



Find out how to access preview-only content

Book Inside Get Access

Handbook of Power Systems I

Energy Systems 2010, pp 121-148

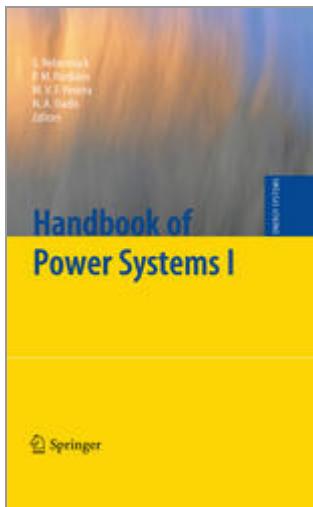
Optimization Models in the Natural Gas Industry

Citations

368 Downloads 200 Citations 9 Comments

Abstract

With the surge of the global energy demand, natural gas plays an increasingly important role in the global energy market. To meet the demand, optimization techniques have been widely used in the natural gas industry, and has yielded a lot of promising results. In this chapter, we give a detailed discussion of optimization models in the natural gas industry, with the focus on the natural gas production, transportation, and market.



Related Content



References (52)

1. Al-Hussainy R (1967) Transient flow of ideal and real gases through porous media. PhD thesis, Texas A&M University, College Station
2. Annual Energy Review (AER) (2009) Technical Report DOE/EIA-0384(2008), US Department of Energy, Energy Information Administration, 26 June 2009
3. Avery W, Brown GG, Rosenbranz JA, Wood RK (1992) Optimization of purchase, storage and transmission contracts for natural gas utilities. *Oper Res* 40(3):446–462 CrossRef
4. Babu BV, Angira R, Chakole PG, Syed Mubeen JH (2008) Optimal design of gas transmission network using differential evolution. <http://discovery.bits-pilani.ac.in/discipline/chemical/BVb/RevisedBabRakPalMub%20CIRAS-2003.pdf>
5. Bazaraa M, Sherali HD, Shetty CM (2006) Nonlinear programming, 3rd edn. Wiley, New York
6. Beggs HD (1984) Gas production operations. Oil Gas Consultants International Inc., Tulsa, Oklahoma
7. Boots MG, Rijkers FAM, Hobbs BF (2004) Modeling the role of trading companies in the downstream European gas market: A successive oligopoly approach. *Energ J* 25(3):73–102
8. BP (2008) BP Statistical Review of World Energy 2008. London, UK, June 2008
9. Breton N, Zaccour Z (2001) Equilibria in an asymmetric duopoly facing a security constraint. *Energ Econ* 25:457–475 CrossRef
10. Brooks RE (2003) Optimizing complex natural gas models. <http://rbac.com/Articles/tabid/63/Default.aspx>
11. Brooks RE, Neill CP (2003) Natural gas operations optimizing system. <http://rbac.com/Articles/tabid/63/Default.aspx>
12. Cameron F (2007) The north stream gas pipeline project and its strategic implications. Briefing Note for The European Parliament's committee on Petitions, December 2007

13. Chabar RM, Pereira MVF, Granville S, Barroso LA, Iliadis N (2006) Optimization of fuel contracts management and maintenance scheduling for thermal plants under price uncertainty. In Proceedings of the 2006 Power Systems Conference Expo (PSCE 06), October, pp. 923–930
14. Chebouba A, Yalaoui F, Smati A, Amodeo L, Younsi K, Tairi A (2009) Optimization of natural gas pipeline transportation using colony optimization. *Comput Oper Res* 36(6):1916–1923 CrossRef
15. Cottle RW, Pang JS, Stone RE (1992) Linear complementarity problem. Academic Press, NY
16. De Wolf D, de Bisthoven OJ, Smeers Y (1991) The simplex algorithm extended to piecewise linearly constrained problems I: The method and an implementation, CORE DP No. 9119, Universite Catholique de Louvain, Belgium
17. De Wolf D, Smeers Y (1996) Optimal dimensioning of pipe networks with application to gas transmission networks. *Oper Res* 44:596–608 CrossRef
18. De Wolf D, Smeers Y (1997) A stochastic version of a Stackelberg Nash-Cournot equilibrium model. *Manag Sci* 43(2):190–197 CrossRef
19. De Wolf D, Smeers Y (2000) The gas transmission problem solved by an extension of the simplex algorithm. *Manag Sci* 46:1454–1465 CrossRef
20. Edgar TF, Himmelblau DM (2001) Optimization of chemical processes. McGraw-Hill, New York
21. Edgar TF, Himmelblau DM, Bickel TC (1978) Optimal design of gas transmission networks. *Soc Petrol Eng J* 30:96–104
22. Energy Information Administration (2003) The national energy modeling system: an overview, natural gas transmission and distribution module. http://www.eia.doe.gov/oiaf/aeo/overview/nat_gas.html
23. Facchinei F, Pang JS (2003) Finite-dimensional variational inequalities and complementarity problems, vol. I and II. Springer, New York
24. Gabriel SA, Manik J, Vikas S (2003) Computational experience with a large-scale, multi period, spatial equilibrium model of the North America natural gas system. *Networks Spatial Econ* 3:97–122 CrossRef
25. Gabriel SA, Kiet S, Zhuang J (2005) A mixed complementarity-based equilibrium model

- of natural gas markets. *Oper Res* 53(5):799–818 CrossRef
- 26. Goldberg DE (1983) Computer-aided gas pipeline operation using genetic algorithms and rule learning. PhD thesis, University of Michigan
 - 27. Hiriart-Urruty JB, Lemarechal C (1993) Convex analysis and minimization algorithms Springer, Berlin
 - 28. Horne RN (2002) Optimization applications in oil and gas recovery. In: Handbook of applied optimization, pp. 808–813. Oxford University Press, New York
 - 29. Horst R, Pardalos PM, Thoai NV (2000) Introduction to global optimization, 2nd edn. Kluwer, The Netherland
 - 30. International Energy Outlook 2009 Technical Report DOE/EIA-0484(2009), US Department of Energy, Energy Information Administration, 27 May 2009. Chapter 3 – Natural Gas
 - 31. Kallrath J, Wilson JM (1997) Business Optimization using Mathematical Programming. MacMillan Business
 - 32. Locatelli M, Thoai NV (2000) Finite exact branch-and-bound algorithms for concave minimization over polytopes. *J Global Optim* 18:107–128 CrossRef
 - 33. Luo ZQ, Pang JS, Ralph D (1996) Mathematical programs with equilibrium constraints. Cambridge University Press, London
 - 34. Mantini LA, Beyer WA (1979) Optimization of natural gas production by waterflooding. *Appl Math Optim* 5:101–116 CrossRef
 - 35. Midthun KT (2007) Optimization models for liberalized natural gas markets. PhD thesis, Norwegian University of Science and Technology, 2007
 - 36. Munoz J, Jimenez-Redondo N, Perez-Ruiz J, Barquin J (2003) Natural gas network modeling for power systems reliability studies. 2003 IEEE Bologna PowerTech Conference, 23–26 June, Bologna, Italy, 2003
 - 37. Murray JE, Edgar TF (1978) Optimal scheduling of production and compression in gas fields. *SPE J Petrol Technol* 30:109–116
 - 38. Murty KG (1988) Linear complementarity, linear and nonlinear programming. Helderman. http://ioe.engin.umich.edu/people/fac/books/murty/linear_complementarity_webbook/

39. Nemhauser GL, Wolsey LA (1999) Integer and combinatorial optimization. Wiley, New York
40. O'Neil RP, Williard M, Wilkins B, Pike R (1979) A mathematical programming model for allocation of natural gas. *Oper Res* 27(5):857–873 CrossRef
41. Pereira MVF, Pinto LMVG (1991) Multi-stage stochastic optimization applied to energy planning. *Math Program* 52:359–375 CrossRef
42. Peretti A, Toth P (1982) Optimization of a pipeline for the natural gas transport. *Eur J Oper Res* 11:247–254 CrossRef
43. Rios-Mercado (2002) Natural gas pipeline optimization. In: Handbook of applied optimization. Oxford University Press, New York, pp. 813–826
44. Rios-Mercado RZ, Kim S, Boyd EA (2006) Efficient operation of natural gas transmission systems: a network-based heuristic for cyclic structures. *Comput Oper Res* 33:23–51
45. Rosen JB (1960) The gradient projection method for nonlinear programming. Part I. linear constraints. *SIAM J* 22:181–217
46. Rothfarb B, Frank H, Rosenbaum DM, Steiglitz K, Kleitman DJ (1970) Optimal design of offshore natural-gas pipeline systems. *Oper Res* 18:992–1020 CrossRef
47. Tussing AR, Barlow CC (1984) The natural gas industry: evolution, structure, and economics. Ballinger Publishing Company, Cambridge, MA
48. US Department of Energy, Energy Information Administration (2008) International Energy Annual 2006, 25 September 2008
49. Wattenbarger RA (1970) Maximizing seasonal withdrawal from gas storage reservoir. *SPE J Petrol Technol* 22:994–998
50. Wolsey LA (1998) Integer programming. Wiley, New York
51. Worldwide Look at Reserves and Production (2008) *Oil Gas J* 106(48):22–23
52. Wu S, Rios-Mercado RZ, Boyd EA, Scott LR (2000) Model relaxations for the fuel cost minimization of steady-state gas pipeline networks. *Math Comput Model* 31:197–220 CrossRef

About this Chapter

Title

Optimization Models in the Natural Gas Industry

Book Title

Handbook of Power Systems I

Pages

pp 121-148

Copyright

2010

DOI

10.1007/978-3-642-02493-1_6

Print ISBN

978-3-642-02492-4

Online ISBN

978-3-642-02493-1

Series Title

Energy Systems

Series ISSN

1867-8998

Publisher

Springer Berlin Heidelberg

Copyright Holder

Springer-Verlag Berlin Heidelberg

Additional Links

- About this Book

Topics

- Calculus of Variations and Optimal Control, Optimization
- Operations Research/Decision Theory
- Energy Technology

Keywords

- Gas market
- Gas recovery
- Gas transmission
- Mixed integer nonlinear programming (MINLP)
- Mixed integer programming (MIP)

- Natural gas industry

- Optimization

Industry Sectors

- Electronics

- Telecommunications

- IT & Software

eBook Packages

- eBook Package english full Collection

- Energy Ebook Package

Editors

- Panos M. Pardalos  (ID1)

- Steffen Rebennack  (ID2)

- Mario V. F. Pereira  (ID3)

- Niko A. Iliadis  (ID4)

Editor Affiliations

- ID1. Dept. Industrial & Systems, Engineering, University of Florida

- ID2. , Division of Economics and Business, Colorado School of Mines

- ID3. Rio Praia de Botafogo, Centro Empresarial

- ID4. Research & Development, EnerCoRD - Energy Consulting,

Authors

- Qipeng P. Zheng ⁽¹⁾

- Steffen Rebennack

- Niko A. Iliadis

- Panos M. Pardalos

Author Affiliations

- 1. Department of Industrial & Systems Engineering, Center for Applied Optimization, University of Florida, Gainesville, FL, 32611, USA

Continue reading...

To view the rest of this content please follow the download PDF link above.

Over 8.3 million scientific documents at your fingertips
© Springer, Part of Springer Science+Business Media