

# The E3-India Model

Technical model manual, Volume 1:  
Introduction and Background



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## Authorisation and Version History

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# 1 Introduction and Background

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## Introduction to E3-India

E3-India model is a new macro-econometric E3 (energy-environment-economy) model of India that can be used to assess policy at the level of the 32 states and territories. This introductory volume describes briefly the model's main functions, objectives and aims, outputs, and theoretical foundation.

### 1.1 What is E3-India?

E3-India is an advanced software tool that can be used to assess energy-economy linkages in India. It is built on the existing structure offered by the global E3ME model<sup>1</sup> but accounts for more detailed data and issues that are specific to India. As the model operates at state level, policies in individual states can be addressed and the distribution of impacts across India can be considered for national policy.

The E3-India model has the following dimensions:

- 32 Indian states and territories
- 20 economic sectors
- 8 users of 5 different energy carriers
- CO<sub>2</sub> emissions from 8 sources
- annual projections out to 2035

### 1.2 Aims of the model

The E3-India model was constructed with the following aims:

- The model represents best practice for sectoral policy simulations.
- Its development is transparent. Designed through a collaborative process it aims to capture local knowledge and expertise in India.

- The data used represent the best available data sources relevant to India.
- The parameters in the model reflect the behavioural characteristics of the states of India.
- The outputs of model simulations can be readily identified and explained.
- Use of the model is accessible and affordable to a broad base of prospective users over time.

### 1.3 Policy questions that E3-India aims to address

As a general model of the economy, E3-India can be used to assess a wide range of fiscal and general macroeconomic policies. However, it has been designed to have a particular focus on the energy sector. Policies that the model can assess include:

- changes in the power sector energy mix, including the share of renewables in the mix
- policies to promote renewable uptake, such as Feed-in-Tariffs or direct subsidies
- direct regulation on energy efficiency
- energy and carbon pricing instruments

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<sup>1</sup> [www.e3me.com](http://www.e3me.com)

## 1.4 What are the main outputs from the model?

E3-India produces a wide range of socio-economic outputs at state and national level, for example:

- employment and unemployment
- GDP and sectoral output
- investment
- international trade and trade between states
- household income (by income group) and consumption
- public balances
- prices and inflation

The model results also include a full set of energy balances (and prices), detailed power sector results by technologies, and energy-related emissions.

## 1.5 How is the model being developed?

The modelling design centres on state actions, since much of energy policy and its implementation occurs at the state level.

In addition, the character of energy markets in India are unique by international standards. This requires the establishment of a model that captures attributes that are distinct from traditional economic textbooks.

The technical development of the model was carried out in Cambridge, UK, in collaboration with partners in India. Many of these partners are using the model already and it is available to other academic groups under licence.

## 1.6 How does the model work?

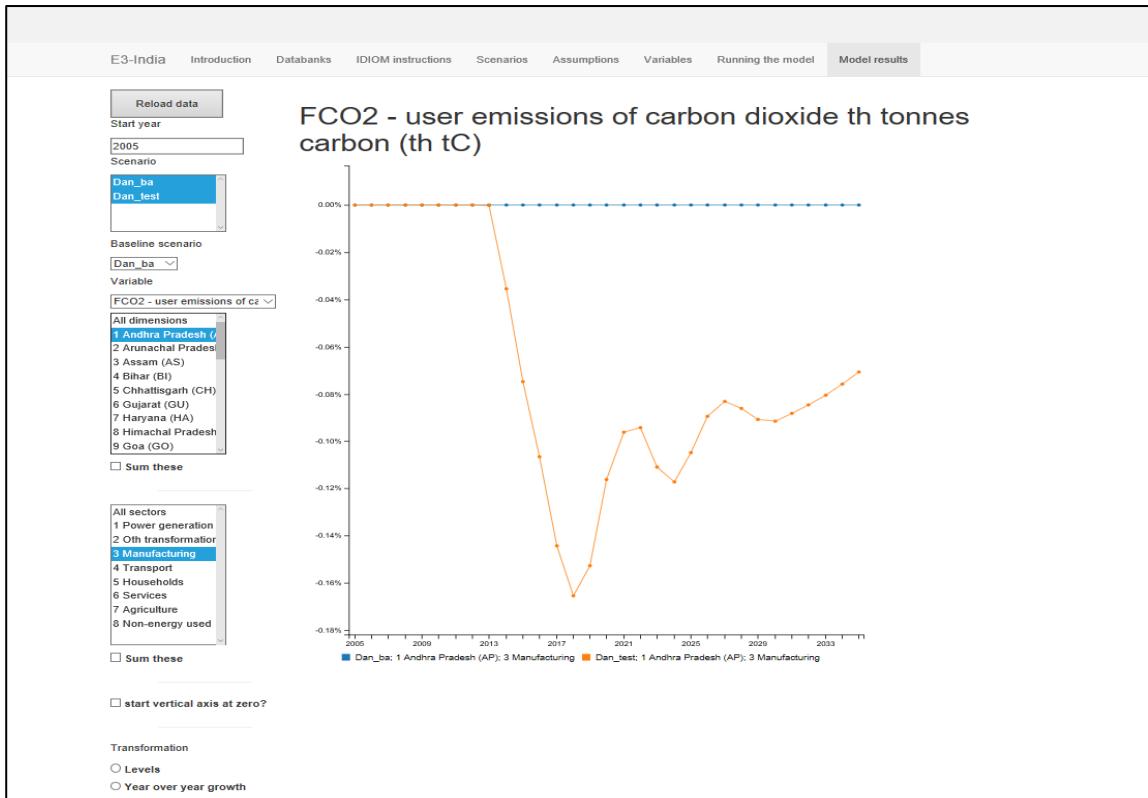
E3-India is based on a series of econometric equations that are similar in design to those in the E3ME model (see [www.e3me.com](http://www.e3me.com)). Unlike the more common computable general equilibrium (CGE) approach to economic modelling, E3-India does not assume full employment or perfectly competitive markets; instead it estimates behaviour based on available historical data.

## 1.7 Comparative advantages of E3-India

Compared to other macroeconomic models in operation currently across the world, E3-India has advantages in four important areas:

- Geographical coverage, with explicit representation of each state and territory in India.
- Sectoral disaggregation, which allows for representation of fairly complex scenarios at state level and the impact of any policy measure can be represented in a detailed way to show winners and losers.
- The econometric pedigree and empirical grounding of the model makes it better able to represent performance in the short to medium term, as well as providing long-term assessments without being too reliant on rigid assumptions.
- E3 linkages, and the hybrid nature of the model. A non-linear interaction between the economy, energy demand/supply and environmental emissions is an undoubtable advantage over other models.

## 1.8 How does the model look?



## 1.9 Structure of the volume series covering the E3-India model

[Volume 2](#) is an installation guide and describes how to run the model through the user-friendly E3-India Model Manager.

[Volume 3](#) describes the data and practical aspects of the model, including the economic accounting system, forecasts, econometrics, and model classifications. Model validation is also described here.

[Volume 4](#) presents the econometric equations of the model.

[Volume 5](#) provides a detailed description of E3-India's structure, including theory of how the economic and energy/environment components fit together.

[Volume 6](#) provides the references for the volume series and a list of publications that have resulted.

[Volume 7](#) presents special modules, and a description of top-down and bottom-up modelling approaches.

[Volume 8](#) provides example case studies of analyses that have been carried out with the model.

[Volume 9](#) sets out responses to a list of frequently asked questions.