OGET 8007	**Business Modeling in Energy Sector**	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	- Graduation/ Bridge Course in Economics				
Co-requisites	Knowledge of basic econometrics				

Course Objectives

The objectives of this course are:

(a) To familiarize students with basic concept of model building and estimation.

(b) To teach the students various business modeling tools and their application in energy sector.

(c) To apply modeling tools in decision making.

Course Outcomes

Upon successful completion of the course a student will be able to:

CO1: To be able to **formulate** business models in energy sector;

CO2: **To estimate** business models in energy sector after learning the concepts;

CO3: **To analyze and interpret** the results of estimated business models in energy sector; and

CO4: To **demonstrate** ability to successfully use computer package such as STATA, Excel, etc.

Course Content

Module: 1 Energy Quantity and Price Data **(4lecture hours)**

- Collection
- Processing
- Methods of Analysis

Module: 2 Dynamic Demand Analysis and the Process of Adjustment **(5 lecture hours)**

- The econometric methods used for analysing the dynamics and the adjustments of energy consumption
- The partial adjustment model
- The adaptive expectations model

Module: 3 Panel data analysis and its application in Energy Sector **(12 lecture hours)**

- The fixed effects model and its application in energy sector

- The random effects model and its application in energy sector
- Economic Development and Energy Intensity

Module: 4 Data Envelopment Analysis (DEA) **(5lecture hours)**

- The Constant Returns to Scale DEA Model
- The Variable Returns to Scale Model and Scale Efficiencies
- Input and Output Orientations

Module: 5 Estimation of Production Technology **(6 lecture hours)**

- Production, Cost and Profit Functions
- Single Equation Estimation
- Imposing Equality Constraints
- Systems Estimation
- Inequality Constraints

Module: 6 Stochastic Frontier Analysis **(2 lecture hours)**

- The Stochastic Production Frontier
- Estimating the Parameters
- Predicting Technical Efficiency
- Distance Functions
- Cost Frontiers
- Decomposing Cost Efficiency
- Scale Efficiency
- Panel Data Models and Accounting for the Production Environment

Module: 7. The Calculation and Decomposition of Productivity change using frontier method **(2 lecture hours)**

- The Malmquist TFP Index and Panel Data
- Calculation using DEA Frontiers
- Calculation using SFA Frontiers
- Empirical Application in Energy Sector

Text Books

- Keppler, J. H., Bourbonnais, R., & Girod, J. (Eds.). (2007). The Econometrics of Energy Systems, Palgrave Macmillan.
- Gujarati, D. N. (2009). Basic Econometrics. Tata McGraw-Hill
- Coelli, T. J., Rao, D. S. P., O'Donnell, C. J., & Battese, G. E. (2005). An introduction to efficiency and productivity analysis. Springer Science-i-Business Media, Inc.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Class Test	Assignment	Project Report	Presentation	ESE
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Programme Outcomes
CO1	To be able to **formulate** business models in energy sector;	PO 1,2, 3,4,7,8,9,10, 11,13, 14
CO2	**To estimate** business models in energy sector after learning the concepts;	PO 1,2, 3, 7,8,9,10, 11,14
CO3	**To analyze and interpret** the results of estimated business models in energy sector;	PO 1,2, 3,6 8,9,10, 11, 13,14
CO4	To **demonstrate** ability to successfully use computer package such as STATA, Excel, etc.	PO 4,5, 8,12,13, 14

Program Outcome / Course Outcome mapping

CO	CO 1	CO 2	CO 3	CO 4
PO 1	3	3	3	
PO 2	3	3	3	
PO 3	3	3	3	
PO 4	2			3
PO 5				3
PO 6			3	
PO 7	3	3		
PO 8	3	3	3	3
PSO 9	3	3	3	
PSO 10	3	3	3	
PSO 11	3	2	3	
PSO 12				3
PSO 13	3		3	3
PSO 14	3	3	3	3

Course Code	**OGET 8007**
Course Title	Business Modeling in Energy Sector

PO 1	Students will be able to develop and evaluate alternate managerial choices and identify optimal solutions.	2
PO 2	Students will demonstrate effective application capabilities of their theoretical understanding of economics theories – Microeconomics, Macroeconomics and trade theories to the renewable and non-renewable energy sectors.	2
PO 3	Students will exhibit effective decision-making skills, employing analytical and critical thinking ability.	2
PO 4	Students will demonstrate effective oral and written communication skills in presenting frameworks, models and regulations of the energy sector.	1
PO 5	Students will be able to work effectively in teams and demonstrate team-working capabilities.	1
PO 6	Students will exhibit leadership and networking skills.	1
PO 7	Students will demonstrate sensitivity towards ethical and moral issues and have ability to address them in energy economics.	2
PO 8	Students will demonstrate employability traits in line with the needs of changing dynamics of renewable and non-renewable energy sectors.	3
PSO 9	Students will demonstrate strong conceptual knowledge of economic theory in the context of renewable and non-renewable energy sectors.	2
PSO 10	Students will demonstrate effective understanding of economics as it is applicable to energy markets, energy pricing, energy trading and risk management.	2
PSO 11	Students will demonstrate analytical skills in designing solutions for energy efficiency.	2
PSO 12	Students will exhibit the ability to evaluate working of energy policies.	1
PSO 13	Students will have domestic and global perspective towards legal frameworks and environmental regulations with respect to energy sectors.	2
PSO 14	Students will exhibit deployable skills pertinent to the renewable and non-renewable energy sectors.	3

1 – Weakly mapped

2 – Moderately mapped

3 – Strongly mapped

Model Question Paper

Name: **Enrolment No:**	UPES

End Semester Examination-December 2017

Program/course: MA Economics (Energy Economics) **Semester : III**
Subject: Business Modeling in Energy Sector **Max. Marks : 100**
Code : OGET 8007 **Duration : 3 Hrs**

Section A (attempt all)

Q1. Fill in the blanks

i.	By studying the_____, panel data are better suited to study the dynamics of change.	**[2]**	**CO1**
ii.	If the number of observations remain same among panel members, we call such a panel an _____.	**[2]**	**CO1**
iii.	In panel data econometrics we assume that the _____are nonstochastic.	**[2]**	**CO1**
iv.	The composite error term ω_{it} consists of two components, ε_i , which is the cross-section, or individual-specific, error component, and u_{it}, which is the combined time series and cross-section error component.	**[2]**	**CO1**
v.	In ECM, the intercept β_1 represents the mean value of all the _____intercepts.	**[2]**	**CO1**
vi.	The sum of the random effect values is always_____.	**[2]**	**CO1**
vii.	Hausman Test is used to select between _____and _____model.	**[2]**	**CO1**
viii.	The LM test helps you decide between a random effects regression and a simple OLS regression.	**[2]**	**CO1**
ix.	_____model is known as ECM.	**[2]**	**CO1**
x.	In random effect model the individual differences in the intercept values of each company are reflected in the _____.	**[2]**	**CO1**

	SECTION B **Answer any four questions** 5 X4= 20		
Q2.	What is a random walk process? Explain with suitable example.	**[5]**	**CO3, CO4**
Q3.	What is stationary time series? Explain with suitable example.	**[5]**	**CO3, CO4**
Q4.	What is ADF test?	**[5]**	**CO3, CO4**
Q5.	What do you mean by integrated stochastic process? Explain with suitable example.	**[5]**	**CO3, CO4**
Q6.	What do you mean by SFA?	**[5]**	**CO3, CO4**
	SECTION C **Answer any two questions** 2 X 15 = 30		
Q7.	Explain the procedure of random effect model with example.	**[15]**	**CO1, CO4**
Q8.	Explain the procedure of fixed effect model with example.	**[15]**	**CO3, CO4**
Q9.	Describe the variable returns to scale model?	**[15]**	**CO3, CO4**
	Section D **Answer any one question** 1 X 30 = 30		
Q10.	Write a report with interpreting the following results: CO2 emissions (metric tons per capita) = CO2; Foreign direct investment, net inflows (BoP, current US$) = FDI; Energy use (kg of oil equivalent per capita) = EU; Urban population(In numbers) = UB `sum year co2 fdi eu ub`	**[30]**	**CO1, CO3, CO4**

Variable	Obs	Mean	Std. Dev.	Min	Max
year	456	1999.5	6.929789	1988	2011
co2	456	3.153295	5.159307	.3644157	38.33784
fdi	456	3.47e+09	8.94e+09	-1.14e+09	1.01e+11
eu	456	1355.765	2016.586	349.9062	15109.24
ub	456	1.94e+07	3.38e+07	104277	1.70e+08

```
. xi: reg co2 fdi eu ub i.country
i.country         _Icountry_1-19      (_Icountry_1 for cou~y==Argentina omitted)

      Source |       SS       df       MS              Number of obs =     456
-------------+------------------------------           F( 21,   434) = 1423.65
       Model |  11938.0927     21  568.480605           Prob > F      =  0.0000
    Residual |  173.301633    434  .399312518           R-squared     =  0.9857
-------------+------------------------------           Adj R-squared =  0.9850
       Total |  12111.3943    455  26.6184491           Root MSE      =  .63191

------------------------------------------------------------------------------
         co2 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         fdi |   7.70e-14   6.65e-12     0.01   0.991    -1.30e-11   1.31e-11
          eu |   .0021522   .0000327    65.73   0.000     .0020879   .0022166
          ub |  -9.11e-10   8.12e-09    -0.11   0.911    -1.69e-08   1.50e-08
  _Icountry_2 |   -.235693   .2719489    -0.87   0.387    -.7701936   .2988077
  _Icountry_3 |  -.8414318   .8052281    -1.04   0.297    -2.424064   .7411999
  _Icountry_4 |  -.1511049   .2446277    -0.62   0.537    -.6319071   .3296974
  _Icountry_5 |  -.2570117   .1866415    -1.38   0.169    -.6238453   .1098219
  _Icountry_6 |  -.5826501   .2892443    -2.01   0.045    -1.151144  -.0141564
  _Icountry_7 |  -.8330492   .2820328    -2.95   0.003    -1.387369  -.2787292
  _Icountry_8 |   .0239467   .2579854     0.09   0.926    -.4831093   .5310028
  _Icountry_9 |  -.8333274   .2700659    -3.09   0.002    -1.364127  -.3025277
 _Icountry_10 |  -.6918758   .2853988    -2.42   0.016    -1.252812   -.13094
 _Icountry_11 |   .5632273   .2931893     1.92   0.055    -.0130203   1.139475
 _Icountry_12 |   .3654537   .3547755     1.03   0.304     -.331838   1.062745
 _Icountry_13 |  -.7615168   .2859428    -2.66   0.008    -1.323522   -.199512
 _Icountry_14 |  -.2950673   .2931276    -1.01   0.315    -.8711934   .2810589
 _Icountry_15 |  -1.270863   .2838894    -4.48   0.000    -1.828832  -.7128937
 _Icountry_16 |  -.1961448   .2108964    -0.93   0.353    -.6106501   .2183605
 _Icountry_17 |   3.081979   .3825527     8.06   0.000     2.330093   3.833865
 _Icountry_18 |  -.6154673   .2842007    -2.17   0.031    -1.174048  -.0568864
 _Icountry_19 |   1.280573   .1989054     6.44   0.000     .8896353   1.67151
        _cons |   .3711805    .275727     1.35   0.179    -.1707457   .9131068
------------------------------------------------------------------------------
```

_Icountry_2	country==Bolivia
_Icountry_3	country==Brazil
_Icountry_4	country==Chile
_Icountry_5	country==Colombia
_Icountry_6	country==Costa Rica
_Icountry_7	country==EL Salvador
_Icountry_8	country==Ecuador
_Icountry_9	country==Guatemala
_Icountry_10	country==Honduras
_Icountry_11	country==Jamaica
_Icountry_12	country==Mexico
_Icountry_13	country==Nicargua
_Icountry_14	country==Panama
_Icountry_15	country==Paraguay
_Icountry_16	country==Peru
_Icountry_17	country==Trinidad and tobago
_Icountry_18	country==Uruguay
_Icountry_19	country==venezula RB