C. Oglesby, D. Ross, M. Smith, T. Womack
OMDE 606
Due date: December 2, 2009
Assignment 3: Going Green: Exploring Energy Efficiency in the Data Center

# Course Scenario and Costing for The Online Course: Going Green: Exploring Energy Efficiency in the Data Center

## Project Description

Energy Efficiency University[1] by Green Machine Inc (GMI) is a one-stop global provider of high quality Data Center Design, Build and Operations education for IT Professionals, Facilities Managers, and Engineers. It is intended for those individuals seeking added training and certification to complement their workplace experiences and education. The leaders at EEU have recently determined that a Green Associate Certification Program would fit well with their offerings. "Green is the hot topic these days, and the concept is having an impact on the way people think about data centers. Companies around the world are announcing ways to save energy and reduce costs by buying new hardware and services" (Microsoft Tech Net Magazine, 2007).

The completion of EEU's Green Associate Certification Program can provide added credibility and enhanced career training in an industry that is constantly changing. Training certificate courses are available on-line, thus providing flexibility for students who seek out the benefits of distance learning. The curriculum is designed around core competencies required to solve real world problems related to the greening of the physical infrastructure of data centers today. While Energy Efficiency University is a part of Green Machine Inc (GMI), the curriculum does not include courses related to GMI products. EEU is product agnostic, and vendor neutral;

[1] *The fictional case study for EEU and its course were developed based on a real corporate online university, Data Center University by APC (DCU). For more information on DCU, visit www.datacenteruniversity.com

it is based upon on valid theory and best practice, as well as the scientific findings and writings of GMI's world class engineers.

EEU is created within the Customer Education Department and is staffed by a full time group of more than a dozen Instructional Designers, Electrical Engineers, and Data Center Professionals all working out of the West Kingston, RI facility.

**Technology**

Microsoft PowerPoint and Adobe Presenter (part of the Adobe Acrobat Connect Pro suite), and Adobe Flash for the videos that are sometimes contained with the courses are required software. The Certification curriculum includes six modules and incorporates one Video Conference (20 min with 10 min Q&A) to kick off the course, and one (20 min with 10 min Q&A) to wrap up the course. These will be recorded and hosted on the LMS for all to see. One of the course modules will be conducted by a visiting "green" expert from The Green Grid, a global consortium dedicated to advancing energy efficiency in data centers and business computing ecosystems. Also, there will be six supporting podcasts using the Audacity® software, which is free, open source software for recording and editing sounds. (Audacity, 2009)

**Delivery Platform**

EEU delivers its training online, and utilizes an internal LMS that is provided by E-Central. E-Central is a global leader in online learning. They offer web-based software applications for the management, documentation, tracking, and reporting of e-learning programs, and training content.

**Course Specifics**

Going Green: Exploring Energy Efficiency in the Data Center includes:

- 6 online modules, 1 of which will utilize a visiting expert
- 2 video conferences
- 1 Student Resource/Study Guide
- 6 podcasts (1 per module)

The course will be offered three times a year for five years with expected enrollment of 100 students in each course. As a program managed by Green Machine Inc, a board member of The Green Grid, the following list of courses are included in the Green Associate Certification:

| Module Name | Description | Learning Objectives |
|---|---|---|
| **I. Fundamentals of Power** | Power is the foundational cornerstone in the data center. Many instances of equipment failure, downtime, software and data corruption, are the result of a problematic supply of power. It is imperative that servers are insulated against utility power failures, surges, and other potential electrical problems. This course will explore the topic of power, and how it is utilized within the data center. | • Identify basic electricity concepts<br>• Describe electrical power and its generation<br>• Differentiate between various power usages in a data center<br>• Define power factor<br>• Recognize the importance of electrical safety measures in a data center<br>• Identify potential problem areas in the data center |
| **II. Fundamentals of Cooling I** | In every data center excess heat has the potential to create downtime. In addition, the performance and lifespan of IT equipment is directly related to the efficiency of cooling equipment. If you're involved with the operation of computing equipment it's critical that you understand the importance of cooling in the data center environment. This foundational course explains the fundamentals of air conditioning | • Explain why cooling in the data center is so critical to high availability<br>• Distinguish between Precision and Comfort Cooling<br>• Recognize how heat is generated and transferred<br>• Define basic terms like Pressure, Volume and Temperature as well as their |

| | | |
|---|---|---|
| | systems, covering such topics as the refrigeration cycle, ideal gas law, condensation, convection and radiation, heat generation and transfer, and precision vs. comfort cooling. | units of measurement<br>• Describe how these terms are related to the Refrigeration Cycle<br>• Describe the Refrigeration Cycle and its components |
| **III. Data Center Efficiency: Reducing Electrical Power Consumption** | Conventional models for estimating electrical efficiency of data centers are grossly inaccurate for real-world installations. Electricity usage costs have become an increasing fraction of the total cost of ownership (TCO) for data centers. It is possible to dramatically reduce the electrical consumption of typical data centers through appropriate design of the physical infrastructure and IT architecture. This course explains how to quantify the electricity savings and provides examples of methods that can greatly reduce electrical power consumption | • Discuss the importance of managing a data center's electrical expense<br>• Recognize how electrical energy is used by data centers<br>• Correct misconceptions about data center efficiency<br>• Describe key approaches to reduce IT equipment energy consumption<br>• Identify typical savings from various energy consumption reduction approaches<br>• Propose practical strategies for efficiency in new and existing data centers |
| **IV. Data Center Economics: Keeping It Green** | Tax breaks, lower electric bills, impressed customers - Companies are finding plenty of benefits in greening up their buildings. As the overall cost of supplying power, energy, and resources increases, data centers will need to take a new approach and examine where they can be cost and energy efficient, as well as reliable. As this course will demonstrate, one is not mutually exclusive of the other. There are some clear ways to remain at an acceptable level of reliability without sacrificing the efficiency that the environmentally responsible data center requires.<br>**This module includes a visiting expert* | • Define what it means to be green in the data center<br>• List the benefits of being green<br>• Identify the key elements involved in sustaining a green environment<br>• Demonstrate how reliability and a green environment are related<br>• Examine the efficiency level of a green data center, and<br>• Describe how developing a green environment can potentially lower the total cost of ownership |
| **V. Standardization in the Data Center** | Standardization is a powerful concept that has established itself as a critical ally in managing process. In recent | • Define Network Critical Physical Infrastructure (NCPI) |

| | | |
|---|---|---|
| | decades, the long-standing idea of standardization has gained new stature in many different industries as a creative and compelling strategic enterprise philosophy. Similar success can be achieved by applying standardization to the design, deployment, and operation of Network-Critical Physical Infrastructure (NCPI). Together, we will discover that there is indeed a catalyst for moving towards implementing a process of standardization in the data center: Data center managers' desire to eliminate the significant business cost of unnecessary downtime, lost opportunity, and expense caused by human error, lack of agility, and data center over-sizing. This course will discuss how implementing a plan to standardize the data center will help to increase efficiency levels, reduce downtime, support better business agility, and lower costs. | • Describe the fundamental attributes of standardization in the data center<br>• Identify how standardization can address some of the challenges that data center managers face<br>• List the benefits that standardization brings to the data center<br>• Explain how utilizing standardization processes increases NCPI business value |
| **VI. Data Center Project Planning: Establishing a Floor Plan** | A floor plan strongly affects the power density capability and electrical efficiency of a data center. Yet many floor plans are established through incremental deployment without a central plan. Once a poor floor plan has been deployed, it is often difficult or impossible to recover the resulting loss of performance. This course provides structured floor plan guidelines for defining room layouts and for establishing IT equipment layouts within existing rooms. This is the fourth course in the Data Center Projects series. | • Define a data center floor plan<br>• Discuss floor planning concepts; including structural room and equipment layouts<br>• Describe the effects of the floor plan on data center performance<br>• Review basic principles of both equipment layouts and structural room layouts<br>• Identify the floor planning sequence<br>• Avoid common errors in equipment layout |

## ACTIONS Model Analysis

A description of ACTIONS model applications is provided in Appendix A: Table l. In selecting and planning for the use of technology in this course the ACTIONS model developed by Bates (1988, 1995) was used as a guide.

***A***- *Accessibility of Technology*

In an effort to meet the needs of those seeking certification as well as to provide education for a topic of major global concern, this course is designed for online study. The LMS provides secure password access to courseware from any computer or mobile device that has the basic hardware and software requirements. Internet access to course materials will provide students with continuous and flexible learning opportunities. Students may access course materials regardless of geographic location. Both synchronous and asynchronous interactions are incorporated in the course structure to support student flexibility in time management.

**C**- *Cost Structure Analysis of Technology*

Appendix B provides the cost structure estimates for this online course. Total fixed cost for this six module course for the duration of five year is $354,133.33. Total variable cost per student is $389.70 while income per student is $1,200.00. Fixed costs of development include video conferencing equipment, production, and technical support, experts ($318,550.00). The course will maintain current knowledge standards by updating at year two with fixed maintenance costs ($35,583.33). The estimated student cost includes course matriculation as well as certification fees. The breakeven point with a student enrollment of 506 occurs during year two.

**T-** *Teaching and Learning*

The LMS provides an online learning environment that includes learning objectives and course information in a syllabus format in addition to asynchronous and synchronous online activities. Podcasts provide students with content with audio and visual components of lessons. A student guide gives text-based structure of learning activities in a well-organized learning plan for mastery of content with supportive resources and activities. Use of video conferencing gives students added opportunity to gather knowledge.

**I-** *Interactivity and User-friendliness*

Teacher-student, student-student, and student-content interaction are facilitated through the LMS. Conference discussions and chats give student opportunities for asynchronous two-way discussion with download, print, and archive capability as well as share experiences and knowledge learned. Online learning modules give students guided student-content interaction. Podcasts increase the student's ability to learn-on-the-go giving greater flexibility for time management. Video conferencing is provided so that the learning experience is enriched by synchronous two-way interaction that can be referenced later.

**O-** *Organizational Concerns*

Full development and production of this course will be impacted if institutional funding is limited. Facets that may be most affected are training for instructional staff, technology use with learning modules. The implementation of the course is subject to review by the institution in timely manner. Review of updated content may be an institutional requirement.

**N-** *Novelty*

This course targets professionals seeking certification and appeals to those interested in a global and current environmental topic – green living. Technologies provided in this course provide continual access to learning formatted to fit multiple learning styles and preferences. Learning experiences of visually, impaired, auditory impaired and physically challenged learners may be enhanced by learning at a distance with the use of podcasts and video conferencing. Learning on-the-go is a course feature provide by the use of podcasts.

**S-** *Speed*

Depending on student location and computer features, Internet capabilities may vary. Download time of courseware such as guides, conferencing, video conferencing, and transcripts may vary. The LMS provides easy mounting of course materials and enables revisions to posted course material. Development time for each module is approximated at 160 hours.

**Conclusion**

Application of the ACTIONS model has given us information from which we base our decision to consider this online course to be worth development and implementation. The relevancy of the content and need for certification suits the needs of a targeted population. Technology infused throughout this course provides students with easy access to course materials, flexibility in matching learning styles, time management needs, and portability. Students should discover that the variety of student-friendly technology coupled with the organizational structure and sound pedagogy enable mastery of content and promote deeper learning.

Appendix A: **Table 1 ACTIONS Model**

| | **Learning Management System** | **Video Conferencing** | **Podcasts** | **Student Resource Study Guide** | **Online Learning Modules** |
|---|---|---|---|---|---|
| **A**<br><br>*Accessibility of Technology* | Students have access to web-based LMS 24x7x365 | Two sessions will be available to course participants:<br>-During first module<br>-During last module<br>Students must meet software requirements. | On-the-go learning is provided by portability of lessons using podcasts. | Guide is available online and with participant packet. | Available for participants enrolled in the course with password security. |
| **C**<br><br>*Cost Structure Analysis of Technology* | An internal LMS will be used eliminating licensing costs. | Equipment and costs for technicians will be a factor. | Minimal cost; will not greatly influence cost structure. | Distribution cost will vary with enrollment where downloading is not used. | Most visual resources are found in-house, but occasionally, outsourcing the development of a shockwave file, or the purchase of external stock images, is necessary. |

Appendix A: **Table 1 ACTIONS Model** (cont.)

| | **Learning Management System** | **Video Conferencing** | **Podcasts** | **Student Resource Study Guide** | **Online Learning Modules** |
|---|---|---|---|---|---|
| **T**<br>*Teaching and Learning* | This system promotes learning through asynchronous and synchronous online activities. Course organizational structure is provided in syllabus format with clearly defined objectives. | Learning is enhanced by synchronous communication with content experts. Q & A sessions provide opportunities for shared learning. | Use of podcasts will elaborate content with audio and visual components of lessons. | Provides text-based structure of learning activities in an organized manner; gives supplemental material and resources as well as strategies to improve comprehension for challenged learners. | Well-organized learning plan for mastery of content with supportive resources and activities; fulfills content and skills needed for certification in subject matter. |
| **I**<br>*Interactivity and User-friendliness* | Learning is facilitated through online discussion through conferencing and chats. Student-content, student-student, and student-teacher interaction is incorporated. | Students will have an opportunity to participate in real-time, synchronous events. Students will have an opportunity to interact with a content expert. | Student-content interaction is enhanced with replay/repeat and fast-forward capability. | Guide provides an easy to use checklist for participants to track progress. | Learner-content interaction is promoted through these modules. Students will engage in conferencing with a visiting/guest expert concerning subject matter relevant to thinking green. |

Appendix A: **Table 1 ACTIONS Model** (cont.)

| | **Learning Management System** | **Video Conferencing** | **Podcasts** | **Student Resource Study Guide** | **Online Learning Modules** |
|---|---|---|---|---|---|
| **O**<br>*Organizational Concerns* | Institution-wide use of LMS enhances its effectiveness in the facilitating learning. | Cost factors may restrict full implementation if institutional funding is limited. | Additional training for instructional staff may be needed. | Incorporating technology use with learning modules highlighting institutional resources and student needs for certification. | Subject to review by institution in timely manner; updating as content area evolves. |
| **N**<br>*Novelty* | Provides comprehensive means of interaction and communication within a single system | Provides opportunity for archiving both events and scripts of communication for future use and further study and support learners with visual as well as auditory disability. | Use of podcasts provides non-text reinforcement of lessons and support visually impaired learners. | Novel approach of instructional team may be used to enhance learning. | Content provides novel ideas in developing industrial concepts for environmental concerns and issues; experts in the field of green technology develop relevant content |
| **S**<br>*Speed* | Computer and Internet capabilities may vary. | Computer and Internet capabilities may vary. | Download time of courseware may vary. | Guide can be easily downloaded. | Minimal time to access modules through LMS. |

**Appendix B: The Ingredients and Their Costs**

| 1 | Input | Unit of input | Amount of input | Cost per unit of input |
|---|---|---|---|---|
| 2 | **Overhead** | | | |
| 3 | Project Manager | per annual salary | 1/3 of full-time appointment for first year | $100000 |
| 4 | Creative Services Assistant | per annual salary | 1/4 of full-time appointment for two years | $30000 |
| 5 | Curriculum Advisor | Per annual salary | 15% of full-time appointment for two years | $40000 |
| 6 | Data Line for Video Conference | Percent of total annual cost | 45% of annual cost | $5,000 |
| 7 | Marketing | Percent of tuition | 1% of tuition ($1,200 for 3 CEUs) | $1,200 |
| 8 | **Development** Costs **– 6 Modules Per Course** | | | |
| 9 | Authoring Course Module Material | Per module – 25 percent of full-time appointment | Five | $80000 |
| 10 | Visiting Expert – The Green Grid | Per module - 25 percent of full-time appointment | One | $80000 |
| 11 | LMS Use | $25 Per student – per year | 300 students per year for 5 years | $25 |
| 12 | **Printed Material** | | | |
| 13 | Edit and Design Modules | Per module (100 pages) | Six | $4000 |
| 14 | Copyright clearance | Per module (100 pages) | Six | $500 |
| 15 | ***Assignment*** | | | |
| 16 | Development assignments | 1 assignment per module | Six | $200 |
| 17 | ***Video Conferencing Cost*** | | | |
| 18 | Polycom Video Conference Equipment | Includes camera, mic, projector, & laptop per site | Four | $10000 |
| 19 | Visiting Expert Presenting | Per appearance | Three | $1,000 |
| 20 | Technician | Per site per hour two VC per course | Four sites, three courses per year | $250 |

**Appendix B: The Ingredients and Their Costs**

| | | | | |
|---|---|---|---|---|
| 21 | ***Maintenance*** **(printed and on-line)** | | | |
| 22 | Author | 1/3 of 25% of annual salary of development | Two | $80000 |
| 23 | Update LMS material | Once after updates of all revised courses | One | $1250 |
| 24 | Copyright Clearance | Per Module | Two | $500 |
| 25 | ***Student support*** | | | |
| 26 | Grading assignments | per assignment | Eighteen (6 modules x 3 semesters) | $200 |
| 27 | Instructor for Video Conference Presence | Per hour VC session | Twenty four | $75 |
| 28 | Tutor expenses | per group of 25 | Twelve | $50 |
| 29 | Administrative Support | 20% of tuition | One | $3600 |
| 30 | Technology & Support (Both LMS and VC) | 40% of tuition | One | $3600 |
| 31 | Library Resources | Per course | Three | 750 |
| 32 | Mailing of Materials | Once, at beginning of each semester | 300 | $18 |
| 33 | Certification Exam (fee included in tuition) | Per student | One | $295 |
| 34 | ***Income*** | | | |
| 35 | Fee | per student per continuing education unit (Note: includes certification fee) | Three | $400 |

**References**

Audacity (2009). *The Free, Cross-Platform Sound Editor.* Retrieved November 29, 2009, from http://audacity.sourceforge.net/

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# Course Costing Ingredients

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| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **A ONE TIME DEVELOPMENT AND PRODUCTION COSTS** | | | | | | |
| 1 | **COURSE OVERHEADS** | **Type of unit** | | **No of units** | **Rate per unit** | **No of classes** | **Costs ($$)** |
| 2 | Project Management Support | | 33.00% | 1.00 | $100,000 | | $33,000.00 |
| 3 | Creative Services Assistant | | 25.00% | 2.00 | $30,000 | | $15,000.00 |
| 4 | Curriculum Advisor | | 15.00% | 2.00 | $40,000 | | $12,000.00 |
| 5 | data line for video conference | | 45.00% | 1.00 | $5,000 | | $2,250.00 |
| 6 | Marketing for course - 1% of tuition | | 1.00% | 1.00 | $360,000 | | $3,600.00 |
| 7 | **Development of Online Modules** | **Type of unit** | | **No of units** | **Rate per unit** | | **Costs ($$)** |
| 8 | Authoring of Course Modules | percent of annual appointment | | 0.25 | $80,000 | 5 | $100,000.00 |
| 9 | Visiting Expert - topic - The Green Grid | percent of annual appointment | | 0.25 | $80,000 | 1 | $20,000.00 |
| 10 | Use of LMS | number of students per year | | 300 | $25 | 5 | $37,500.00 |
| 11 | **Development of Print-Based Materials** | **Type of unit** | | **No of units** | **Rate per unit** | | **Costs ($$)** |
| 12 | Edit and design modules | 100 pages per module | | 6 | $4,000 | | $24,000.00 |
| 13 | Copyright clearance | per module | | 6 | $500 | | $3,000.00 |
| 14 | **Assignments** | | | | | | |
| 15 | Developing assignments | per module | | 6 | $200 | | $1,200.00 |
| 16 | **Video Conferencing (VC) Expense** | **Type of unit** | | **No of units** | **Rate per unit** | | **Costs ($$)** |
| 17 | Polycom Video Conferencing equipment | includes camera, mics, projector, laptop | | 4 | $10,000 | | $40,000.00 |
| 18 | Visiting Expert - topic - The Green Grid | per appearance | | 1 | $1,000 | 3 | $3,000.00 |
| 19 | Technician at each site | 1/2 day twice during course at four sites | | 32 | $250 | 3 | $24,000.00 |
| 20 | **Total fixed costs of development** | | | | | | **$318,550.00** **FD** |
| 21 | **B MAINTENANCE COSTS (INCL. PRINTED MATERIALS & ONLINE MODULES)** | | | | | | |
| 22 | 1/3 of material will be updated in year 2 | per course | | 2 | $16,667 | | $33,333.33 |
| 23 | Update material in the LMS | once after updates | | 1 | $1,250 | | $1,250.00 |
| 24 | Copyright clearance | per Module (updating) | | 2 | $500 | | $1,000.00 |
| 25 | **Total fixed costs of maintenance** | | | | | | **$35,583.33** **FM** |
| 26 | ***Total fixed costs*** | | | | | | **$354,133.33** **F** |
| 27 | **C ANNUAL PRESENTATION COSTS (all per student)** | | | | | | |
| 28 | **Student Support** | **Type of unit** | | **No of units** | **Rate per unit** | | **Cost/student ($$)** |
| 29 | Grading assignments | per module for all students (100) (3x a year) | | 18 | $200 | 300 | $12.00 |
| 30 | Instructor (per video conference per hour) | per hour of video conference for all students | | 24 | $75 | 300 | $48.00 |
| 31 | Tutor expenses | per group of 25 | | 12 | $50 | 300 | $2.00 |
| 32 | Administrative Support | 20% of student tuition | | 20% | $3,600 | 300 | $2.40 |
| 33 | Technology & Support (LMS + VC) | 40% of student tuition | | 40% | $3,600 | 300 | $4.80 |
| 34 | Library Resources | per course (3x a year) | | 3 | $750 | 300 | $7.50 |
| 35 | Mailing of materials | once at start of course | | 1 | $5,400 | 300 | $18.00 |
| 36 | Certification Exam | per student | | 1 | $295 | 1 | $295.00 |
| 36 | ***Total variable cost per student*** | | | | | | **$389.70** **V** |
| 37 | **D INCOME (per student per credit)** | | | | | | **Income per student** |
| 39 | Tuition Fee | per student per continuing education unit - includes $295 certification fee | | 3 | $400 | 1 | $1,200 |
| 40 | ***Total income per student*** | | | | | | **$1,200.00** **I** |

# Modelling Course Costs

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| | Formula | Ingredients | | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Total |
|---|---|---|---|---|---|---|---|---|---|
| **No of students** | | | | 300 | 300 | 300 | 300 | 300 | 1500 |
| **Accumulated** | | | | 300 | 600 | 900 | 1200 | 1500 | |
| **FD annualized (5 years at 5.25%)** | FD*0.210 | 318,550.00 | 74,086.23 | 74,086.23 | 74,086.23 | 74,086.23 | 74,086.23 | 74,086.23 | 370,431.15 |
| **FM annualized (3 years at 5.25%)** | FM*0.381 | 35,583.33 | 13,127.76 | | | 13,127.76 | 13,127.76 | 13,127.76 | 39,383.28 |
| **F annualized/per year** | | | | 74,086.23 | 74,086.23 | 87,213.99 | 87,213.99 | 87,213.99 | 409,814.43 |
| **F annualized (total)** | | 409,814.43 | | 409,814.43 | 409,814.43 | 409,814.43 | 409,814.43 | 409,814.43 | |
| **Aggregate unit costs** | V | 389.70 | | 389.70 | 389.70 | 389.70 | 389.70 | 389.70 | |
| **Total Cost** | TC=F+VxN | | | 526,724.43 | 643,634.43 | 760,544.43 | 877,454.43 | 994,364.43 | |
| **Average Cost** | AC=F/N+V | | | 1,755.75 | 1,072.72 | 845.05 | 731.21 | 662.91 | |
| **Income per student** | | 1,200.00 | | 1,200.00 | 1,200.00 | 1,200.00 | 1,200.00 | 1,200.00 | |
| **Income** | I=SF*N | | | 360,000.00 | 720,000.00 | 1,080,000.00 | 1,440,000.00 | 1,800,000.00 | |
| **Profit** | | | | (166,724.43) | 76,365.57 | 319,455.57 | 562,545.57 | 805,635.57 | 1,597,277.84 |
| **Break even** | N=F/(SF-V) | | | | 506 | | | | |

| **Annualization (FD)** | | | |
|---|---|---|---|
| Input | r | rate | 5.25% |
| Input | n | years | 5 |
| Input | C | amount | $ 318,550 |
| | (1+r) n | (Intermediate va | 1.2915 |
| | a(r,n) | Annualization fa | 0.233 |
| **Result** | **C*a(r,n)** | **Annualized am** | **$ 74,086.23** |

| **Annualization (FM)** | | | |
|---|---|---|---|
| Input | r | rate | 5.25% |
| Input | n | years | 3 |
| Input | C | amount | $ 35,583 |
| | (1+r) n | (Intermediate valu | 1.1659 |
| | a(r,n) | Annualization fact | 0.369 |
| **Result** | **C*a(r,n)** | **Annualized amou** | **$ 13,127.76** |

# Costs and Income

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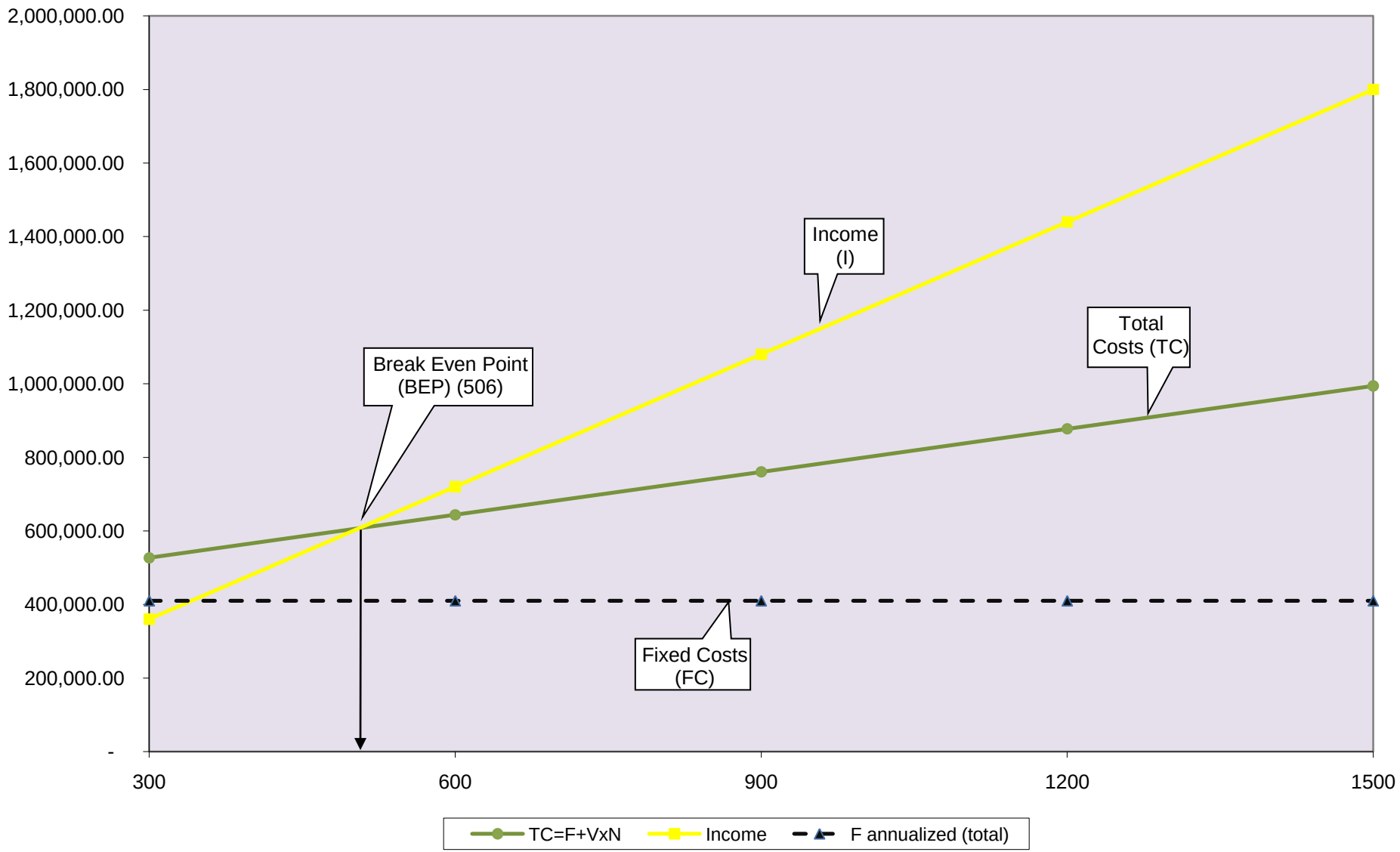

# Average Cost Per Student

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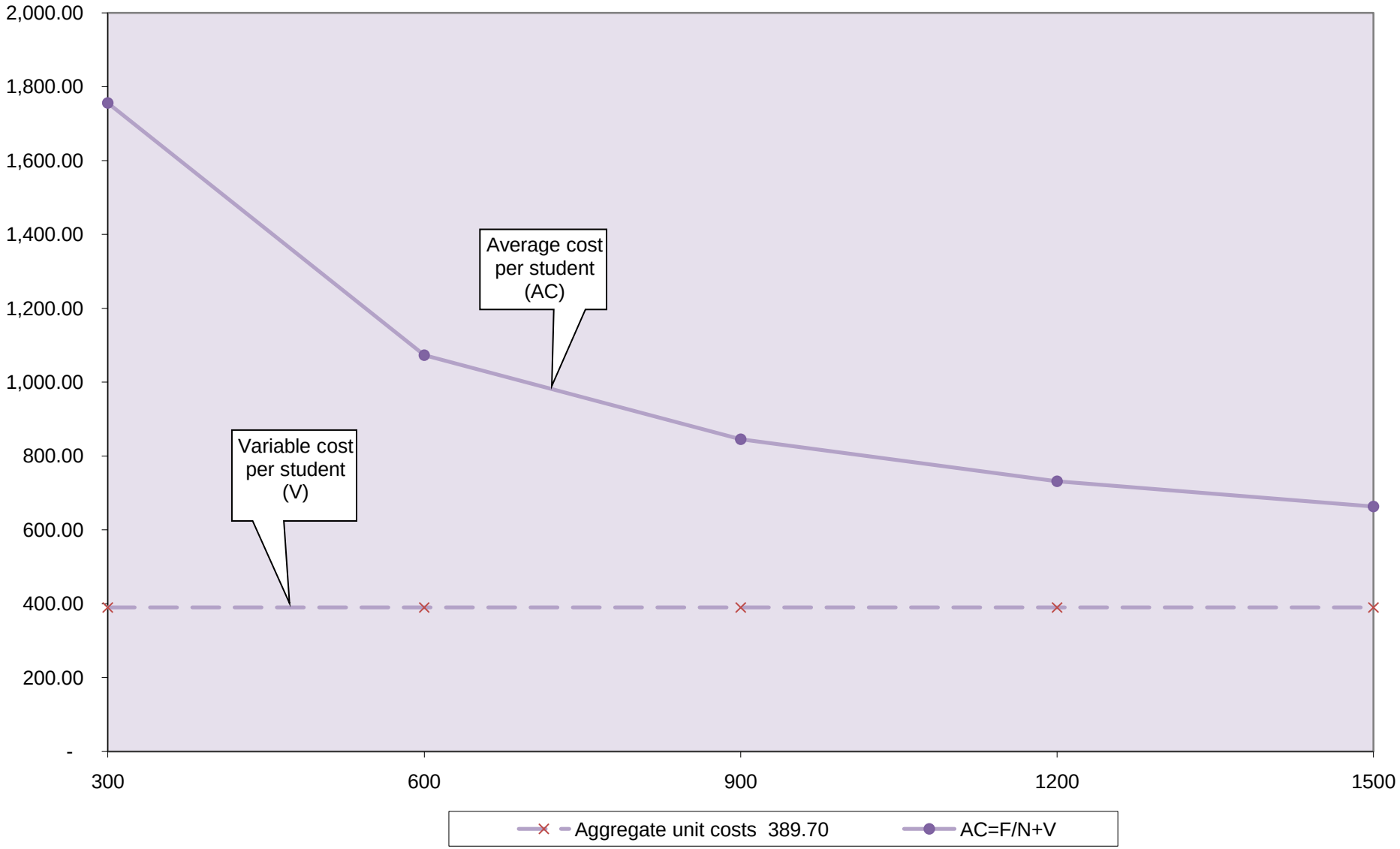

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# Graph Source Data

| | | | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
|---|---|---|---|---|---|---|---|
| | **No of students** | | 300 | 300 | 300 | 300 | 300 |
| | **Accumulated** | | 300 | 600 | 900 | 1200 | 1500 |
| | **F annualized (total)** | 409,814.43 | 409,814.43 | 409,814.43 | 409,814.43 | 409,814.43 | 409,814.43 |
| | **Aggregate unit costs** | 389.70 | 389.70 | 389.70 | 389.70 | 389.70 | 389.70 |
| | **TC=F+VxN** | | 526,724.43 | 643,634.43 | 760,544.43 | 877,454.43 | 994,364.43 |
| | **AC=F/N+V** | | 1,755.75 | 1,072.72 | 845.05 | 731.21 | 662.91 |
| | **Income per student** | 1,200.00 | 1,200.00 | 1,200.00 | 1,200.00 | 1,200.00 | 1,200.00 |
| | **Income** | | 360,000.00 | 720,000.00 | 1,080,000.00 | 1,440,000.00 | 1,800,000.00 |
| | **Profit** | | -166724 | 76366 | 319456 | 562546 | 805636 |