

eurac research

**Internationale Forschungskoperationen im Bereich der
Gebäudeeffizienz – In memoriam Raphael Bointner**





Scenarios of public energy research and development expenditures: financing energy innovation in Europe

Raphael Bointner,^{1*} Simon Pezzutto² and Wolfram Sparber³



The aim of this study is to examine public expenditures for energy R&D in Europe and the resulting energy knowledge stock. After the first oil shock energy R&D became more and more important in Europe. The energy R&D distribution among technologies of the EU member states and the European Commission was similar in the 1980s with a strong focus on nuclear energy. Nowadays, energy efficiency and renewable energy technologies are of growing importance. The new program Horizon 2020 is expected to have an equal distribution between nonnuclear and nuclear energy R&D expenditures. The cumulative energy knowledge stock induced by public R&D expenditures amounts to approximately 36 billion EUR in 2013, whereupon the EU member states' share is more than three times larger than the European Commission's share. The study provides knowledge stock scenarios for the next years under business as usual and changing conditions. According to the scenarios, the knowledge stock will increase to 48.5–55 billion EUR by 2023. For the first time, such comparison between the EU member states' and the European Commission's R&D expenditures has been performed for a period of more than 30 years, obtaining a clear picture of the induced energy knowledge stock. © 2016 John Wiley & Sons, Ltd

How to cite this article:
WIREs Energy Environ 2016, 5:470–488. doi: 10.1002/wene.200

INTRODUCTION

In 1973, the Organization of Arab Petroleum Exporting Countries (OAPPEC) declared an oil embargo and crude oil prices dramatically increased worldwide. Since then, the aim was and still is to find alternatives to fossil fuels and to decrease the EU dependence on energy imports. The European Commission and EU member states promoted research activities for energy technologies, *inter alia* via research and development (R&D)^{1–3} expenditures.

*Correspondence to: bointner@eeg.tuwien.ac.at

¹Institute of Energy Systems and Electric Drives, Energy Economics Group, Vienna University of Technology, Vienna, Austria

²Institute for Renewable Energy, EURAC Research, Bolzano, Italy

Conflict of interest: The authors have declared no conflicts of interest for this article.

The future distribution of energy R&D expenditures is a political decision depending on several factors such as the availability of local energy resources, energy prices, technological expectations as well as society's acceptance of certain energy technologies, which may change over time.

Several recently published documents of the European Commission highlight the importance of R&D concerning energy technologies. The most prominent documents are the European Strategic Energy Technology Plan (SET-Plan), which is a roadmap for moving to a competitive low carbon economy in 2050, and the Energy Roadmap 2050.^{4,5} Although all these documents call for strengthening efforts in energy R&D, they do not provide any amounts to be invested. Precise numbers on energy R&D expenditures are hard to find, especially at European level. To gain time series of the energy

Article

Financing Innovations for the Renewable Energy Transition in Europe

Raphael Bointner^{1,2,*}, Simon Pezzutto³, Gianluca Grilli³ and Wolfram Sparber³

¹ Institute of Energy Systems and Electric Drives, Energy Economics Group, Vienna University of Technology, Gusshausstrasse 25-29/370-3, 1040 Vienna, Austria

² e-think Energy Research, Argentinierstrasse 18/10, 1040 Vienna, Austria

³ Institute for Renewable Energy, European Academy of Bozen/Bolzano (EURAC Research), Viale Druso 1, 39100 Bolzano, Italy; simon.pezzutto@eurac.edu (S.P.); Gianluca.Grilli@eurac.edu (G.G.); Wolfram.Sparber@eurac.edu (W.S.)

* Correspondence: bointner@e-think.ac.at; Tel: +43-1-58801-370372

Academic Editor: José C. Riquelme

Received: 21 September 2016; Accepted: 16 November 2016; Published: 25 November 2016

Abstract: Renewable energy sources are vital to achieving Europe's 2030 energy transition goals. Technological innovation, driven by public expenditures on research and development, is a major driver for this change. Thus, an extensive dataset on these expenditures of the European Member States and the European Commission, dating back to the early 1970s, was created. This paper creates predictive scenarios of public investment in renewable energy research and development in Europe based on this historical dataset and current trends. Funding from both, European Member States and the European Commission, between today and 2030 are used in the analysis. The impact on the cumulative knowledge stock is also estimated. Two projection scenarios are presented: (1) business as usual; and (2) an advanced scenario, based on the assumption that the Mission Innovation initiative causes public expenditures to increase in the coming years. Both scenarios are compared to the European 2030 climate and energy framework target sets. Results indicate that Member States in Europe currently tend to fund renewables more than the European Commission, but funding from both sources is expected to increase in the future. Furthermore, the European Commission distributes its funding more equally across the various renewable energy sources than Member States.

Keywords: research and development expenditures; renewable energy; Europe; 2030

1. Introduction

After World War II, many European countries agreed it was necessary to reconstruct their economies and establish a long-term peace. One major challenge was reducing competition among European countries over natural resources. To facilitate this, the European Coal and Steel Community (ECSC) was created in 1951. The ECSC was an international organization creating a common market for coal and steel among the member countries. The original members were Belgium, France, Italy, the Federal Republic of Germany, The Netherlands, and Luxembourg. This was the first step toward the creation of the European Union (EU) [1]. Six years later, the European countries continued toward integration by creating a second international energy collaboration, the European Atomic Energy Community (EURATOM) [2]. Energy was a primary issue in the development of the EU [3]. The EU can only provide half of its gross inland energy consumption (~47% in 2013) [4]. Despite significant efforts to transition towards a low-carbon economy, the EU is highly dependent on non-renewable (primarily fossil fuels) imports. Most of the imports come from Africa, Russia, and OPEC (Organization of Petroleum Exporting Countries), which are fragile markets due to current conflicts. The International

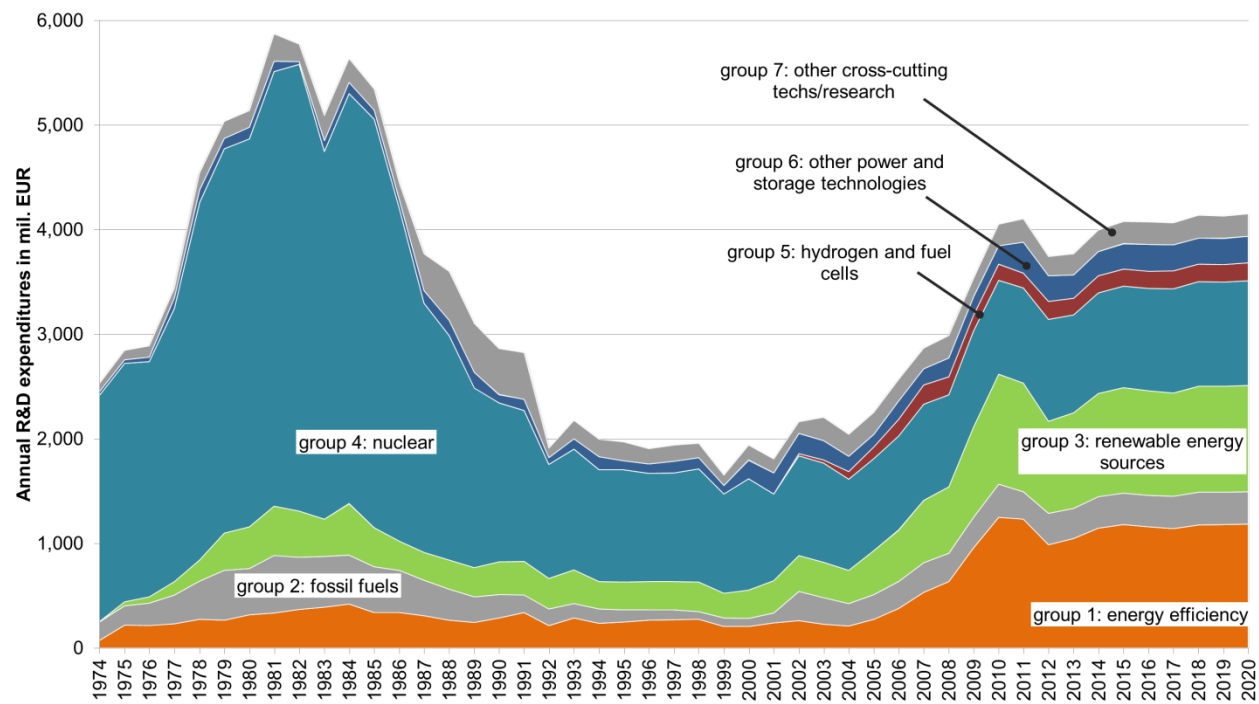


Figure 1: Energy R&D expenditures of the EU member states from 1974-2012 and estimated until 2020 [Mil. EUR, BAU Scenario] (2012 prices and exc. rates)

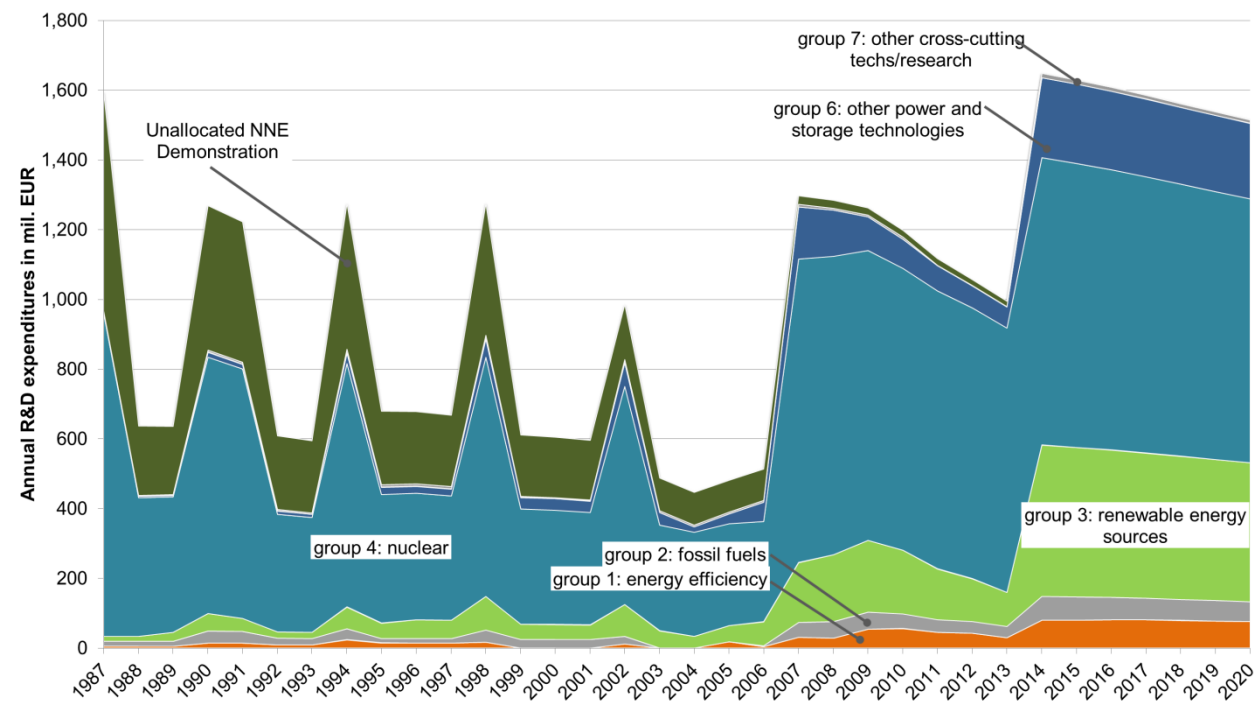


Figure 2: R&D expenditures of the European Commission from 1987-2013 and estimated until 2020 [Mil. EUR] (2012 prices and exc. rates)



Heating and Cooling: Open Source Tool for Mapping and Planning of Energy Systems

ZEBRA 2020 - NEARLY ZERO-ENERGY BUILDING STRATEGY 2020

Strategies for a nearly Zero-Energy Building
market transition in the European Union



In memoriam Dipl. Ing. Dr. techn. Raphael Bointner

