

2023 International Conference on ICT for Sustainability (ICT4S 2023)

**Rennes, France
5 – 9 June 2023**



**IEEE Catalog Number: CFP23IC4-POD
ISBN: 979-8-3503-1110-5**

**Copyright © 2023 by the Institute of Electrical and Electronics Engineers, Inc.
All Rights Reserved**

Copyright and Reprint Permissions: Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

****** This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number:	CFP23IC4-POD
ISBN (Print-On-Demand):	979-8-3503-1110-5
ISBN (Online):	979-8-3503-1109-9

Additional Copies of This Publication Are Available From:

Curran Associates, Inc
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: (845) 758-0400
Fax: (845) 758-2633
E-mail: curran@proceedings.com
Web: www.proceedings.com

CURRAN ASSOCIATES INC.
proceedings
.com

2023 International Conference on ICT for Sustainability (ICT4S) **ICT4S 2023**

Table of Contents

Preface	viii
Organizing Committee	xi
Local Committee	xiii
Program Committee	xiv

In/For/By Society

Untangling the Relationship between Degrowth and ICT	1
<i>Sergio España (Utrecht University, the Netherlands; Universitat Politècnica de València, Spain), Willem Hulst (Utrecht University, the Netherlands), Nivard Jansen (Utrecht University, the Netherlands), and Daniel Pargmam (KTH Royal Institute of Technology, Sweden)</i>	
Obsolescence Paths: Living with Aging Devices	13
<i>Léa Mosesso (Univ Lyon, UCBL, CNRS, INSA Lyon, Centrale Lyon, Univ Lyon 2, France), Nolwen Maudet (Université de Strasbourg, France), Edlira Nano (Univ Lyon, UCBL, CNRS, INSA Lyon, Centrale Lyon, Univ Lyon 2, France), Thomas Thibault (Praticable, France), and Aurélien Tabard (Univ Lyon, UCBL, CNRS, INSA Lyon, Centrale Lyon, Univ Lyon 2; Univ. Lille, Inria, CNRS, Centrale Lille, France)</i>	
"We are always on, is that really necessary?" Exploring the Path to Digital Sufficiency in Flexible Work	24
<i>Maël Madon (Université de Toulouse, France) and Patricia Lago (Vrije Universiteit Amsterdam, The Netherlands)</i>	

Energy Efficiency

Just Measure IT! – Electricity Consumption Measurements of Electronic Devices and Estimates of Datacenter and Network Services for One Household	35
<i>Malmodin Jens (Ericsson Research, Sweden)</i>	

Evolution of Kotlin Apps in Terms of Energy Consumption: An Exploratory Study	46
<i>Hesham Ahmed (Vrije University, Netherlands), Alina Boshchenko (Vrije University, Netherlands), Niaz Ali Khan (Vrije University, Netherlands), Dmitriy Knyajev (Vrije University, Netherlands), Dinara Garifollina (Vrije University, Netherlands), Gian Luca Scoccia (University of L'Aquila, Italy), Matias Martinez (Universitat Politècnica de Catalunya, Spain), and Ivano Malavolta (Vrije University, Netherlands)</i>	
Energy Cost and Machine Learning Accuracy Impact of k-Anonymisation and Synthetic Data Techniques	57
<i>Pepijn de Reus (University of Amsterdam, The Netherlands), Ana Opreescu (University of Amsterdam, The Netherlands), and Koen van Elsen (University of Amsterdam, The Netherlands)</i>	
A Middleware Architecture for Mastering Energy Consumption in Internet of Things Applications	66
<i>Pedro Victor Borges (Institut Polytechnique de Paris, France), Chantal Taconet (Institut Polytechnique de Paris, France), Sophie Chabridon (Institut Polytechnique de Paris, France), Denis Conan (Institut Polytechnique de Paris, France), and Everton Cavalcante (Federal University of Rio Grande do Norte, Brazil)</i>	
Assessing VoD Pressure on Network Power Consumption	76
<i>Gaël Guennebaud (Univ. Bordeaux, France), Aurélie Bugeau (Univ. Bordeaux, France), and Antoine Dudouit (Univ. Bordeaux, France)</i>	
Investigating the Sustainability of the 5G Base Station Overhaul in the United States	87
<i>Zesen Zhang (University of California San Diego), Leila Scola (University of California San Diego), and Aaron Schulman (University of California San Diego)</i>	

SDG Impact Cases

The Research Landscape of ICT for Sustainability: Harnessing Digital Technology for Sustainable Development	97
<i>Aiste Rugeviciute (La Rochelle University, France), Vincent Courboulay (La Rochelle University, France), and Lorenz M. Hilty (University of Zurich, Switzerland)</i>	
Sustainable Development Goals in the ICT Sector	108
<i>Vijanti Ramautar (Utrecht University, the Netherlands), Sergio España (Utrecht University, the Netherlands; Universitat Politècnica de València, Spain), Minh Nguyen (Utrecht University, the Netherlands), and Abdelouassil El Yousfi (Utrecht University, the Netherlands)</i>	
Assessing the Potential of Carpooling for Reducing Vehicle Kilometers Traveled	120
<i>Aina Rasoldier (Univ. Grenoble Alpes, Inria, CNRS, Grenoble INP, LIG, France), Alain Girault (Univ. Grenoble Alpes, Inria, CNRS, Grenoble INP, LIG, France), Sophie Quinton (Univ. Grenoble Alpes, Inria, CNRS, Grenoble INP, LIG, France), Jacques Combaz (Univ. Grenoble Alpes, CNRS, Grenoble INP, VERIMAG, France), and Kevin Marquet (Univ. Lyon, INSA Lyon, Inria, CITI, France)</i>	

Social and Environmental Effects of Post-COVID-19 Computer Science Virtual Conferencing: The Euro-par Case	132
<i>Danilo Carastan-Santos (Univ. Grenoble Alpes, France), Krzysztof Rzadca (University of Warsaw, Poland), Leonel Sousa (Universidade de Lisboa, Portugal), and Denis Trystram (Univ. Grenoble Alpes, France)</i>	

LCA & Reviews

Tech4Bad in the Oil and Gas Industry: Exploring Choices for ICT Professionals	142
<i>Ian Brooks (University of the West of England, United Kingdom), Minna Laurell Thorslund (KTH Royal Institute of Technology, Sweden), and Aksel Biørn-Hansen (KTH Royal Institute of Technology, Sweden)</i>	
Estimating the Carbon Footprint of ICT using Input-Output Analysis: Dealing with Overcounting and Other Challenges	154
<i>Francis Charpentier (CITEPA (Associate Researcher), France), Bernardo Martins (CITEPA, France), and Pascal Bourcier (Independent Researcher, France)</i>	
ReThink Your Processes! A Review of Process Mining for Sustainability	164
<i>Nina Graves (RWTH Aachen University, Germany), István Koren (RWTH Aachen University, Germany), and Wil M. P. van der Aalst (RWTH Aachen University, Germany)</i>	
Uncovering the Environmental Impact of Software Life Cycle	176
<i>Thibault Simon (Orange Labs, France), Pierre Rust (Orange Labs, France), Romain Rouvooy (Univ. Lille, Inria, CNRS, France), and Joël Penhoat (Orange Labs, France)</i>	

Business Case Studies

The Long Road to Sobriety: Estimating the Operational Power Consumption of Cellular Base Stations in France	188
<i>Arsalan Ahmed (Université de Lorraine, France) and Marceau Coupechoux (Institut Polytechnique de Paris, France)</i>	
Sustainable Digital Transformation for Rural Business – A Case Study of a Norwegian Startup	197
<i>Karine Wendelborg Risdalen (University of South Eastern Norway, Norway), Magnhild Marie Solberg (University of South Eastern Norway, Norway), Noor Jahan Khan (University of South Eastern Norway, Norway), and Anh Nguyen Duc (University of South Eastern Norway, Norway)</i>	
Co-Design Framework for Green ICT Ecosystem: A Tale from the Finnish Green ICT Ecosystem ...	207
<i>Larry Abdullahi (LUT University, Finland), Laura Partanen (LUT University, Finland), Antti Sipilä (TIEKE, Finland), Shola Oyedeji (LUT University, Finland), Md Sanaul Haque (LUT University, Finland), and Jari Porras (LUT University, Finland)</i>	

Author Index	217
---------------------------	------------