

## Long-term Energy Intensity with Non-renewable and Renewable Energy Inputs

### **Istemi Berk**

Dokuz Eylul University, Turkey  
istemi.berk@gmail.com

### **Hakan Yetkiner**

Izmir University of Economics, Turkey  
hakan.yetkiner@ieu.edu.tr

### **Abstract**

This paper aims to analyze long-run energy intensity dynamics of a stylized economy which consumes both non-renewable and renewable energy. To this end, we propose an augmented Solow model, in which both types of energy resources are factors of production along with capital and efficient labor. Steady-state solution of the model suggests positive economic growth as long as rate of technological progress and re-generation rate of renewable energy stock exceed depletion rate of non-renewable energy resource stock. Using this framework, we also derive the long-term energy intensity path of the economy, which composes of non-renewable energy intensity and renewable energy intensity. We show that while non-renewable energy intensity tends to decline over time, renewable energy intensity declines only if technological progress outpaces re-generation of renewable energy stock.

**Keywords:** economic growth, non-renewable energy, renewable energy, energy intensity

**JEL Codes:** O41, Q32, Q20