2021 20th International Symposium
INFOTEH-JAHORINA (INFOTEH)

infoteh

PROCEEDINGS

IEEE Catalog Number: CFP21JAH-ART

ISBN 978-1-7281-8229-2

infoteh.etf.ues.rs.ba

2021 20th International Symposium INFOTEH-JAHORINA (INFOTEH) | 978-1-7281-8229-2/20/$31.00 ©2021 IEEE | DOI: 10.1109/INFOTEH51037.2021.9400522

2021 20th International Symposium INFOTEH-JAHORINA (INFOTEH)

March 17-19, 2021

Jahorina, East Sarajevo, Republic of Srpska, Bosnia and Herzegovina

infoteh.etf.ues.rs.ba

PROCEEDINGS

Main organizer

University of East Sarajevo, Faculty of Electrical Engineering

Technical co-sponsorship

IEEE Industry Applications Society
IEEE Bosnia and Herzegovina Section
IEEE Serbia and Montenegro Section
IEEE B&H IAS/PEL/IE Jt Chapter

2021 20th International Symposium INFOTEH-JAHORINA (INFOTEH) | 978-1-7281-8229-2/20/$31.00 ©2021 IEEE | DOI: 10.1109/INFOTEH51037.2021.9400692

Co-organizers

University of Banja Luka, Faculty of Electrical Engineering
University of Belgrade, Faculty of Electrical Engineering
University of Niš, Faculty of Electronic Engineering
University of Novi Sad, Faculty of Technical Sciences
University of Kragujevac, Faculty of Technical Sciences Čačak
Ss. Cyril and Methodius University in Skopje
Enterprise Europe Network of Republic of Srpska
Alumni Association of Electrical Engineers, East Sarajevo

Under the auspices of

Ministry for Scientific and Technological Development, Higher Education and Information Society of Republic of Srpska

Sponsors

Power utility ”Elektrodistribucija Pale”
City of East Sarajevo
Enterprise Europe Network of Republic of Srpska

Supporters and friends

Municipality of East Novo Sarajevo
Municipality of East Ilidža
Municipality of Pale
PTT Inženjering Podgorica
IRCE East Sarajevo
Bit Alliance

XX međunarodni simpozijum INFOTEH-JAHORINA 2021

Jahorina, Hotel "Bistrica"
17 – 19. mart 2021.

Glavni organizator
Univerzitet u Istočnom Sarajevu, Elektrotehnički fakultet

Suorganizatori
Univerzitet u Banjoj Luci, Elektrotehnički fakultet
Univerzitet u Beogradu, Elektrotehnički fakultet
Univerzitet u Nišu, Elektronski fakultet
Univerzitet u Novom Sadu, Fakultet tehničkih nauka
Univerzitet u Kragujevcu, Fakultet tehničkih nauka u Čačku
Ss. Cyril and Methodius University in Skopje
Evropska mreža preduzetništva Republike Srpske
Alumni asocijacija inženjera elektrotehnike, Istočno Sarajevo

Urednik
dr Slobodan Milojković

Izdavač
Univerzitet u Istočnom Sarajevu, Elektrotehnički fakultet
Za izdavača: Prof. dr Božidar Popović

Tehnička obrada
dr Danijel Mijić
mr Budimir Kovačević
Miljan Sikimić

ISBN 978-99976-710-8-0

Univerzitet u Istočnom Sarajevu, Elektrotehnički fakultet
Vuka Karadžića 30, 71123 Istočno Sarajevo
Tel./Fax: 387 57 342 788
infoteh@etf.ues.rs.ba
www.etf.ues.rs.ba

Preliminary cost-benefit analysis for the heat pump application in industry

Dubravka Živković
Department of Technical-Technological Sciences
Institute for Information Technologies, University of Kragujevac
Kragujevac, Serbia
dubravka@uni.kg.ac.rs

Davor Končalović, Vladimir Vukašinović, Mladen Josijević, Jelena Nikolić
Energy and Process Engineering
Faculty of Engineering, University of Kragujevac
Kragujevac, Serbia

Ivan Novaković
Jim tim ltd,
Gornji Milanovac, Serbia

Abstract— **Industry processes are characterized by large amounts of energy losses dissipated as waste heat to the ambient. In industry sectors analyzed in the US, China and EU28 low-temperature waste heat below 230ºC makes up from 33% up to 60% of waste heat. The recovery of low-temperature waste heat is usually complex, affected by the user demand, mismatches between the waste heat source and the user demand, limited space for heat recovery facilities, the heat-power conversion is not efficient for low-temperature waste heat, payback period, etc. To address these in practice frequently met issues, this paper first briefly summarizes options on the low-temperature waste heat recovery. Then, user-friendly optimization methodology integrating the heat exchange, energy conversion and heat storage is presented.**

Keywords- waste heat recovery, cooling system, heat pump

I. INTRODUCTION

The global economy growth in past few decades has come mainly from the industry and at the expense of the environment while raising primary energy consumption and CO_2 emissions. Industry processes are characterized by large amounts of energy losses dissipated as waste heat to the ambient. That waste heat manifests in different forms and at different temperatures. Waste heat recovery is the process of capturing heat from these processes to be used later directly, upgrading it to a more useful temperature, and/or converting it to electrical power or cooling. Thus, recovering waste heat can provide extra power, heat or cooling but this opportunity at the same time is a great challenge. The energy generated from heat recovery, if it not required by the process or industrial site then must be exported to neighboring facilities or electrical and/or heat distribution networks.

In the EU28, it is estimated that 70% of total energy use in the industrial sector is used in thermal processes (furnaces, reactors, boilers and dryers) and up to a third of this energy is wasted through losses. Furthermore, most of the energy sources in the industry are fossil fuels. A significant portion of this heat can be recovered and utilized to contribute to energy efficiency and greenhouse gas emission reduction [1]. In recent analysis considering waste heat and Carnot's potential estimations (Carnot's potential provides a more precise indication on whether waste heat could still perform technical work or, better, be used for heat transfer) it was shown that there is a rather significant potential accounting 370 TWh (waste heat) or 174 TWh (Carnot's) per year in the European industry [2].

The waste heat is generally classified into high-temperature (>650°C), medium-temperature (230–650°C), and low-temperature (< 230°C) waste heat [3].

The recovery techniques for high- and medium-temperature waste heat are well developed and analyzed [4], [5], [6]. Compared with low-temperature waste heat, high-temperature waste heat is more accessible to be recovered due to its high energy level and could also be used for power generation with relatively mature technologies such as a steam turbine or organic Rankine cycle. For the same reason, the application of low-temperature waste heat recovery is limited by its temperature level: suitable user demand is not always available, and the heat-power conversion is not efficient for low-temperature waste heat. All these issues lead to difficulties and challenges in effectively achieving low-temperature waste heat recovery. But according to (Z.Y. Xu, 2019) [7] in industry sectors analyzed in the US, low-temperature waste heat below 230ºC makes up ~60% of the total waste heat; in China ratio of waste heat below 150ºC is in the range from 44% to 66% (depending on the industrial sector) and in the 28 countries in European Union, one-third of the waste heat has temperature level below 200ºC.

The recovery of low-temperature waste heat is usually complex, affected by the user demand, limited space for heat

CIP - Каталогизација у публикацији
Народна и универзитетска библиотека
Републике Српске, Бања Лука

007:004(082)(0.034.2)

МЕЂУНАРОДНИ симпозијум Инфотех-Јахорина (20 ; 2021 ; Источно Сарајево)
Zbornik radova [Електронски извор] / XX međunarodni simpozijum Infoteh-Jahorina 2021, Jahorina,17 - 19. mart 2021. ; [glavni organizator Elektrotehnički fakultet, Istočno Sarajevo ; suorganizatori Elektrotehnički fakultet, Banja Luka ... [et al.] ; urednik Slobodan Milojković]. - Onlajn izd. - El. zbornik. - Istočno Sarajevo : Elektrotehnički fakultet, 2021

Način pristupa (URL): https://infoteh.etf.ues.rs.ba/zbornik/2021/. - Насл. са насл. екрана. - Опис извора дана 16. 4. 2021. - Радови на срп. и енгл. језику. - Библиографија уз сваки рад. - Abstracts.

ISBN 978-99976-710-8-0

COBISS.RS-ID 132039169