

# **ISDS 551: GREEN COMPUTING PROJECT**

## **GROUP 2**

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## **PART 1: Project Integration Management**

### **Task 1: Research green computing**

#### **Green Computing Definition:**

Green computing enables organizations to improve environmental stewardship by increasing energy efficiency, improving information management and providing appropriate analytical capability. It aims to attain economic viability and improve the way computing devices are used. Green IT practices include the development of environmentally sustainable production practices, energy efficient computers and improved disposal and recycling procedures.

#### **Data Center and overall energy efficiency:**

Every search that gets submitted, email sent, page served, comment posted, and video loaded passes through data centers that can be larger than a football field. Despite skyrocketing demand for computing, data center electricity use has flattened over the past few years, largely due to enormous opportunities to improve efficiency as these facilities scale up. Google's data centers employs advanced cooling techniques, using highly efficient evaporative cooling or outside air whenever possible instead of mechanical chillers. Google reduced facility energy use by installing smart temperature and lighting controls and redesigning how power is distributed to minimize energy loss. Due to all this Google data centers used 50% less energy than the industry average by spring 2014.

#### **Disposal of Electronic Waste and Recycling:**

With the advancement in technology the use of electronic products has risen. According to the Consumer Electronic Association (CEA), Americans now own 24 electronic products per household. These electronic products must be disposed properly to minimize cost and to help the environment by recycling. A program by Apple known as "Apple renew" works with over 160 recyclers around the world and with this Apple has kept more than 597 million pounds of equipment out of landfills since 1994. Apple invented a robot named "Liam" which can quickly disassemble iPhone 6 and apple has even started zero waste program in all its store. Amount of waste recovered as of 2015 is 61,357,800 lb.

#### **Telecommuting**

Studies have shown that remote workforces contribute to sustainable, environmentally-friendly workplaces by reducing congestion, lowering fuel consumption, minimizing construction,

lessening pollution emissions, reducing the strain on transportation systems, and improving air quality. And Dell has experienced this first-hand. In early 2015, Dell embarked on a study of its employee base to develop a more granular understanding of employee commute patterns and the sustainability-related effects of its remote work initiatives. The average Dell U.S. employee, whether through a formal program or informal arrangement, works remotely 9.7 times per month and saves \$339 by avoiding using 175 gallons of gas and much more is saved in travel miles etc.

### **Virtualization of server resources**

Server virtualization is the masking of server resources, including the number and identity of individual physical servers, processors, and operating systems, from server users. Cloud computing has recently known nowadays as a platform to outsourced server instead of being powered on site. Virtualizing IT infrastructure can allow companies to dramatically cut down on both their hardware and energy needs. Companies using IBM's mainframe or its new BladeCenter server, can use nearly 100 percent of a server's capacity, and cut down power use by as much as 50 percent.

### **Thin Client Solution**

This concept is nothing but reduction in energy use, material use etc. Every company through their supply chain try to employ this strategy. Apple has been a leader in its supply chain management. For every product they find the best way for it to stay with its users as long as possible, for eg: during manufacturing of Macbook, it's keys are pressed a million times. As per the ranking by Gartner group, the inventory turnover is 82.7

### **Use of Open Source Software**

The open source model offers liberties to users and developers and supports true collaborative innovation. Open source software can provides accessibility, low or no upgrade or switching costs, and provide a better value in an environment that allows for everyone's participation and competition. A very good example of open source software under operating systems is Ubuntu with many companies shifting towards Linux.

### **Development of new software to address green computing for internal use and potential sale to other organizations**

Cisco EnergyWise is a green computing technology that uses a network-based procedure to communicate messages, which helps to calculate and regulate energy between network devices and endpoints. The Cisco EnergyWise technology helps the network to discover Cisco

EnergyWise-controllable devices, keep track of their power use, and carry out necessary actions according to business rules in order to cut down their power consumption. Cisco EnergyWise uses standard protocols, such as Simple Network Management Protocol and Secure Sockets Layer, to smoothly work with third-party network management systems.

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## **Task 2: Weighted decision matrix**

To be successful in the Green Computing project, Ben, the CIO and project sponsor, claims several requirements of potential project manager. We created the weighted decision matrix in seven criteria with reasonable weight.

First, the basic project management skills are mandatory to the project managers. For instance, planning and scheduling skills, project manager need to make the project plan and schedule regular meetings. Therefore, we think the Project Management Body of Knowledge should be one of the most crucial criteria, which is weighted by 25%.

Second, project managers should be able to start the Green Computing project quickly, which is the critical requirement of Ben. We think the candidates could either from internal or external, but the experiences of Green Computing are needed. Thus, the Application Area Knowledge, standards and regulations should be important as well, which is weighted by 25%.

Third, in order to achieve the goal, project managers of Green Computing should be responsible for doing research, writing, and editing for the project. Ben will sponsor the expert consultants, related books and articles. Therefore, we think this part should be weighted by 10%.

Fourth, project managers need to serve as the manager of project team, who should “provide leadership by example.” Because project managers often take on the role of both leader and manager, the general management knowledge and skills are weighted by 15%.

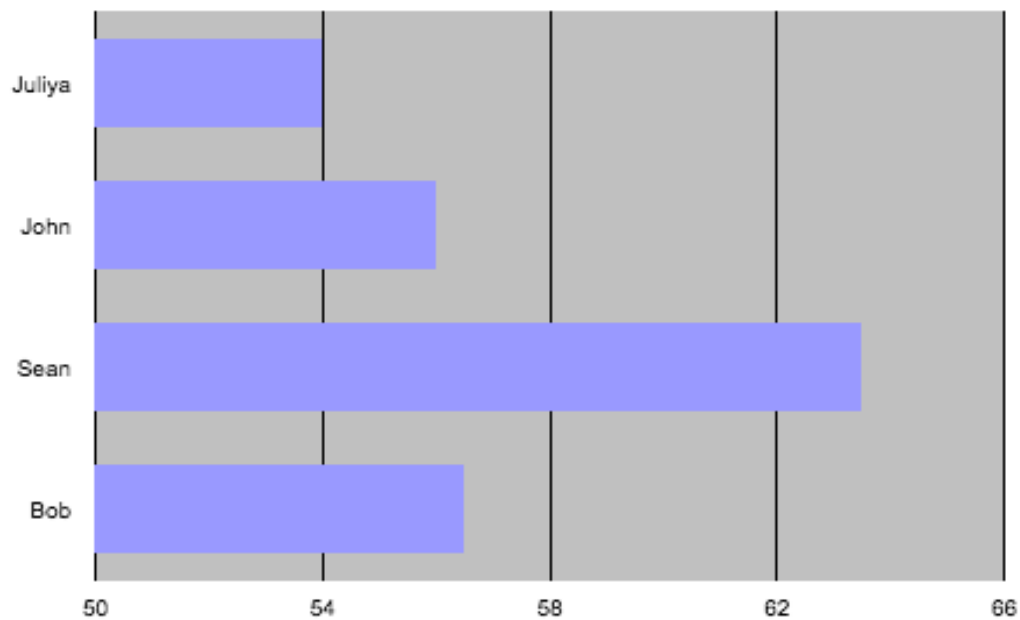
Next, project managers need to communicate with most of the people who are involved in the project, so effective and efficient communications are important to the effective project management. Those are Soft skills or human relations skills, and weighted by 15%.

Moreover, projects cannot move forward without money, so project managers should proficient in financial analysis skill. With those skills, project managers can better control the project without running out of budget. Therefore, the Financial Analysis skill is weighted by 5%.

Finally, Green Computing Research Project aims to research possible applications, which includes data center and overall energy efficiency, disposal of electronic waste and recycling, and telecommuting. Therefore, the knowledge of Sales and Marketing in Green Computing industry is weighted by 5%.

Criteria	Weight	Bob	Sean	John	Juliya
Administrative Skills (Basic PM skills, Planning, Scheduling, Coordinating)	20%	90	70	80	20
Knowledge of Green Computing project mangement (Application area knowledge, standards, and regulations)	20%	70	60	50	45
Research, writing, and editing skills	10%	50	90	50	20
General management knowledge and skills	15%	25	90	50	70
Soft skills or human relations skills (Communication Skills, Teamwork spirit, Conflict resolution)	15%	55	20	50	90
Financial Analysis skills in IT industry	5%	50	70	50	50
Knowledge of Sales and Marketing in Green Computing industry	5%	20	50	50	70
Able to start immediately	10%	40	60	50	90
<b>Weighted Project Scores</b>	<b>100%</b>	<b>56.5</b>	<b>63.5</b>	<b>56</b>	<b>54</b>

**Weighted Score by Project**



### Task 3: Financial Analysis

Discount rate	7.00%						
Assume the project is completed in Year 0			Year				
	0	1	2	3	Total		
Costs	500,000	2,000,000	600,000	600,000			
Discount factor	1.00	0.93	0.87	0.82			
Discounted costs	500,000	1,860,000	522,000	492,000	3,374,000		
Benefits	0	500,000	2,500,000	2,500,000			
Discount factor	1.00	0.93	0.87	0.82			
Discounted benefits	0	465,000	2,175,000	2,050,000	4,690,000		
Discounted benefits - costs	(500,000)	(1,395,000)	1,653,000	1,558,000	1,316,000	← NPV	
Cumulative benefits - costs	(500,000)	(1,895,000)	(242,000)	1,316,000			
ROI →	39%						
Assumptions					Payback in Year 3		

### Task 4: Project charter

**Project Title:** Green Computing Research Project

**Project Start Date:** April

**Projected Finish Date:** October

**Budget Information:** The budget for the project is \$500,000.

**Project Manager:** Sean Prawn, (913)423-3331, seanprawn@gmail.com

#### Project Objectives:

Research possible applications of green computing, including:

- Data center and overall energy efficiency
- Disposal of electronic waste and recycling
- Telecommuting
- Virtualization of server resources
- Thin client solutions
- Use of open source software
- Development of new software to address green computing for internal use and potential sale to other organizations.

#### Main Project Success Criteria:

Provide an extensive report, including detailed financial analysis and recommendations for which green computing technologies to implement. Official project request forms for the recommended solutions will also be created as part of the project.



### Approach:

- Select the project team as quickly as possible. The group of people work full time on this project, the priority to people who is already working in the company.
- Do some of the research, writing, and editing required to produce the desired results
- Open to paying expert consultants for their advice and to purchasing books and related articles as needed
- Allow people to work virtually for the project.

### Roles and Responsibilities

<b>Role</b>	<b>Name</b>	<b>Organization/ Position</b>	<b>Contact Information</b>
Project Sponsor	Ben	CIO	ben@wearebig.com
Program Manager	Sean Prawn	Manager	seanprawn@gmail.com
Senior Technical Specialist	Matt	IT Department	Matt@wearebig.com
Senior Systems Analyst	Teresa	IT Department	Teresa@wearebig.com
Senior Consultant	James	Consultant	James@wearebig.com
Green Computing Expert	Le	New Hire/Researcher	Le@wearebig.com
Part-time Editor	Deb	Consultant	Deb@wearebig.com

**Sign-off:** (Signatures of all above stakeholders. Can sign by their names in table above.)

**Comments:** (Handwritten or typed comments from above stakeholders, if applicable)

### **Task 5: Change request**

Thorough project planning can be an important factor to the success of a project in many situations. However, in most occasions, a project will almost never go according to plan as there are so many unknown factors that may affect the outcome. In the time period it takes to complete a project, many things can change such as budget, newer technology, and even the need of such project. Having a functional integrated change control process in place is an absolute critical necessity to a project's success as it allows the project to adapt cost, scope, and time to the company's needs.

Changes can range in importance from trivial to very significant in terms of an IT project. A very convoluted change control system can delay subsequent changes and even squander a project's success by not adapting fast enough. In this sense, it is very important to address a project's change in a timely manner. One method we plan to implement to address this issue is the 48-hour policy. For large projects, the task leaders are given 48 hours to decide on key factors in a project. The person most affected by change is then given another 48 hours to show it to top management for approval. Top management then is given another 48 hours to reverse the decision and otherwise the change will be approved. This 48-hour policy allows the process to move along swiftly while providing ample time to make key decisions. However, for more trivial and informal key decisions, having a standing meeting with involved team members can prove to be useful as well. By having each member stand, it will keep meetings short, brief, informal, and straight to the point.

One of the most important things to improve the change control process is to create a change control board (CCB). The board will consist of some key stakeholders in the company, project managers, and sometimes even project sponsors. These key individuals will rotate based on the needs of our company and project. Their main function will be to accept or decline changes, provide guidelines on preparing change requests, evaluating change requests, and managing implementation of changes.

For requesting the change, we will use a paper entitled Change Request Form, which highlights many things that are important to provide the CCB with the information needed to proceed with changes. Such changes include the category of change, the reasons why for change, the justification, the impact, and required approvals to make change. By having this information on the request form, the CCB can analyze and see its positive and negative impact more thoroughly to quickly determine whether the change should be implemented.

Finally, as needs change, the change control system can be adapted to suit whether the company benefits from the most. If the current structure of implementing change is not suitable, our program sponsor, project manager, key stakeholders, as well as other top management officials can configure it to suit the needs of the company.

## PART 2: Project Scope Management

### Task 1: Requirements traceability matrix

Prepared by: Xiangwei liu

Date: May 6,2017

Requirement No.	Name	Category	Source	Status
1	Finance specialist	Internal Staffing	Project Charter	Complete
2	IT Specialists	Internal Staffing	Project Charter	Complete
3	Project Manager	Internal Staffing	Project Charter	Complete
4	Green Computing Consultant	External Staffing	Project Charter	Complete
5	Project Researcher	Internal Staffing	Project Charter	Complete
6	Access to Relevant Databases	Research Resources	Project Specs	Pending
7	Computers	Hardware	Project Specs	Complete
8	Office Space	Work Space	Project Specs	Complete
9	Telecommuting	Hardware	Project Specs	Pending
10	Office Supplies	Supplies	Project Specs	Complete
11	Travel Budget	Logistics	Project Specs	Pending

Question for project sponsor:

1. What part of IT infrastructure should the company improve with green computing?
2. In how many days should the company implement green computing?
3. What applications of green computing should be focused on through research?
4. How should the Return on investment be researched considering the future?

## **Task 2: Scope Statement**

### **Scope Statement (Version 1.1)**

<b>Project Title: Green Computing Research Project</b>	
<b>Date:</b> April 21, 2017 Xiaoyuan li	<b>Prepared by:</b>
<b>Project Justification:</b> The main purpose is to produce an extensive report, which includes details financial analysis and recommendations to improve the environment while increasing revenues and reducing costs.	
<b>Product Characteristics and Requirements:</b>	
<ol style="list-style-type: none"> <li>1. Data center and overall energy efficiency</li> <li>2. Disposal of electronic waste and recycling</li> <li>3. Telecommuting</li> <li>4. Virtualization of sever resources</li> <li>5. Thin client solution</li> <li>6. Open sources software</li> <li>7. Power Management</li> <li>8. Environmental friendly</li> <li>9. Based on previous founded research</li> <li>10. Stay within allocated budget and time</li> </ol>	
<b>Product User Acceptance Criteria:</b> A series of professional research reports for each green computing technology includes plenty of charts and references, a good formal and detailed project proposal, and a detailed business case for We Are Big. The overall project success will be determined by the quality of the documentation produce, the product will expected make a return above what the initially dedicated time and budget to team.	
<b>Summary of Project Deliverables</b>	
<b>Project management-related deliverables:</b> business case, charter, team contract, scope	

statement, WBS, schedule, cost baseline, status reports, final project presentation, final project report, lessons-learned report, and any other documents required to manage the project.

**Product-related deliverables:** research reports, design documents, software code, hardware

1. four top recommendations to implement some of the green computing technologies
2. twenty different project ideas
3. Requirement traceability matrix
4. Work Schedule Breakdown
5. Gantt Chart with a detailed work breakdown structure
6. Summary of project progress

### **Task 3: Work breakdown structure**

**Prepared by:** Archit Jajoo and Yash Agrawal

**Date:** April 23, 2017

- 1 Initiating
  - 1.1 Form a Team
  - 1.2 Kickoff Meeting
  - 1.3 Research on Green Computing and Green Projects
  - 1.4 Develop a Business Case
  - 1.5 Create Project Charter
  - 1.6 Project Charter Signed
  - 1.7 Prepare Change Request Form
- 2 Planning
  - 2.1 Develop Project Plans
    - 2.1.1 Develop Project Requirement Traceability Matrix(Computers, Office Space, TeleComputing, Office supplies, Software)
    - 2.1.2 Coordinate with Environmental Technologies Program
  - 2.2 Prepare Scope Statement
  - 2.3 Create work breakdown structure
  - 2.4 Create Gantt Chart in Microsoft Project 2016

- 2.5 Review Project Plans
  - 2.6 Project Plans Approved
- 3 Analysis
  - 3.1 Define Green Computing
  - 3.2 Data Center and Overall Energy Efficiency
    - 3.2.1 Identify Data Center Functioning and Energy Efficiency
    - 3.2.2 Assessing Current Situation of Data Center and Improving Energy Efficiency
    - 3.2.3 Analyzing Monetary Benefits
    - 3.2.4 Identifying the outcome
  - 3.3 Disposal of Electronic Waste and recycling
    - 3.3.1 Differentiating Cost and Benefits
  - 3.4 Telecommuting
    - 3.4.1 Identifying Impacts to working Environment
    - 3.4.2 Providing Solutions to Issues and associated problems
  - 3.5 Virtualization of Server Resources
    - 3.5.1 Analyzing Server Utilization and Requirements
    - 3.5.2 Thin Client Solutions
  - 3.6 Use of Open Source Software
    - 3.6.1 Comparing Proprietary and Open Source Technologies
    - 3.6.2 Analyzing Stability, Scalability and Support
  - 3.7 Developing Software for monitoring Green Computing Environment
    - 3.7.1 Propose Solution
    - 3.7.2 Design and Execute
    - 3.7.3 Testing and Maintenance
- 4 Execution
  - 4.1 Designing
    - 4.1.1 Requirement Matrix
    - 4.1.2 Scope Statement
    - 4.1.3 Work Breakdown Structure
    - 4.1.4 Gantt Chart

#### 4.1.5 Financial Analysis

#### 4.2 Prototyping

#### 4.3 System Implementation

##### 4.3.1 Coding and Integration

#### 4.4 Testing

### 5 Reporting

#### 5.1 Report Performance and Control Changes

### Task 4: Gantt chart

		Task Mode ▾	Task Name	Duration ▾	Start ▾	Finish ▾	Predecessors ▾	Resour
1			1. Initiating	1 day	Mon 5/1/17	Mon 5/1/17		
2			1.1 Form a Team					
3			1.2 Kickoff Meeting					
4			1.3 Research on Green Computing and Green Projects					
5			1.4 Develop a Business Case					
6			1.5 Create Project Charter					
7			1.6 Project Charter Signed					
8			1.7 Prepare Change Request Form					
9			2. Planning	1 day	Mon 5/1/17	Mon 5/1/17		
10			2.1 Develop Project Plans	1 day	Mon 5/1/17	Mon 5/1/17		
11			2.1.1 Develop Project Requirement Traceability Matrix(Computers, Office Space, Telecomputing, Office supplies, Software)	1 day	Mon 5/1/17	Mon 5/1/17		
12			2.1.2 Coordinate with Environmental Technologies Program					
13			2.2 Prepare Scope Statement					
14			2.3 Create work breakdown structure					
15			2.4 Create Gantt Chart in Microsoft Project 2016					
16			2.5 Review Project Plans					
17			2.6 Project Plans Approved					
18			3. Analysis	1 day	Mon 5/1/17	Mon 5/1/17		



## PART 3: Project Time Management

### **Task 1: Review Gantt chart & Work breakdown structure**

The Work Breakdown structure (WBS) in Part 2 has covered tasks that are important, but in addition to this some tasks could be added, because tasks can change as the project progresses and in the process, it is also possible that some tasks already mentioned in the WBS may not be required or may be replaced by some other tasks. Also, it is possible for some sub-tasks to become independent tasks reflecting on the overall WBS. Some tasks which may be deemed as independent or sub-tasks are as follow:

**Review change request forms:** Any changes made to the project in between through change request form should be reviewed again to see to it that there are no more errors or changes required after this. In other words, to avoid any further changes relating to the changes made through the change request form.

**Conduct cost and profitability analysis:** Although monetary benefits are considered but an overall cost and profitability analysis is important since this will help to determine the various avenues through which the project will achieve maximum profitability. This analysis will also help us determine whether the allocated budget is in excess or in simple words, if the project will require more money with time. In addition to this, the cost and profitability analysis will help in timely delivery of project milestones. Many companies consider this method as the base of the project and their project completion is dependent on this analysis.

**Conduct surveys:** Another good approach that we thought should be included is to conduct surveys to understand more about the product and modify the project as per the expectations of the potential customers. This can be done simultaneously with the planning of the the project and since this is related to environment, so it would also be advantageous for the company as a whole.

**Conduct Critical path analysis:** A very well-known method used by many companies is Critical Path Method (CPM). This method should be used for every project as it focuses on the critical tasks and leads to better time management. It also focuses on the aspects where the project has a tendency to get stuck which helps to improve these processes for future.

## **Task 2: Milestones**

### **Milestone 1:**

Milestone 1 defines the post initiation phase and we start planning the project in detail just after it. At the end of this phase all the vital tasks like executives initiating/ approving the project, creating a business case, having the project charter signed, preparing change request form should be completed. It confirms that the project has been initiated. After the completion of this milestone the planning can be started and the team can be assigned with their tasks. Steward has to make sure this milestone is met in time.

### **Milestone 2:**

Milestone 2 describes the completion of planning phase. Project plans are approved now, the team has been selected. Project Scope Statement, Work Break Down structure, and Gantt chart have been created. Steward will ensure that each task is completed before the deadline, so that analysis of the analysis of potential green computing practices can be started.

### **Milestone3:**

Milestone 3 will make sure that the potential green computing practice have been well analyzed, planned and all the aspects of implementation such as data center efficiency, thin client solutions and virtualization of server resources have been taken into consideration. Le will ensure that analysis of all practices is allotted desired time and task completes before the deadline.

### **Milestone 4:**

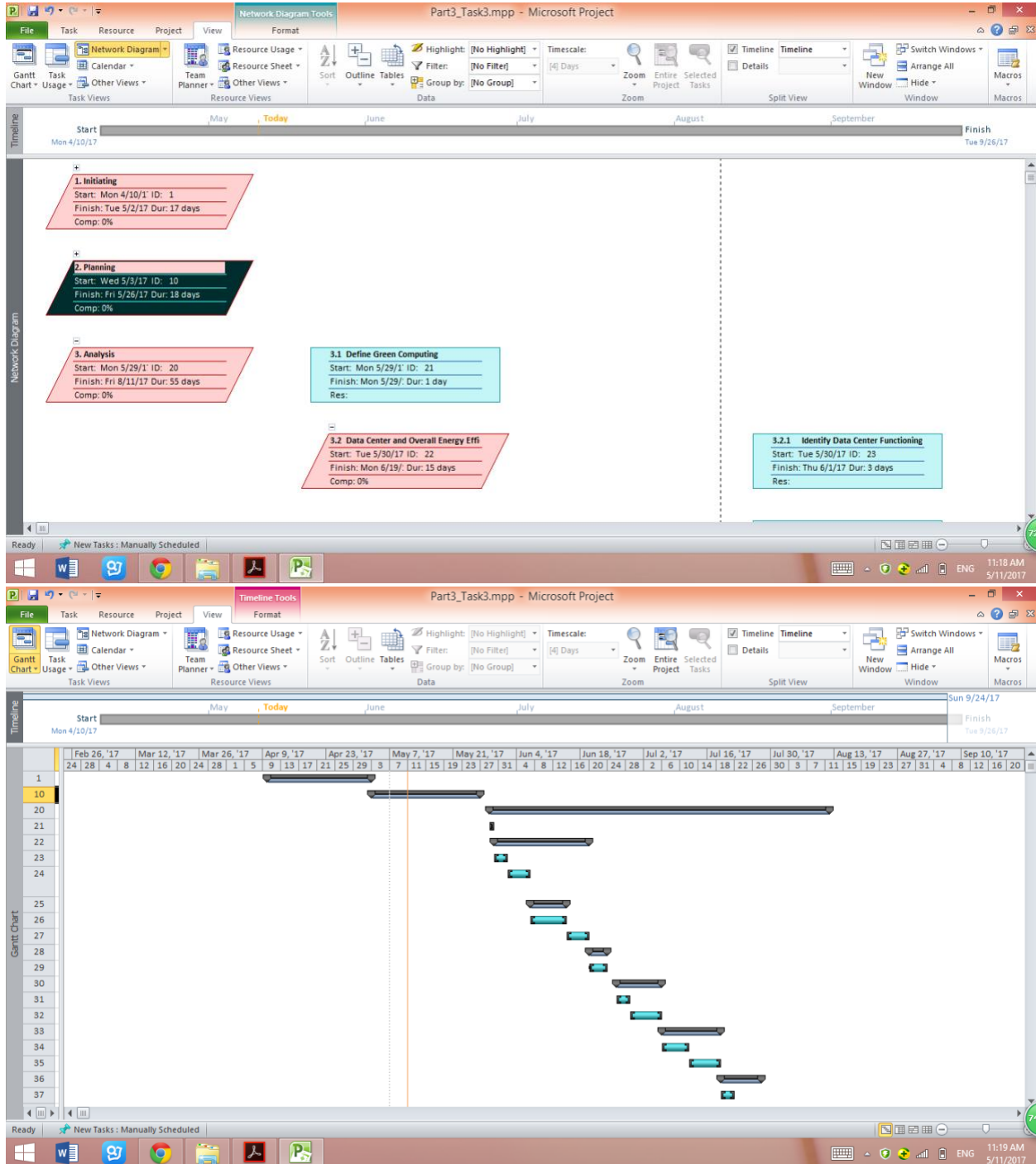
Milestone 4 is important because when the milestone is completed there will be a working prototype of the system. Chief Officers and managers will have an estimate of how the product will look like after project completion. Prototype means a working product in a controlled environment. Changes are made based on the working of prototype model. Matt will have to make sure the milestone for prototyping is met.

### **Milestone5:**

Milestone 5 is most important for the project since it is the completion of the core of the project. The solution is implemented and the changes have an effect in real time. Even after milestone 5

the project is not complete, there would be periodic and systematic/ ad-hoc reporting on the performance of the system and solution. Matt will have to make sure the milestone for implementation is met.

### Task 3: Gantt chart & Network diagram



## Task 4: Number of hour's matrix

Tasks	Assigned To:	Number of Days	Number of Total Hours
<b>Initiating</b>		17	136
Form a Team	Sean/Ben	1	8
Kickoff Meeting	Everyone	1	8
Research on Green Computing and Green Projects	Sean, James	5	40
Develop a Business Case	Sean, James	3	24
Create Project Charter	Sean	2	16
Project Charter Signed	Sean	3	24
Prepare Change Request Form	Sean	2	16
Reviewn Changes request Form	Sean	2	16
<b>Planning (Total)</b>		18	144
Develop Project Plans (Total)	Sean	5	40
Develop Project Requirement Traceability Matrix (Computers, Office Space, Telecomputing, Office supplies, Software)	Sean	2	16
Coordinate with Environmental Technologies Program	Sean	3	24
Prepare Scope Statement	Everyone	2	16
Create work breakdown structure	Sean	4	32
Create Gantt Chart in Microsoft Project 2016	Sean	3	24
Review Project Plans	Sean	2	16
Conduct Surveys	Sean	2	16
Project Plans Approved	Everyone	2	16
<b>Analysis</b>	Sean	55	440
Define Green Computing	Sean, Le	1	8
Data Center and Overall Energy Efficiency (Total)	Sean, Le, Teresa, Matt	15	120
Identify Data Center Functioning and Energy Efficiency		3	24
Assessing Current Situation of Data Center and Improving Energy Efficiency		3	24
Analyzing Monetary Benefits		6	48
Cost and Profitability Analysis		6	48
Identifying the outcome		3	24
Disposal of Electronic Waste and recycling (Total)	Sean, Matt, Le, James	4	32
Differentiating Cost and Benefits		4	32
<b>Telecommuting (Total)</b>	Sean, James, Le, Teresa	8	64
Identifying Impacts to working Environment		3	24
Providing Solutions to Issues and associated problems		5	40
Virtualization of Server Resources (Total)	Sean, Teresa, Le, Matt	9	72
Analyzing Server Utilization and Requirements		4	32
Thin Client Solutions		5	40
<b>Use of Open Source Software (Total)</b>	Sean, Teresa, Matt, Le	7	56
Comparing Proprietary and Open Source Technologies		3	24
Analyzing Stability, Scalability and Support		4	32
Developing Software for monitoring Green Computing Environment (Total)	Sean, James, Le, Teresa	11	88
Propose Solution		3	24
Design and Execute		4	32
Testing and Maintenance		2	16
Critical Path Analysis		2	16
<b>Execution (Total)</b>		27	216
Designing	Sean, Matt, Teresa, Deb	17	136
Requirement Matrix	Sean, Matt, Teresa, Deb	3	24
Scope Statement	Sean, Matt, Teresa, Deb	4	32
Work Breakdown Structure	Sean, Matt, Teresa, James	3	24
Gantt Chart	Sean, Matt, Teresa, James	3	24
Financial Analysis	Sean	4	32
Prototyping	Sean, Matt, James, Teresa,	4	32
System Implementation (Total)	Sean, Matt, James, Le	3	24
Coding and Integration	Sean, Matt, James, Le	3	24
Testing	Sean, Matt, Le, Teresa	3	24
<b>Reporting (Total)</b>	Sean, Deb, Teresa	5	40
Report Performance and Control Changes	Sean	5	40

Given the staff that we hired, it would make sense to pair each individual with their particular skillset to improve the success of this project. We list each person and their skillset along with the activity they should be paired with to increase success rate of the project.

Matt is a senior technical specialist in the corporate IT department. He is an expert in

collaboration technologies and his skills will be invaluable to the success of our project. Since our team works remotely, his skillset will prove useful in the Planning sector due to his need to understand the entire project to allow us all to work well together. Not only this, his skills will be useful in developing Software for monitoring the Green Computing Environment. Lastly, assigning him to execution might make sense. We would like Matt to attend the program meeting in Europe.

Teresa is a senior systems analyst in the IT department. We believe every member should be part of the planning phase due to everyone's need to understand how everything works. Furthermore, and to the scope of her abilities, she should work on Analysis as well especially in the Virtualization of Server Resources. The task of Data Center and Overall Energy Efficiency will be a task she will excel at as well. Teresa will also complete the work breakdown structure, prototyping system, and the testing under the system implementation stage.

James is a senior consultant in the strategic research department and a wonderful presenter. He, like all the others, will be involved in the planning. Furthermore, his skillset points to help with the analysis and execution section. With his charisma, he should be able present this information well to the executives which will prove useful.

Le is our new hire and also did her thesis on green computing. Her knowledge of the subject will be vital to our project. She should mainly focus on all the informational and analysis of the project which includes defining Green Computing, Disposal of Electronic Waste and recycling, telecommuting, and possibly testing the software.

Deb was hired as a part-time editor and consultant to help the team with the final reports and project proposals. We've assigned tasks to Deb that include writing the scope statement of the project, reporting any plan changes and reporting the final project to the Executives.

## **Task 5: Contingency Strategies**

Because it is difficult to find detailed information on some of the green computing technologies, especially financial data, we use a buffer to make up lost time and provide an accurate estimate of how long each task should take. The buffer depends on the types of task assigned, the resources

availability and the person who is responsible for that task. Since each team member has specific skill, the task will be assigned according to each person's background and specialty.

To avoid the schedule slips in the future, we need constantly monitoring the project progress and the budget allocated to each task, so we will be able to take efficient measures when emergency happens. For example, if a team member needs help to stay the task on track, we will check how the other team members' performance on their individual task, then allocate resources that could most effectively improve the process of the project.

## PART 4: Project Cost Management

### Task 1: Cost estimate

Cost Estimate							
Project Name: Green Computing Research							
	Duration	# Units/Hrs.	Resources	Cost/Unit/Hr.	Subtotals	WBS Level 2 Totals	% of Total
<b>WBS Items</b>							
<b>1. Initiating</b>		<b>136</b>				\$ 22,160.00	4%
1.1 Form a Team	1	8	Sean/Ben	\$ 100.00	\$ 800.00		
1.2 Kickoff Meeting	1	8	Everyone	\$ 450.00	\$ 3,600.00		
1.3 Research on Green Computing and Green Projects	5	40	Sean, James	\$ 190.00	\$ 7,600.00		
1.4 Develop a Business Case	3	24	Sean, James	\$ 190.00	\$ 4,560.00		
1.5 Create Project Charter	2	16	Sean	\$ 100.00	\$ 1,600.00		
1.6 Project Charter Signed	3	24	Sean	\$ 100.00	\$ 2,400.00		
1.7 Prepare Change Request Form							
1.7.1 Review Change Request Form	2	16	Sean	\$ 100.00	\$ 1,600.00		
<b>2. Planning</b>		<b>144</b>				\$ 25,600.00	5%
2.1 Develop Project Plans			Sean				
2.1.1 Develop Project Requirement Traceability Matrix/Coordinate resource (Computers, Office Space, Telecomputing, Office supplies, Software)	2	16	Sean	\$ 100.00	\$ 1,600.00	\$ 152,500.00	
2.1.2 Coordinate with Environmental Technologies Program	3	24	Sean	\$ 100.00	\$ 2,400.00		
2.2 Prepare Scope Statement	2	16	Everyone	\$ 450.00	\$ 7,200.00		
2.3 Create work breakdown structure	4	32	Sean	\$ 100.00	\$ 3,200.00		
2.4 Create Gantt Chart in Microsoft Project 2016	3	24	Sean	\$ 100.00	\$ 2,400.00		
2.5 Review Project Plans							
2.5.1 Conduct Surveys	2	16	Sean	\$ 100.00	\$ 1,600.00		
2.6 Project Plans Approved	2	16	Everyone	\$ 450.00	\$ 7,200.00		
<b>3. Analysis</b>		<b>440</b>				\$ 158,560.00	32%
3.1 Define Green Computing	1	8	Sean, Le	\$ 190.00	\$ 1,520.00		
3.2 Data Center and Overall Energy Efficiency							
3.2.1 Identify Data Center Functioning and Energy Efficiency	3	24	Sean, Le, Teresa, Matt	\$ 360.00	\$ 8,640.00		
3.2.2 Assessing Current Situation of Data Center and Improving Energy Efficiency	3	24	Sean, Le, Teresa, Matt	\$ 360.00	\$ 8,640.00		
3.2.3 Analyzing Monetary Benefits							
3.2.3.1 Cost and Profitability Analysis	6	48	Sean, Le, Teresa, Matt	\$ 360.00	\$ 17,280.00		
3.2.4 Identifying the outcome	3	24	Sean, Le, Teresa, Matt	\$ 360.00	\$ 8,640.00		
3.3 Disposal of Electronic Waste and recycling							
3.3.1 Differentiating Cost and Benefits	4	32	Sean, Matt, Le, James	\$ 360.00	\$ 11,520.00		
3.4 Telecommuting							
3.4.1 Identifying Impacts to working Environment	3	24	Sean, James, Le, Teresa	\$ 370.00	\$ 8,880.00		
3.4.2 Providing Solutions to Issues and associated problems	5	40	Sean, James, Le, Teresa	\$ 370.00	\$ 14,800.00		
3.5 Virtualization of Server Resources							
3.5.1 Analyzing Server Utilization and Requirements	4	32	Sean, Teresa, Le, Matt	\$ 360.00	\$ 11,520.00		
3.5.2 Thin Client Solutions	5	40	Sean, Teresa, Le, Matt	\$ 360.00	\$ 14,400.00		
3.6 Use of Open Source Software							
3.6.1 Comparing Proprietary and Open Source Technologies	3	24	Sean, Teresa, Matt, Le	\$ 360.00	\$ 8,640.00		
3.6.2 Analyzing Stability, Scalability and Support	4	32	Sean, Teresa, Matt, Le	\$ 360.00	\$ 11,520.00		
3.7 Developing Software for monitoring Green Computing Environment							
3.7.1 Propose Solution	3	24	Sean, James, Le, Teresa	\$ 370.00	\$ 8,880.00		
3.7.2 Design and Execute	4	32	Sean, James, Le, Teresa	\$ 370.00	\$ 11,840.00		
3.7.3 Testing and Maintenance	2	16	Sean, James, Le, Teresa	\$ 370.00	\$ 5,920.00		
3.7.4 Critical Path Analysis	2	16	Sean, James, Le, Teresa	\$ 370.00	\$ 5,920.00		
<b>4. Execution</b>		<b>216</b>				\$ 75,600.00	15%
4.1 Designing							
4.1.1 Requirement Matrix	3	24	Sean, Matt, Teresa, Deb	\$ 470.00	\$ 11,280.00		
4.1.2 Scope Statement	4	32	Sean, Matt, Teresa, Deb	\$ 470.00	\$ 15,040.00		
4.1.3 Work Breakdown Structure	3	24	Sean, Matt, Teresa, James	\$ 360.00	\$ 8,640.00		
4.1.4 Gantt Chart	3	24	Sean, Matt, Teresa, James	\$ 360.00	\$ 8,640.00		
4.1.5 Financial Analysis	4	32	Sean	\$ 100.00	\$ 3,200.00		
4.2 Prototyping	4	32	Sean, Matt, James, Teresa	\$ 360.00	\$ 11,520.00		
4.3 System Implementation							
4.3.1 Coding and Integration	3	24	Sean, Matt, James, Le	\$ 360.00	\$ 8,640.00		
4.4 Testing	3	24	Sean, Matt, Le, Teresa	\$ 360.00	\$ 8,640.00		
<b>5. Reporting</b>		<b>40</b>				\$ 15,600.00	3%
5.1 Report Performance and Control Changes	5	40	Sean, Deb, Teresa	\$ 390.00	\$ 15,600.00		
<b>Reserves</b>						\$ 45,022.00	9%
<b>Total project cost estimate</b>	<b>244</b>	<b>1952</b>				<b>\$ 495,022.00</b>	<b>69%</b>
<b>Title Cost/Hour</b>							
Project Manager				\$100			
Senior systems analyst-Teresa				\$90			
Senior consultant-James				\$90			
Le				\$90			
Senior technical specialist-Matt				\$80			
Outsourced Labor				\$200			

## Task 2: Cost baseline

Green Computing Research Cost Baseline							
WBS Items	4	5	6	7	8	9	Totals
<b>1. Initiating</b>	\$ -						\$ -
1.1 Form a Team	\$ 800.00						\$ 800.00
1.2 Kickoff Meeting	\$ 3,600.00						\$ 3,600.00
1.3 Research on Green Computing and Green Projects	\$ 7,600.00						\$ 7,600.00
1.4 Develop a Business Case	\$ 4,560.00						\$ 4,560.00
1.5 Create Project Charter	\$ 1,600.00						\$ 1,600.00
1.6 Project Charter Signed	\$ 2,400.00						\$ 2,400.00
1.7 Prepare Change Request Form	\$ -						\$ -
1.7.1 Review Change Request Form	\$ 26,600.00	\$ 26,000.00	\$ 30,000.00	\$ 34,000.00	\$ 35,000.00		\$ 151,600.00
<b>2. Planning</b>	\$ -						\$ -
2.1 Develop Project Plans	\$ -						\$ -
2.1.1 Develop Project Requirement Traceability Matrix (Computers, Office Space, Telecomputing, Office supplies, Software)	\$ 1,600.00						\$ 1,600.00
2.1.2 Coordinate with Environmental Technologies Program	\$ 2,400.00						\$ 2,400.00
2.2 Prepare Scope Statement	\$ 7,200.00						\$ 7,200.00
2.3 Create work breakdown structure	\$ 3,200.00						\$ 3,200.00
2.4 Create Gantt Chart in Microsoft Project 2016	\$ 2,400.00						\$ 2,400.00
2.5 Review Project Plans	\$ -						\$ -
2.5.1 Conduct Surveys	\$ 1,600.00						\$ 1,600.00
2.6 Project Plans Approved	\$ 7,200.00						\$ 7,200.00
<b>3. Analysis</b>	\$ -						\$ -
3.1 Define Green Computing	\$ 1,520.00						\$ 1,520.00
3.2 Data Center and Overall Energy Efficiency	\$ -						\$ -
3.2.1 Identify Data Center Functioning and Energy Efficiency	\$ 5,760.00	\$ 2,880.00					\$ 8,640.00
3.2.2 Assessing Current Situation of Data Center and Improving Energy Efficiency	\$ 2,880.00	\$ 5,760.00					\$ 8,640.00
3.2.3 Analyzing Monetary Benefits	\$ -						\$ -
3.2.3.1 Cost and Profitability Analysis		\$ 17,280.00					\$ 17,280.00
3.2.4 Identifying the outcome		\$ 8,640.00					\$ 8,640.00
3.3 Disposal of Electronic Waste and recycling		\$ -					\$ -
3.3.1 Differentiating Cost and Benefits		\$ 11,520.00					\$ 11,520.00
3.4 Telecommuting		\$ -					\$ -
3.4.1 Identifying Impacts to working Environment			\$ 8,880.00				\$ 8,880.00
3.4.2 Providing Solutions to Issues and associated problems			\$ 14,800.00				\$ 14,800.00
3.5 Virtualization of Server Resources			\$ -				\$ -
3.5.1 Analyzing Server Utilization and Requirements			\$ 11,520.00				\$ 11,520.00
3.5.2 Thin Client Solutions			\$ 14,400.00				\$ 14,400.00
3.6 Use of Open Source Software			\$ -				\$ -
3.6.1 Comparing Proprietary and Open Source Technologies			\$ 8,640.00				\$ 8,640.00
3.6.2 Analyzing Stability, Scalability and Support			\$ 11,520.00				\$ 11,520.00
3.7 Developing Software for monitoring Green Computing Environment					\$ -		\$ -
3.7.1 Propose Solution				\$ 5,920.00	\$ 2,960.00		\$ 8,880.00
3.7.2 Design and Execute				\$ 3,382.86	\$ 8,457.14		\$ 11,840.00
3.7.3 Testing and Maintenance				\$ 1,315.56	\$ 4,604.44		\$ 5,920.00
3.7.4 Critical Path Analysis				\$ 4,843.64	\$ 1,076.36		\$ 5,920.00
<b>4. Execution</b>					\$ -		\$ -
4.1 Designing					\$ -		\$ -
4.1.1 Requirement Matrix					\$ 11,280.00		\$ 11,280.00
4.1.2 Scope Statement					\$ 15,040.00		\$ 15,040.00
4.1.3 Work Breakdown Structure					\$ 8,640.00		\$ 8,640.00
4.1.4 Gantt Chart					\$ 8,640.00		\$ 8,640.00
4.1.5 Financial Analysis					\$ 2,635.29	\$ 564.71	\$ 3,200.00
4.2 Prototyping					\$ 7,680.00	\$ 3,840.00	\$ 11,520.00
4.3 System Implementation						\$ -	\$ -
4.3.1 Coding and Integration						\$ 8,640.00	\$ 8,640.00
4.4 Testing					\$ 4,480.00	\$ 4,160.00	\$ 8,640.00
<b>5. Reporting</b>						\$ -	\$ -
5.1 Report Performance and Control Changes						\$ 15,600.00	\$ 15,600.00
<b>Reserves</b>	\$ 2,056.00	\$ 6,236.00	\$ 7,208.00	\$ 11,522.20	\$ 10,949.32	\$ 6,780.47	\$ 44,752.00
<b>Totals</b>	\$ 22,616.00	\$ 68,596.00	\$ 79,288.00	\$ 126,744.25	\$ 120,442.57	\$ 74,585.18	\$ 492,272.00

## Task 3: Short Report

a. Cost variance(CV) = EV-AC=\$150,000 - \$180,000 = -\$30,000

Schedule variance(SV) = EV-PV=\$150,000-\$160,000=-\$10,000

Cost Performance Index (CPI)=EV/AC=\$150,000/\$180,000 =0.8333 (83.33%)

Schedule Performance Index (SPI)=EV/PV=\$150,000/\$160,000=0.9375 (93.75%)

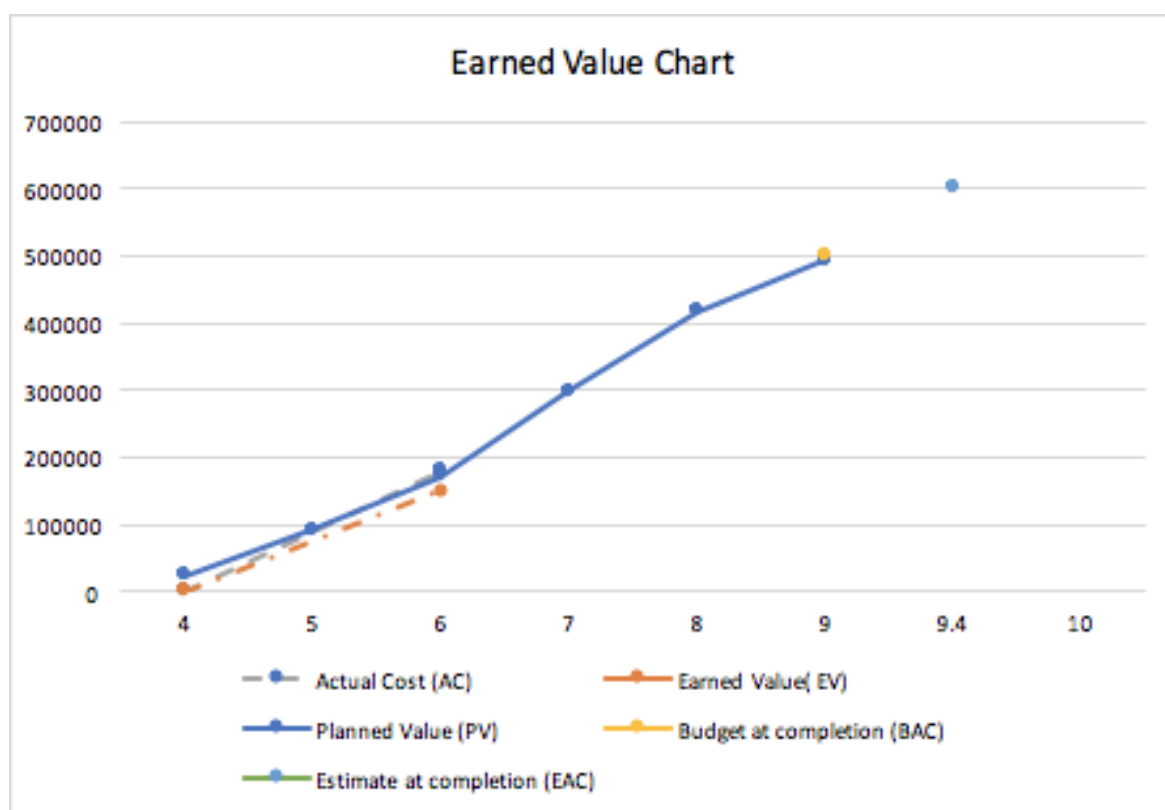


b. Estimate at completion (EAC)=BAC/CPI=\$500,000/.833=\$600,240

Estimated time to finish= 3months/.937=3.2 months.

The budget is lower than the actual cost, and the project is not performing as well as the expected. There is a variation between the earned value and planned value.

c. The green computing project is not doing well. It took longer than the estimated three months, and the new estimate cost of the project is \$100,000 more than its planned. Thus, it is necessary to alert the sponsor since the project is performing worse than planned as over budget and behind schedule.



#### **Task 4: Corrective actions**

During the span of a project, it should be expected that things typically do not go as planned. In the case of our Green Computing Project, we hired some consultants outside of our company that costs more and taking longer to complete than planned. There are several options we may explore to remedy this situation.

In terms of cost, it is very important to keep communication open with the consultants as they progress with their task. We should meet with them and discuss at length the progress they are making on their task and what we can do to speed that process up. By getting involved with their project, we can hopefully clear any roadblocks that are preventing them from completing the project.

In terms of the additional time that will be taken, we can plan for this by allocating our staffing resources to complete everything other than what we need the consulting for to be efficient with our time. It is understandable that consultants may take longer than needed due to multiple clients, but a great idea would maybe to give them deadlines to force progress. Although deadline may seem very harsh, having complete communication with them will help prevent shoddy quality of work.

The additional travel costs that were not accounted for in the additional budget must be made up for in another sector of our project. We could reduce the number of in-person meetings that we have in order to save expenses of gathering everyone as well as increase the number of informal virtual meetups to save time. We could cut the time allocated to unimportant items too if the \$6,000 is taking too much budget. As a last resort, the project sponsor did have additional budget to allocate to Green Computing as well.