

# Chapter 8

## Advancing Sustainability in Software Engineering: Key Practices and Future Directions


**S. Anusha**

*Easwari Engineering College, India*

**R. Nithyanandhan**

*SA Engineering College, India*

**B. Yamini**

 <https://orcid.org/0000-0003-3531-108X>  
*SRM Institute of Science and  
Technology, India*


**S. Balapriya**

*Sathyabama Institute of Science and  
Technology, India*


**V. Kalpana**

*Vel Tech Rangarajan Dr. Sagunthala  
R&D Institute of Science and  
Technology, India*

**T. P. Anish**

 <https://orcid.org/0000-0002-4308-9645>  
*R.M.K. College of Engineering and  
Technology, India*

**A. Venkateshan**

 <https://orcid.org/0009-0006-8570-0023>  
*Sri Muthukumaran Institute of  
Technology, India*

### ABSTRACT

*The escalating environmental consequences of software development have raised a concern for sustainable software engineering throughout the life cycle. Green software engineering aims at reducing the power utilization in software systems as well as containing the carbon impact of software systems, and managing the resources properly. This survey also summarizes the major approaches to integrate sustainability into each phase the following phases are sustainable requirements engineering, energy-aware coding, greenDevOps, and sustainable data management. Sustainability is further improved by ideas such as energy efficient design patterns, resource efficient algorithms, and dynamic resource scaling. It also covers some of*

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*the recent tools for energy profiling, green deployment and green cloud computing. The goal of this paper is to give some idea of the state of sustainable software engineering practices, potential future developments, and to point out where research, automation, and policy may be needed to promote the adoption of such practices.*

## **1. INTRODUCTION**

### **1.1 Background**

Over the last few years, people have become more conscious of the effects that numerous industries have on the environment, including software engineering. With this growing adoption of technology, there are corresponding increases in the energy and raw material requirements in the creation of software. Coding and testing of software, and its deployment and maintenance, are among the practices that have recently been in the news for sustainability reasons. Many industries have gone digital, cloud computing, and data storage as well as large-scale software applications consume a lot of energy (Rani et al 2023). The use of Internet, cloud services, and digital facilities has raised the energy consumption rates around the world and data centers are the major consumers of energy in the world. However, as society and businesses strive to meet specific sustainability goals, it has emerged that the software engineering community needs to adapt more sustainable development to meet the broader environmental and social goals of sustainability.

### **1.2 Motivation**

Environmental effects due to software development exist in various dimensions. Aside from the energy utilized when running the software, the total life cycle of the software development process, as well as its disposal once it has become obsolete, contributes heavily to the consumption of resources, such as hardware disposal, and inefficient coding strategies. Technological advancement and sustainability are two fundamental aspects that are shaping the world's economy and businesses hence software engineering has to embrace sustainability. More specifically, the skills to design, build and implement software in a manner, which minimizes power consumption to keep resource utilization at optimum levels while maximizing system lifespan, is becoming more and more crucial. When organisations apply sustainability principles in software engineering, they are directly investing in the fight against climate change. In addition, there is also need to develop energy efficient software since many consumers and clients consider environmentally sustainable practices. This demand also opens up a chance for software engineers to save costs and at

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