will be divided into a presentation and a practical part, where they will learn about the production of membranes.

The presentation will explain the principle of a membrane and show applications in nature and in technology.

During the practical part, a cellulose acetate membrane will be produced in the laboratory and a filtration experiment or a lateral flow experiment will be performed with the membrane.

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3.2.2 Technische Hochschule Köln (Event 2)

General training information

Organisation name	Technische Hochschule Köln (THK)
Training topic or course	Nacht der Technik
Date	M21
Duration	1 day
Place	THK, Campus Deutz (Cologne)
Training coordinator	Roxanne Engstler & Christine Kleffner
Number of trainees	Ca. 10 per demonstration (public will circulate)
Costs	No fee for the attendees

Training description

Nacht der Technik is an event open to all the public, in order to popularize different engineering fields. At Campus Deutz in Köln poster presentation (or Powerpoint) and lab demonstration of the reverse osmosis (RO) lab plant will be presented. The issue of rinse water of electroplating industry as source of highly contaminated wastewater will be highlighted. Furthermore, demonstration of the RO process to obtain fresh industrial water and to recycle the electrolytic components will be presented.

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3.2.3 National Research Council- Institute on Membrane Technology (ITM-CNR)

General training information

Organisation name	CNR-ITM
Training topic or course	Water and energy recovery from industrial waste solutions through integrated membrane processes: a sustainable approach proposed within the IntelWATT project
Date	September 24, 2021
Duration	A video will be presented during the event "SuperScienceMe - Research is your Re-generation", but it will be freely available on the web even after the end of the event.
Place	Registration of the video at CNR-ITM for the event "SuperScienceMe - Research is your Re-generation" ("SuperScienceMe - Research is your Re-generation" (https://www.superscienceme.it/)
Training coordinator	Enrica Fontananova
Number of trainees	To be determined
Costs	Free registration

Training description

The activity will consist in a short video registered at the CNR-ITM's laboratories to present and to disseminate the concept of energy and water recovery from industrial waste brines by integrated Reverse Electrodialysis (RED) and solar powered membrane distillation (Case Study 2 of the Intelwatt project) among young students, families and citizens interested to sustainable development.

The video will be uploaded and visible from September 24, 2021 by free registration on the website and on the Facebook page of the event "SuperScienceMe - Research is your Re-generation" (https://www.facebook.com/nottericercatoribasilicata/; https://www.superscienceme.it/preview/) with the possibility to share and redistribute the video (e.g.in the Intelwatt website).

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3.3 Employee training programs

3.3.1 Nijhuis Industries

General training information

Organisation name	Nijhuis Industries
Training topic or course	intelWATT general project presentation in Process design engineering
Date	20/04/2021
Duration	1 hr
Place	Online meeting (Doetinchem NL)
Training coordinator	Dimitra Aravani & Hessel Teeuw
Number of trainees	10
Costs	Internal in the company (if we calculate the hr per person and preparation, then we can book 500 EUR)

Training description

An internal training within process design engineering to introduce the project and mainly tasks and goals of the project. Exchange ideas for the shared treatment steps and bring awareness about the main industries we want to proof our concept aiming in similar experience with our prospect clients.

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3.3.2 REDstack BV

General training information

Organisation name	REDstack BV
Training topic or course	Presentation: Technical advances of REDstack in IntelWATT Project
Date	October 2021-2022-2023- March 2024
Duration	1h-2 hrs
Place	Online TEAMS meeting and/or company office (depending on situation)
Training coordinator	Jordi Moreno and Kristan Goeting
Number of trainees	10-20
Costs	To be determined (hrs of trainees attending presentation plus preparations)

Training description

The training consists of a presentation given to the REDstack employees. The main topics will be: general update of IntelWATT project, role of REDstack in the project, and the achievements and challenges. Special focus will be given to our main tasks in the project, especially stack design and manufacturing, integration in the pilot of case study 2 and optimisation with AI tools. Furthermore, special attention will be given to the things we learned from project partners.

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3.3.3 Public Power Corporation SA

General training information

Organisation name	PPC
Training topic or course	On site Visit of NCSR in Megalopolis V Power Plant
Date	09/07/2021
Duration	1 day
Place	Megalopolis V Power Plant, 222 00, Arcadia, Greece.
Training coordinator	PPC Megalopolis V Power Plant, Chemist Technology Sector.
Number of trainees	3
Costs	Trainer personnel costs: 560 EUR

Training description

Outdoor, on-site training visit of the NCSRs members including walkthrough of all facilities, portray of the equipment, analysis of the processes, display of the monitoring and control capabilities, for the better understanding of the processes taking place in the Megalopolis V Power Plant. The whole plant's activities and facilities will be covered but emphasis will be given on the water streams processes from raw water to blow –down and other wastewater treatment.

Scope is the NCSRs members to have a clear depiction of the plant's operation that will provide clarification and answers for the pilot case implementation.

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3.4 Staff exchange

Staff exchange is considered to be a theoretical and practical knowledge transfer, not only between the universities but also between the industry and academia.

3.4.1 BIA Solingen GmbH

General training information

Organisation name	BIA Solingen GmbH
Training topic or course	Staff exchange between BIA Solingen GmbH and THK
Date	M08-M11
Duration	2-3 days
Place	Solingen, Germany
Training coordinator	Felix Heinzeler
Number of trainees	2-3
Costs	-

Training description

Scientific staff members of THK and students are visiting the electroplating facility and learning about the electroplating process as well as standard analytical procedures of the production process (ICP-OES, titration techniques and hull cell plating). The visitors are able to perform the standard procedures by themselves as well as bring samples to create own analytical methods to use in master/bachelor theses on the topic.

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3.4.2 NCSR "Demokritos" (Event 1)

General training information

Organisation name	NCSR "DEMOKRITOS"
Training topic or course	Joint training activities towards Zero Liquid Discharge concept for large scale cooling towers. The demonstration unit in PPC's Power Plant at Megalopolis.
Date	The exact day will be determined (after March of 2023)
Duration	2 times, 1 day each
Place	Athens – Megalopolis, Greece
Training coordinator	Evangelos Kouvelos (NCSR)
Number of trainees	5-10 each group
Costs	5,000 Euros

Training description

The above course concerns the training of intelWATT's young researchers to the cooling tower blow down treatment pilot unit, and the zero liquid discharge concept, that will be installed in the PPC's (unit V) power plant facilities at Megalopolis, Greece in the frame of the staff mobility between the partners.

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3.4.3 NCSR "Demokritos" (Event 2)

General training information

Organisation name	NCSR "DEMOKRITOS"
Training topic or course	Staff exchange between NCSR "Demokritos" and THK
Date	To be determined (probably in 2022)
Duration	To be determined
Place	Athens, Greece
Training coordinator	Andreas Sapalidis
Number of trainees	Up to 3
Costs	To be determined

Training description

Researches from THK will be visiting NCSR "Demokritos" in Greece. This staff exchange will involve the knowledge exchange about the membrane development and production. Further issues regarding the project will discussed.

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3.4.4 Technische Hochschule Köln (Event 1)

General training information

Organisation name	Technische Hochschule Köln (THK)
Training topic or course	Staff exchange between THK and NCSR ”Demokritos”
Date	M14
Duration	To be determined
Place	THK, Campus Deutz (Cologne), Chempark (Leverkusen), Germany
Training coordinator	Stéphan Barbe
Number of trainees	1
Costs	To be determined

Training description

Andreas Sapalidis from NCSR “Demokritos” will be visiting TH Köln in Germany. This staff exchange will involve the introduction into work package 7 and further discussion about the development of the project and new perspectives.

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3.4.5 Technische Hochschule Köln (Event 2)

General training information

Organisation name	Technische Hochschule Köln (THK)
Training topic or course	Staff exchange between THK and University of Birmingham
Date	End of 2021/beginning of 2022
Duration	To be determined
Place	THK, Campus Deutz (Cologne), Chempark (Leverkusen), Germany
Training coordinator	Roxanne Engstler
Number of trainees	1
Costs	To be determined

Training description

Somayeh Karimi (University of Birmingham) will be visiting TH Köln in Germany. This staff exchange will involve the knowledge exchange about the synthetic water as well as the apparatus used in waterwaste treatment.

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3.4.6 Technische Hochschule Köln (Event 3)

General training information

Organisation name	Technische Hochschule Köln (THK)
Training topic or course	Staff exchange between THK and CUT Membrane Technology GmbH
Date	To be determined (probably in 2022)
Duration	To be determined
Place	Chempark (Leverkusen), Germany
Training coordinator	Stéphan Barbe
Number of trainees	Up to 5
Costs	To be determined

Training description

THK collaborates with CUT Membrane Technology GmbH and plans on staff exchange in the near future between researchers and industrial experts regarding active carbon technology.

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3.4.7 University of Birmingham

General training information

Organisation name	University of Birmingham
Training topic or course	Staff exchange between University of Birmingham and THK
Date	To be determined (probably in 2022/2023)
Duration	To be determined
Place	University of Birmingham
Training coordinator	Somayeh Karimi
Number of trainees	Up to 3
Costs	To be determined

Training description

Researches from THK will be visiting University of Birmingham in England. This staff exchange will involve the knowledge exchange about the high recovery reverse osmosis, apparatus and necessary pre- and post-treatment. Further issues regarding the case study 3 will discussed.

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3.4.8 National Research Council- Institute on Membrane Technology (ITM-CNR)

General training information

Organisation name	CNR-ITM and/or the Intelwatt Partners involved as Home or Hosting Partner
Training topic or course	Short term mobilities of young researchers/key staff involved in Case Study 2
Date	To be determined as a function of the research activities in progress in the framework of the Project.
Duration	To be determined
Place	Hosting Partners laboratories and premises
Training coordinator	For each event the training coordinator will be individuated among the key staff of the Hosting Partner. For the events in which CNR-ITM is the Hosting Partner: Enrica Fontananova For the events in which ACSA is the Hosting Partner: Beatriz Corzo García For the events in which CIEMAT is the Hosting Partner: Guillermo Zaragoza
Number of trainees	1-4 for each training activity
Costs	To be determined. As general indication: - The Home Partners will cover salary, travel and living allowance of the young researcher/key staff. - The Hosting Partners will cover laboratory costs for the training activities and salary of their personnel providing the training.

Training description

In the framework of the Intelwatt project short mobility of young researchers and other key staff involved in Case Study 2 (CS2) “Hybrid process for water recovery and energy harvesting from industrial brines” are planned in order to contribute to their professional formation and to facilitate knowledge and technology transfer.

Young researchers/key staff will move from their Home Institute/University/Company (Home Partner) to laboratories of other Partners (Hosting Partner) for specific training activities (e.g advanced membrane characterization and testing at laboratory scale; training at industrial partners premises; training activities at the pilot unit, etc.). These training activities will be given by and for personnel working in the project.

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The total number and the details of each event will be determined as a function of the research activities in progress in the framework of the Project and depending on the pandemic evolution.

For example, it's planned after M24 the mobility of Young researchers/key staff from CNR-ITM (Home Partner) to the brine collector in Castellgalí near Barcelona, Spain (ACSA will be the Hosting Partner) to facilitate knowledge and technology transfer.

Moreover, CNR-ITM will host young researchers/key staff from other Partners for training on advanced membrane characterization and membrane testing at laboratory scale RED-MD unit (CNR-ITM will be the Hosting Partner).

CIEMAT will host young researchers/key staff from partners involved in CS2 (e.g. CNR-ITM and NCSR Demokritos) for training on their solar assisted membrane distillation units.

Very beneficial for the Project will be the mobility in the period M32-M42 of young researchers/key staff involved in CS2 toward the location of the TRL7 prototype located at the brine collector in Castellgalí (ACSA will be the Hosting Partner).

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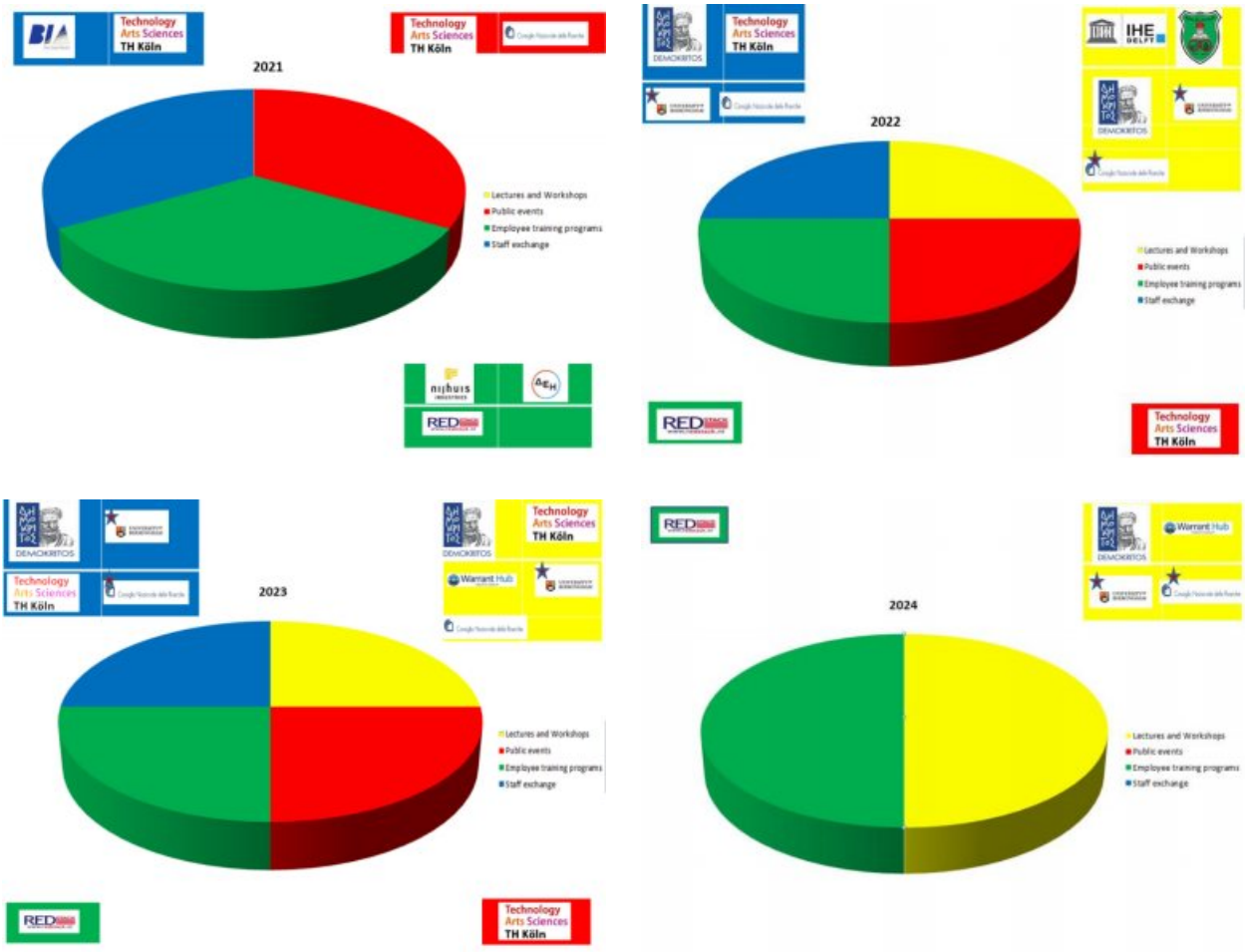
4 Conclusion

Participants of the intelWATT project have developed training plans and are planning of accomplishing them during the course of the project. Due to the COVID-19 pandemic, for some partners it became extremely complicated to plan and to achieve the training programs. For this reason, some of them may be held online. This report represents the plan of the activities participants are willing to perform in order to inform and educate the employees, industrial experts, students and the interested public.

Overall eight lectures/workshops involving scientists and students with different levels (Bachelor, Master and PhD) and from different disciplines (chemistry, membrane science, chemical and civil engineering), three public events involving citizens and children, two employee training programs and seven staff exchanges involving international scientists are planed within intelWATT. The scientific outputs from case study 3 will be disseminated in the Master program “Angewandte Chemie” at TH Köln. During the public events, the relevance and the progress achieved within intelWATT will presented to citizens and children. Employees from both academia and industry will also benefit from the project and learn new evolving techniques and theories. Finally, synergies between the partners have been identified and will be deployed via staff exchanges leading to intense knowledge exchange and transfer. The following Gantt Chart gives an overview of the planed training activities over the total duration of intelWATT.



* The date has not been been determined.

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