

# **Optimal Production-Inventory Policy under Strict Carbon Cap in a Supply Chain with Backorders and Lost Sales**

**Arindam Ghosh**

Department of Industrial & Systems Engineering  
Indian Institute of Technology Kharagpur  
Kharagpur-721302, India

**J. K. Jha**

Department of Industrial & Systems Engineering  
Indian Institute of Technology Kharagpur  
Kharagpur-721302, India

**S. P. Sarmah**

Department of Industrial & Systems Engineering  
Indian Institute of Technology Kharagpur  
Kharagpur-721302, India

## **Abstract**

Environment pollution is a burning issue in recent era. Continuous emissions of carbon into the atmosphere have raised the threat to environment and existence of human civilization. Governments and regulatory bodies across the globe are responding sharply to the threat by introducing different carbon policies. In this study, we consider a strict carbon cap policy in which regulatory bodies allow organizations to emit carbon within a specified level and the penalty for exceeding the level is infinitely large. Regulatory bodies and governments are considering seriously adopting this policy for some sectors. We develop a production-inventory model in a vendor-buyer supply chain under stochastic demand at the buyer with partial backorders. The vendor produces a product at a finite production rate and delivers the same to the buyer in several equal-sized shipments. A mathematical model has been formulated to determine the optimal order quantity, reorder point and number of shipments in a production cycle by minimizing the total expected cost of the supply chain. Further, sensitivity analyses gives insight about how with operational adjustment cost and emission could be controlled. The proposed model can be useful for the firms who are operating under strict carbon cap policy.

## **Keywords**

Carbon emission, strict carbon cap, stochastic demand, supply chain, partial backorders.

## **Biography**

**Arindam Ghosh** is a research scholar in the department of Industrial & Systems Engineering at IIT Kharagpur since December 2011. He received his B.Tech from University of Kalyani in Information Technology and obtained MBA from ICFAI Business School. He has more than five years of experience in telecom industry and hold different managerial posts. He received the best paper award in the doctoral consortium of the XVII Annual International Conference of the Society of Operations Management held at Indian Institute of Technology Madras. He is currently working in the area of green supply chain management.

**J. K. Jha** is an Assistant Professor in the department of Industrial & Systems Engineering at IIT Kharagpur since July 2010. He obtained his PhD from IIT Kanpur where he worked in the area of Supply Chain Management. He graduated in Production Engineering from BIT Sindri and completed his M.Tech in Industrial Management from IIT (BHU) Varanasi. He has received several scholarships and awards from DRPG IIT Kanpur, BITSAA of North America, SJ Jindal Trust New Delhi, etc. His main areas of teaching and research include Operations Research, Statistical Decision Modeling, Facility Planning, Supply Chain Management and Inventory Control. He

published/presented fourteen papers in international journals and conferences, and his publications appeared in Applied Mathematical Modelling, Computers & Industrial Engineering, International Journal of Production Research and Journal of Manufacturing Systems.

**S. P. Sarmah** obtained his PhD degree from IIT Kharagpur, India and currently he is working as Associate Professor in the Department of Industrial and Systems Engineering at IIT Kharagpur. The current research interests of Dr. Sarmah are in the areas of supply chain coordination, supply chain risk management, logistics, production planning and control, inventory management and project management. Dr Sarmah has published a good number of papers in leading international journals such as European Journal of Operational Research, International Journal of Production Economics, Mathematical and Computer Modeling: International Journal, Transportation Research Part E, Applied Mathematical modeling, International Journal of Operational Research etc.