

WE ARE BIG, INC.

GREEN COMPUTING RESEARCH PROJECT



Submitted by:

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Date:

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PART 1: PROJECT INTEGRATION MANAGEMENT

TASK 1.1: GREEN COMPUTING DESCRIPTION

WHAT IS GREEN COMPUTING?

Using computers and their resources wisely in an eco-friendly and environmentally responsible manner is known as *Green Computing*. The development of environmentally sustainable production practices, energy-efficient computers, and improved disposal and recycling procedures are few of the green practices implemented by Information Technology.

NEED FOR GREEN COMPUTING

According to a research, in an average year, 24 million computers become obsolete in the United States. Only about 14% (3.3 million) of these get recycled or donated. The remaining are destroyed or shipped as waste products or to be dealt with later in the temporary storage. We even do not care about how our laptop gets disposed of when it dies. Moreover, the electricity being generated from our computers emit harmful gases which can cause respiratory disease, smog, acid rain, and global climate changes.

Therefore, it is high time that we realize to do our part to protect the environment. Here comes the need for green computing which is an important idea to keep our environment clean and safe.

For instance, we can avoid the impact of harmful gases emitted from switched on computers if we save the electricity and do not leave computers switched-on continuously because most of the world's electricity is generated by burning fossil fuel pollutants such as sulphur, mercury, and carbon dioxide.

10-steps to develop a more environment-friendly IT department in a company

1. Proclamation of the Green Intentions
2. Appointment of a Working Group for Green IT Compliance Assurance:
3. Measurement of Current Carbon Footprints Produced by IT Components:
4. Planning More Centralized IT Operations:
5. Usage of More Efficient Computer Applications:
6. Usage of More Efficient Cooling Systems:
7. Careful Weightage of Life-cycle of IT Devices and Accessories
8. Business Performance Enhancement through Green IT Policies
9. Work with Everyone Involved in IT Process Life-cycle
10. Result Monitoring and Continuous IT Optimization

GREEN COMPUTING FOR A SAFE COMPUTER WORLD

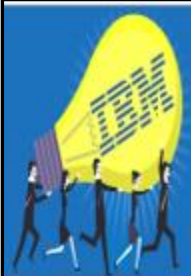





	<ul style="list-style-type: none"> • There are five steps to the program: Diagnose, Build, Virtualize, Manage and Cool, and IBM today outlined each of those in its presentation. • The first step is to know where a company is starting from. • As part of the Build aspect of the plan, IBM has created Mobile Measurement Technology to provide a three-dimensional map of temperatures in data centers, again with the goal of showing what areas need the most urgent attention. • IBM also unveiled a tool that provides a virtual representation of energy needs in data centers. • IBM is encouraging companies to take advantage of power management software as an easy way to drop electricity usage. • Finally, the fifth stage of IBM's road map involves cooling world's data centers.
	<ul style="list-style-type: none"> • Unilever has announced it will work on a project that could deliver industrial scale recycling of PET plastic waste capable of turning the material back into food-grade transparent packaging. • The consumer goods giant confirmed it will partner with innovative recycling technology start-up Ioniqa and Indorama Ventures, the world's largest producer of PET resin, on the pioneering project. • The partnership will support the large-scale testing of a proprietary technology developed by Ioniqa that is designed to turn any PET waste — including colored packs — back into transparent virgin grade material.
	<ul style="list-style-type: none"> • Google has embraced a wide range of environmentally friendly practices like the company's fleet of 32 Wi-fi-enabled, biodiesel-powered employee shuttle buses, and 1.6-megawatt rooftop solar installation just being completed on Google's Mountain View, Calif., headquarters. • Google's "Project 02" is the name for its new data center.
	<ul style="list-style-type: none"> • Apple Becomes a Green Energy Supplier, With Itself as Customer • Apple's store at Palo Alto runs on 100 percent renewable energy. • The company aims to meet its growing needs for electricity with green sources like solar, wind and hydroelectric power.
	<ul style="list-style-type: none"> • Running applications in the cloud, Amazon Web Services (AWS) has contributed to many environmental benefits. • AWS also has a long-term commitment to achieve 100% renewable energy usage for our global infrastructure footprint.
	<ul style="list-style-type: none"> • Facebook's new data center will run entirely on wind power. This means three of the five massive computing facilities that will drive the company's worldwide social network in the years to come will run use only renewable energy. • Backed by nearly 35 big-names companies, including Yahoo, Intel, and Salesforce.com, this manifesto doesn't aim to deregulate regulated states. But it does strive for better ways of getting renewable energy in these markets.

Figure 1: Green computing efforts by renowned IT administrations

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TASK 1.2: WEIGHTED DECISION MATRIX

One of the most crucial parts of running a successful project is choosing the right Project Manager. The weighted decision matrix is an effective method for selecting the Project Manager based on various aspects of a successful project. Here we have listed different criteria based on which any candidate is evaluated. The candidate who scores the highest point as per the weighted decision matrix is selected as the Project Manager of the Green Computing Project. The 8 evaluation criteria are listed below:

- | | |
|------------------------------------|-------------------------------------|
| 1.) Project Management Experience | 2.) Time Management |
| 3.) Leadership | 4.) Potential to manage the project |
| 5.) Communication and Coordination | 6.) Reliability and Dedication |
| 7.) Technical Skills | 8.) Effective writing capabilities |

The weighted decision matrix below shows the weights assigned to each criterion based on the level of significance. The candidate with the highest aggregate score is highlighted.

Criteria	Weight	Abhinay Sariswal	Girish Garg	Prerana Reddy	Ruchika Narang	Sanchit Singh
Project Management Experience	20%	50	60	85	90	95
Leadership	10%	70	70	65	90	85
Communication and Coordination	15%	50	80	65	90	80
Technical Skills	20%	90	80	75	80	90
Time Management	5%	20	50	90	70	50
Potential to manage the project	10%	40	40	70	80	70
Reliability and Dedication	10%	70	80	80	90	70
Effective writing capabilities	10%	40	60	95	80	70
Total Weighted Aggregate	100%	59	68	77	85	81

Table 1: Weighted Decision Matrix

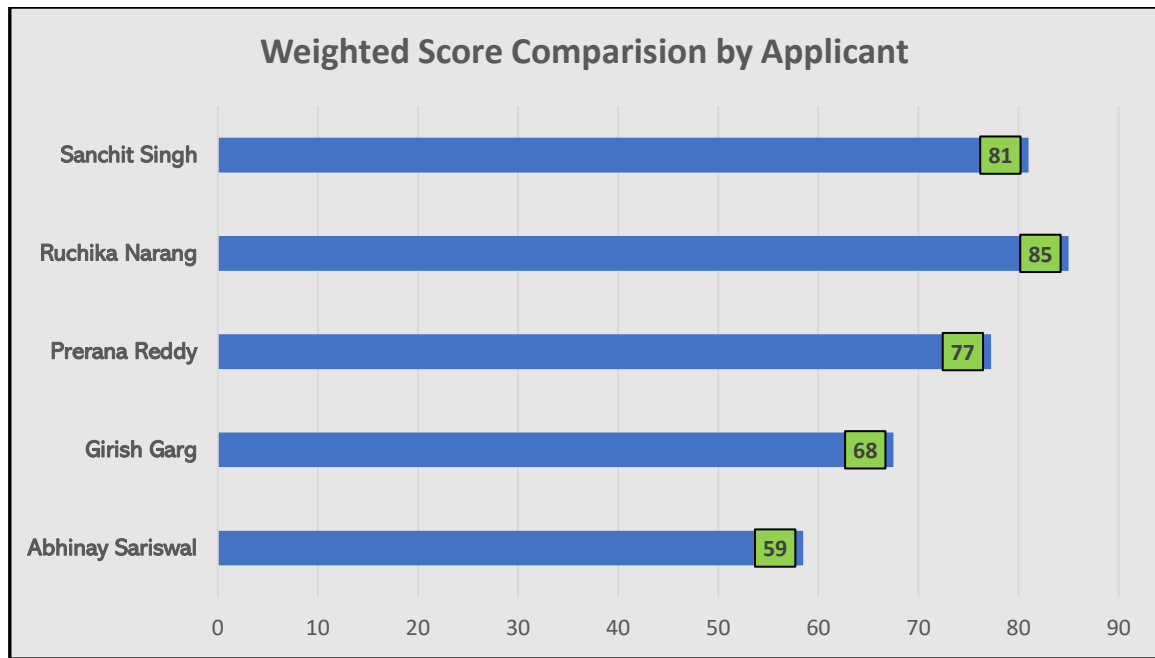


Figure 2: Representation of weighted score comparison by applicants

We have considered the application of five candidates for the Project Manager position of the Green Computing Project. The decision matrix shows the different criteria based on which the candidate has been evaluated. There are some pointers which are highly relevant and have larger weights such as, project management experience 20%, technical skills 20%, and communication & coordination 15%. A candidate scoring higher in the above segments has a higher chance to secure the position. Rest of the criteria include leadership, potential, reliability and dedication, and effective writing which hold 10%, and time management 5%.

It is always an advantage to have a Project Manager who is knowledgeable in most of the aspects of the project. Project management experience and technical skills are one of the several critical criteria for choosing a manager. These 2 criteria have a combined weight of 40%. The candidates are expected to have a good knowledge about Green Computing projects.

“Ruchika Narang” with the highest weighted aggregate score of 85 is chosen as the Project Manager. Her score is followed by “Sanchit Singh,” 81, “Prerana Reddy,” 77, “Girish Garg,” 68, and the lowest score being 59 for Abhinay Sariswal.

TASK 1.3: FINANCIAL ANALYSIS FOR BUSINESS CASE

Financial Analysis for Green Computing Research Project					
Created by: Ruchika Narang		Date:	06-05-2018		
Note: Change the inputs, shown in green below (i.e. interest rate, number of years, costs, and benefits). Be sure to double-check the formulas based on the inputs.					
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%				
			Payback in Year 3		
Assumptions					
1. Assume a 7 percent discount rate.					
2. The costs to implement some of the technologies in Year 0 will be \$500,000, \$2 million for year one, and \$600,000 for years two and three.					
3. Estimated benefits for Year 0 will be 0, \$500,000 in the first year, and \$2.5 million in the following two years.					

Figure 3: Financial analysis for business case

The figure above shows the results of the financial section of a business case for the Green Computing Research Project. On the bottom left of the figure, we have outlined the three assumptions which helped calculate the discounted factor, discounted costs, discounted benefits, total Net Present Value (NPV), and Rate of Interest (ROI). The template helped us calculate the discount factor at 1.00, 0.93, 0.87, and 0.82 for each consecutive year 0, 1, 2, and 3. The total NPV for our business case is \$1.3 million at the end of Year 3. The “Discounted benefits – costs” shows that there is no payback calculated till the end of Year 2. However, the results are different for Year 3 where the payback is estimated to be \$1,558,000. The ROI of 39% seems promising, which is a progressive result for a new project. To summarize, as per the assumptions and results, the range of investment offered over the consecutive years will provide promising results in the long run.

TASK 1.4: PROJECT CHARTER

Project Title: Green Computing Research Project

Project Start Date: 06/01/2018

Projected Finish Date: 12/17/2018

Budget Information: The firms allocated \$500,000 for this project. Majority of the cost will be internal labor, which is \$300,000.

Project Manager: Ruchika Narang, 425-625-1234, ruchikan@wearebig.com

Project Objectives: Research possible application for Green Computing, which includes the following

- 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: The project should pay for itself within five years of completion.

Approach:

- As per Ben suggestion, I am going to use decision support model for this project. Below are some of the steps involved:
- Hand pick the team member with the help of HR department
- Hire outside consultant for project review
- Create a Series of research report
- Pick the top four project ideas from each team

Roles and Responsibilities

Role	Name	Organization/ Position	Contact Information	Signature (Initials)
Sponsor	Ben	CIO	ben@wearebig.com	
Project Manager	Ruchika Narang	Manager	ruchikan@wearebig.com	
Program Manager	Sanchit Singh	Manager	sanchits@wearebig.com	
Outside Consultant	Preranareddy Ananth	Consultant	preddy@wearebig.com	
Team Member	Girish Garg	Systems Analyst	girishg@wearebig.com	
Team Member	Abhinay Sariswal	Green Computing Expert	abhinays@wearebig.com	

Table 2: Roles and responsibilities matrix

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

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

I am ready to provide all the resources that would help in making this project a success.

I would be committed to the work and expect others working on a project to show a high level of commitment-Ben Jones.

TASK 1.5: UPDATE CHANGE REQUEST FORM

Change Request Form, or Change Form, records a request for change to meet a team's objectives. For instance, a Project Manager may utilize a Change Form to request a change in the scope of a project. The advantage of using a Change Form is to document each change in the project before it is approved by the Project Manager. Anyone in a project team should be required to fill a Change Form with the Project Manager being ultimately responsible for its approval. Without proper change control, teams usually encounter error codes, cost overruns, and relative delays. However, with the implementation of this Change Request Form, the Project Manager can monitor and control change, substantially improving the chances of success of the project.

The Change Request Form will help the team to:

- Identify all changes before they occur
- Rank the change urgency
- List the costs and benefits of adopting the change
- Implement a formal change approval process
- Control the extent to which changes are approved
- Monitor the effects of change implemented

If anyone among the team members wants to request a change to any component of the project, then one should document this request for change on a Change Request Form. On this form, the team member will provide all the details requested by the form with appropriate reasons. Any supporting documents are attached to the Change Form before presentation to management for approval. By using this Change Request Form to document change requests, the Project Manager can control all the changes in the organization which helps minimize error and cost, maximize profit and manage changes on this project in a timely manner.

CHANGE REQUEST FORM

SUBMITTER - GENERAL INFORMATION					
Project Name:					
Date Request Submitted:					
Title of Change Request:					
Change Order Number:					
Submitted by:	(name and contact information)				
Priority	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Scope	Scheduled	Cost	Technology	Other
Description of change requested:					
Events that made this change necessary or desirable:					
Justification for the change/why it is needed/desired to continue/complete the project:					
Impact of the proposed change on:					
Scope:					
Schedule:					
Cost:					
Staffing:					
Risk:					
Other:					
Suggested implementation if the change request is approved:					

CHANGE CONTROL BOARD – DECISION			
Name	Position	Date	Approve/Reject

PART 2: PROJECT SCOPE MANAGEMENT

TASK 2.1: REQUIREMENT TRACEABILITY MATRIX

Prepared by: Sanchit Singh & Ruchika Narang

Date: 06/07/2018

Requirement No.	Associated ID	Name	Category	Source	Status
001	1.0	Project Justification	Project Charter	Business Case	Completed
	1.1	Candidates screening and evaluation	Project Team Formation	Project Charter	Ongoing
	1.2	Project execution and control guide documentation	Project Management Plan	Project Charter	Pending
	1.2.1	Collection of all project's processes	Project Statement	Project Charter	Pending
	1.2.2	Documentation of project's requirements	Project Management Plan	Project Management Plan	Ongoing
	1.2.2.1	Project's definition, traceability matrix, and deliverables	Requirements Management Plan	Requirements Management Plan	Pending
002	2.0	Organizes team's work into manageable sections	WBS	Scope Management Plan	Ongoing
	2.1	Finalized WBS, WBS dictionary, and the project scope statement	Scope Management Plan	Scope Management Plan	Ongoing
003	3.0	Establish policies and procedures used to develop, execute, monitor and control the project schedule	Schedule Management Plan	Project Management Plan	Pending
	3.1	Develop detailed list of all project's activities	List of activities	Project Management Plan	Pending
	3.2	Establish fixed timeline measurement for accomplishment of project tasks	Schedule Baseline	Schedule Management Plan	Pending
004	4.0	Develop time-phased spending plan for the project	Cost Baseline	Cost Management Plan	Pending
005	5.0	Develop management strategies to engage stakeholders effectively	Stakeholders Registration	Project Management Plan	Pending

Table 3: Requirement traceability matrix

In the next part of this section we have listed questions relating to our project scope to discuss with our Project Sponsor, Ben.

List of questions to the Project Sponsor, Ben about the scope:

1. What are the business goals the project is aiming to achieve?
2. What is the project deadline? What are the factors or events that are calling for that date?
3. Will the organizations within your company be affected by this?
4. Will You Provide the Necessary Support?
5. What are the success criteria that will indicate the objectives have been met and the benefits delivered?
6. Are there any dates when you will be closed or not available?
7. Has your team been through a project like this in the past?
8. Is there anything (risks or issues) that would prevent the project from being successful?
9. Are there any security issues?
10. Do you have specific performance requirements?
11. Has the project sponsor described the risk to the organization if the project is not completed?
12. Is there a preferred mode of communication?

TASK 2.2: SCOPE STATEMENT (VERSION 1.0)

Project Title: Green Computing Research Project

Date: 06/12/2018

Prepared by: Sanchit Singh & Ruchika Narang

Project Justification: The business goal of the project is to come up with recommendations for establishing a safe and eco-friendly computer world while increasing corporate revenues and decrease operational costs. This involves researching possible applications of green computing and developing series of research reports and project proposals based on ideas and strategies for implementing green computing in organizations.

Product Characteristics and Requirements:

1. Environment- friendly
2. Energy conservation
3. Server resources virtualization
4. Low server utilization rates
5. Development of eco-label software and hardware
6. Project and data management
7. Complete deliverables within time frame
8. Telecommuting
9. Increase revenue
10. Cost management and reduction

Summary of Project Deliverables

Project management-related deliverables: 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, etc.

1. Possible green computing technologies to implement
2. 20 different project ideas for these technologies
3. Decision support model for analyzing the project ideas
4. Top 4 recommended solutions selected among these project ideas
5. Requirements traceability matrix

Project Success Criteria: The success criteria that will indicate the objectives have been met and the benefits delivered are the increase in revenue with reduced cost, consistency of each deliverable with the requirements, and the completion of each deliverable within the designated timeframe.

TASK 2.3: WORK BREAKDOWN STRUCTURE

Prepared by: Sanchit Singh & Ruchika Narang

Date: 06-09-2018

1 Initiating

- 1.1 Assigning task to team members
- 1.2 Research on Green Computing
- 1.3 Kick Off meeting
- 1.4 Prepare business case
- 1.5 Prepare project charter and sign
- 1.6 Create change request form

2 Planning

- 2.1 Create a Project Plan
 - 2.1.1 Requirement tracking matrix
 - 2.1.2 Set up a scope statement
 - 2.1.3 List down the work breakdown structure
 - 2.1.4 Create a Gantt Chart
- 2.2 Create a backup plan

3 Analysis

- 3.1 Virtualization of server resources
 - 3.1.1 Identify the effort involved in physical server virtualization
 - 3.1.2 Analyze the reduction of space, energy and capital
- 3.2 Disposal of electronic waste and recycling
 - 3.2.1 Cost analysis
 - 3.2.2 Identify the benefits
 - 3.2.3 Effort prediction
- 3.3 Data Centre and overall energy efficiency
 - 3.3.1 Analyze the current energy consumption
 - 3.3.2 Prepare energy consumption reduction plan
 - 3.3.3 Finalize the approach
- 3.4 Development of new software to address green computing
 - 3.4.1 Analyze the benefits of internal use
 - 3.4.2 Analyze potential sale to other organizations

4 Implementation

4.1 Propose solution

4.1.1 Design and code

4.1.2 Create prototype

4.1.3 Create software to address green computing

4.2 Testing

4.2.1 Create testing environment

4.2.2 Test the product in different cycles- development, training,
UAT

4.2.3 Track defects until resolution

5 Performance Report

5.1 Change request analysis

5.2 Requirement discussion

5.3 Approve change request

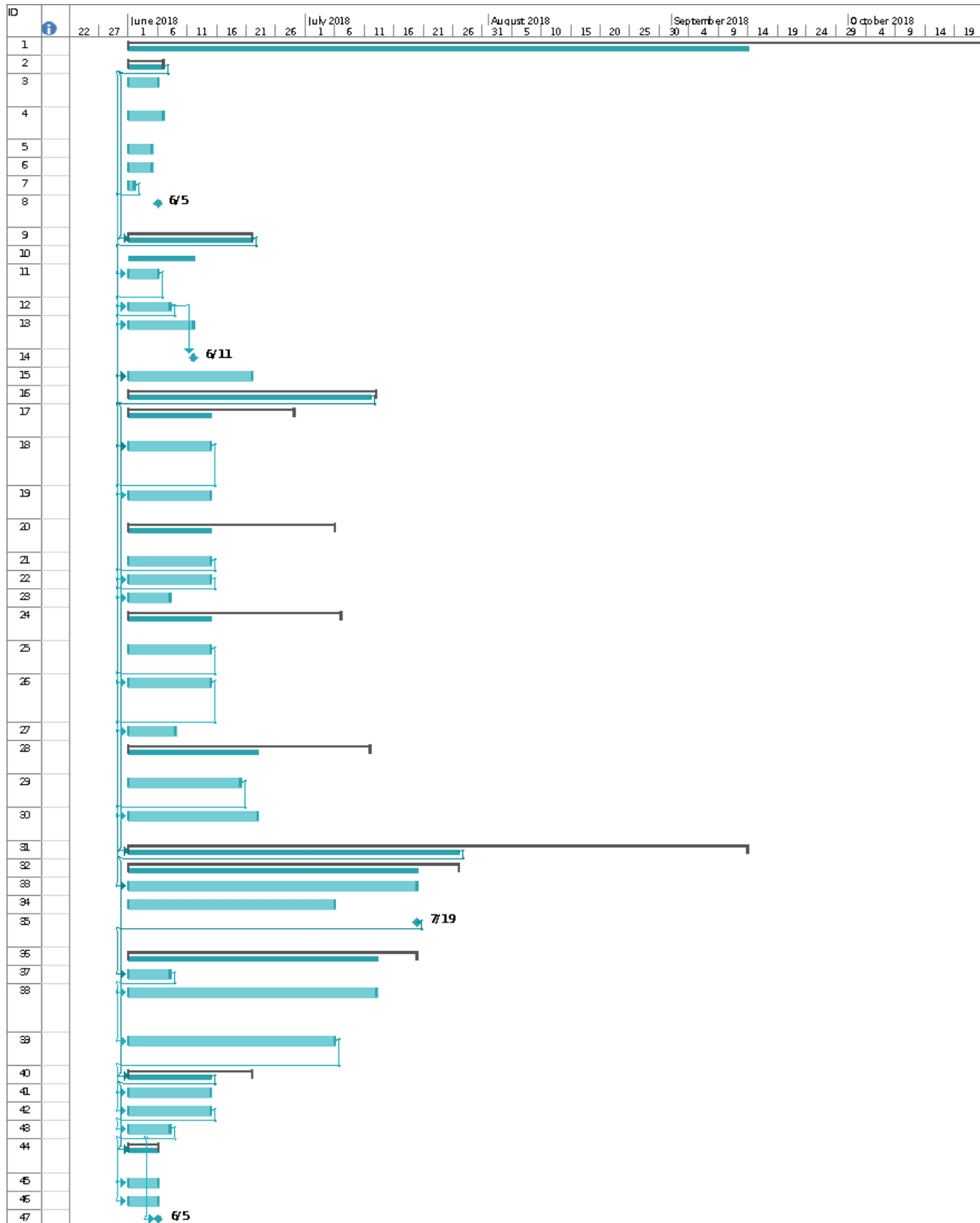
6 Project documentation and next release plan

6.1 Submit project report

6.2 Present final project report

6.3 Project completion

TASK 2.4: GANTT CHART



PART 3 PROJECT TIME MANAGEMENT

TASK 3.1: ADDITIONAL ACTIVITIES

Additional activities to scale up the kick-off:

Ito, the program manager and Ben, the project sponsor, suggested us to speed up the task of selecting tools that will be utilized in the Green Computing project. Ben has proposed to grant additional funds if required but, wants us to deliver a good product within the schedule. Hence, we have reviewed the WBS and the Gantt Chart from the previous task and have included additional activities which are listed below:

Additional activities to estimate resources and durations:

1. **Final project documentation coordination:** Deb would need a few resources to create the final documentation of the Green Computing project after implementation. We have identified Le, the new hire to take the lead on this activity as she has a doctoral degree with a thesis in Green Computing. Her availability onsite will be an added advantage for us to coordinate with Deb and provide him with the required information. Our goal is to efficiently collaborate on the final project report and involve James for the presentation.
2. **Collaborative tools selection:** We have accelerated the process of selecting tools for collaboration. The project team is on track with the new timelines and we will have the tools decided for implementation as per the deadlines. Ben and Ito are happy with this notification.
We have set up a meeting with the IT department to brainstorm the collaboration ideas around Green Computing.
3. **Bi-weekly meeting:** We have chosen Le to coordinate with the relevant stakeholders to conduct a Skype meeting including the customer, where at least one senior member is responsible for representing each vendor. The agenda will be to brainstorm ongoing issues and tasks to be accomplished before the next meet up. Ben and Ito along with some senior executives would be attending the meeting to evaluate the progress of the project. Weekday and meeting time will be decided by as per the availability of the attendees.
4. **Task scheduling:** We are using the “Project Evaluation and Review Technique” popularly known as “PERT” to estimate the milestones and timelines for the completion of this project. A one-week buffer has been added to align with the preparation of the final project report.

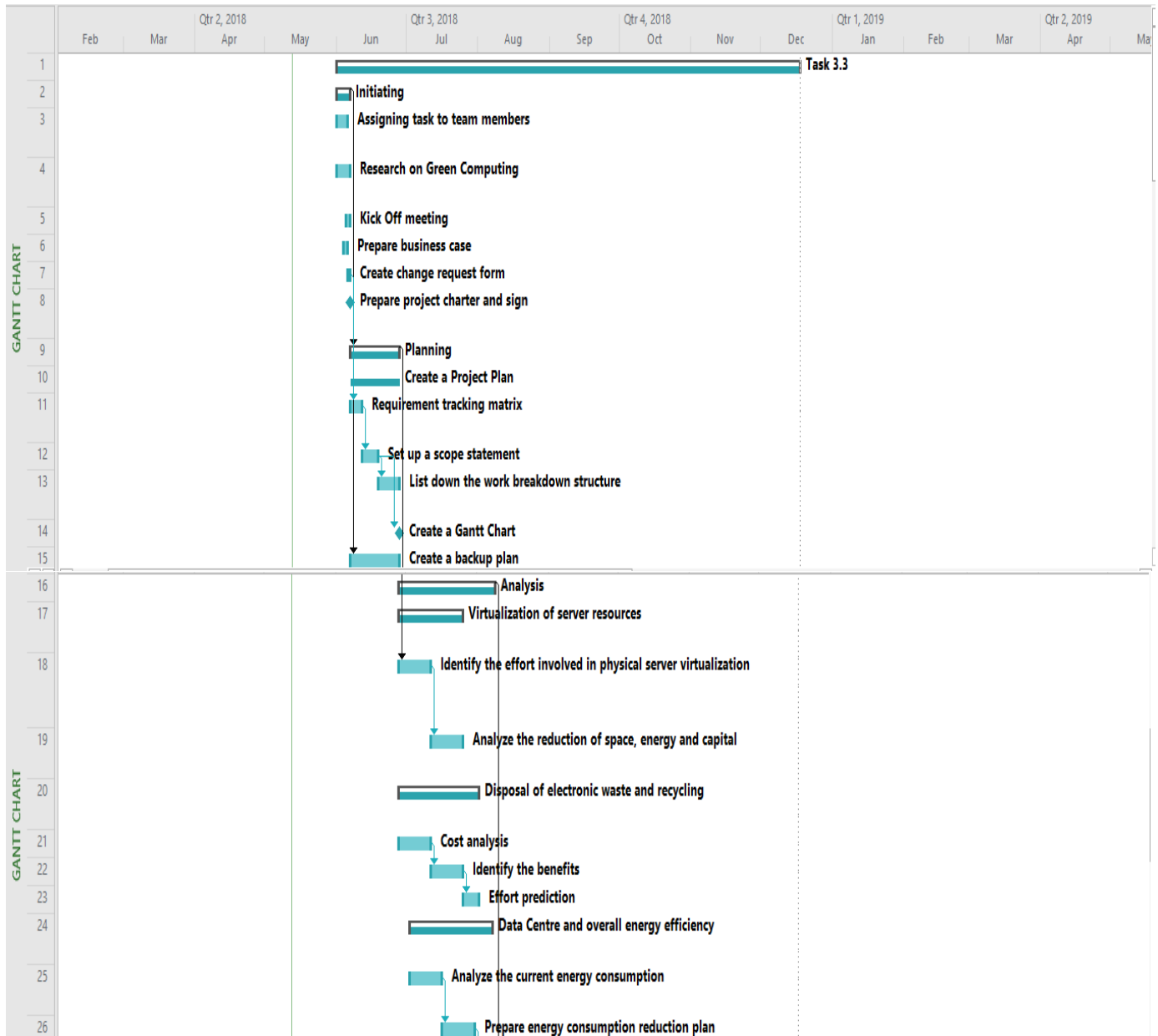
TASK 3.2: MILESTONE (SMART CRITERIA)

List of four milestones for Green Research Project:

S/No.	Milestone	Descriptions
1	Prepare project charter and sign	This document is the project proposal that has been agreed by all the members. Upon completion of each milestone, we will have several tasks completed such as kick off meeting, identifying the team members for the project, developing a business case, and developing a project charter. This milestone will be completed in a month after all the team members have signed the project charter. Also, completion of this milestone marks the beginning of the next milestone (i.e. Milestone 2) of our project.
2	Complete creation of Gantt chart	This milestone depends whether the project plan has been reviewed completely and is planned to be completed within 3 weeks. It will be marked as completed when the project idea is approved. Important documents like requirement matrix, scope statement which defines how the work would be done have been created by the end of this milestone. Deliverables and important tasks are discussed within the senior management and put into writing for everyone to be on the same page. This milestone will lay down a path for the next milestones.
3	Create software to address Green Computing	Product development will be marked completed by the end of this milestone and since it is the longest phase, it will take close to 3 months. A prototype is developed based on the results with a research on all the application with different features. The software is in the designing, development and testing phase and several outcomes have been proposed with respect to the outcome. The changes required to be made in the applications are accepted and is ready to be released. Project sponsors and manager would take responsibility for the timely delivery of the software. The required software has been delivered to the user successfully.
4	Project completion and delivery of the final project	Overall project is marked completed in this milestone. All the work performed during the project have been documented and a project report is being created. The report has been created by the project manager covering all the details of the project from the beginning to the very end. This project report is delivered to the clients as well as the project sponsor.

TASK 3.3: GANTT CHART AND NETWORK DIAGRAM

Gantt Chart



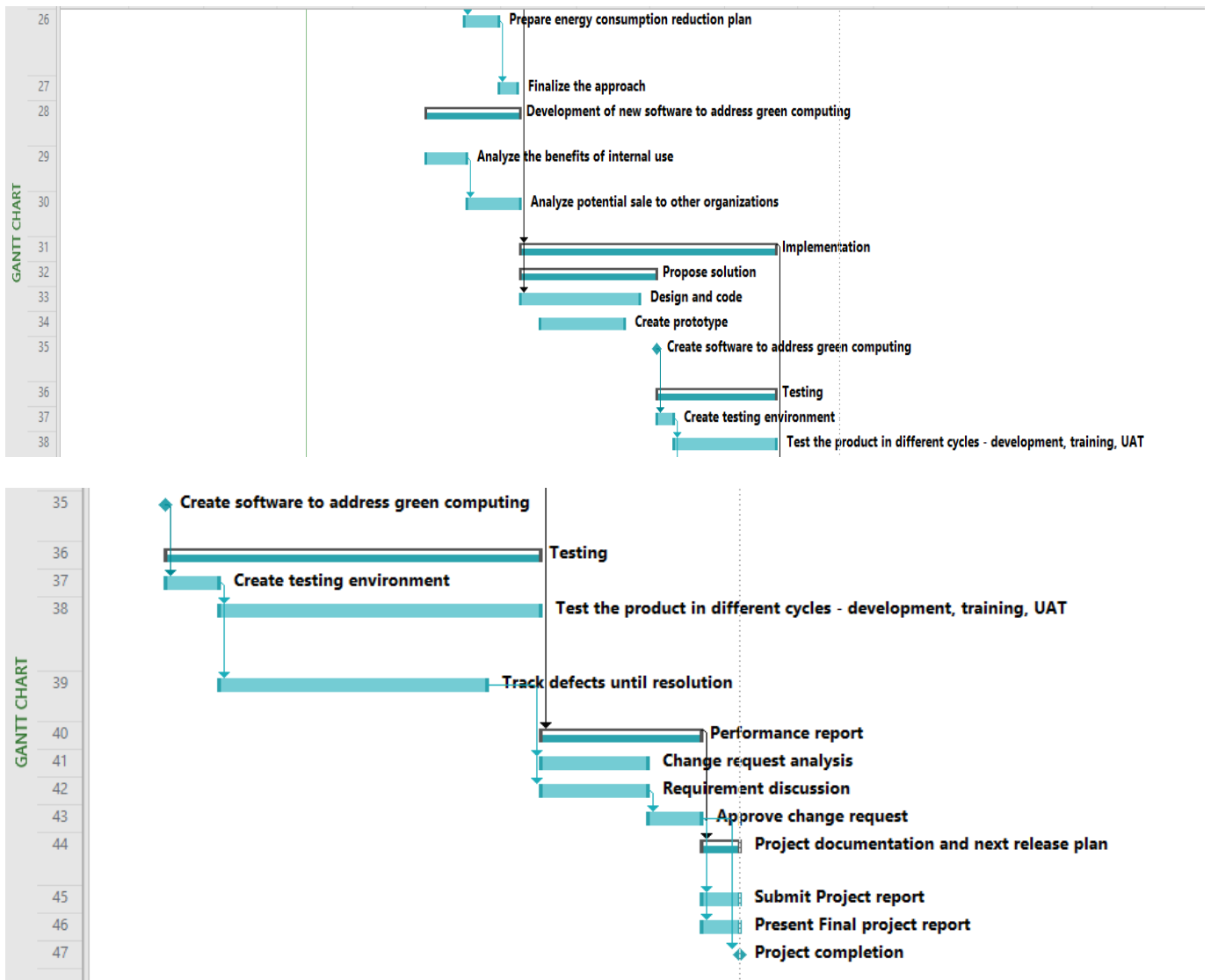
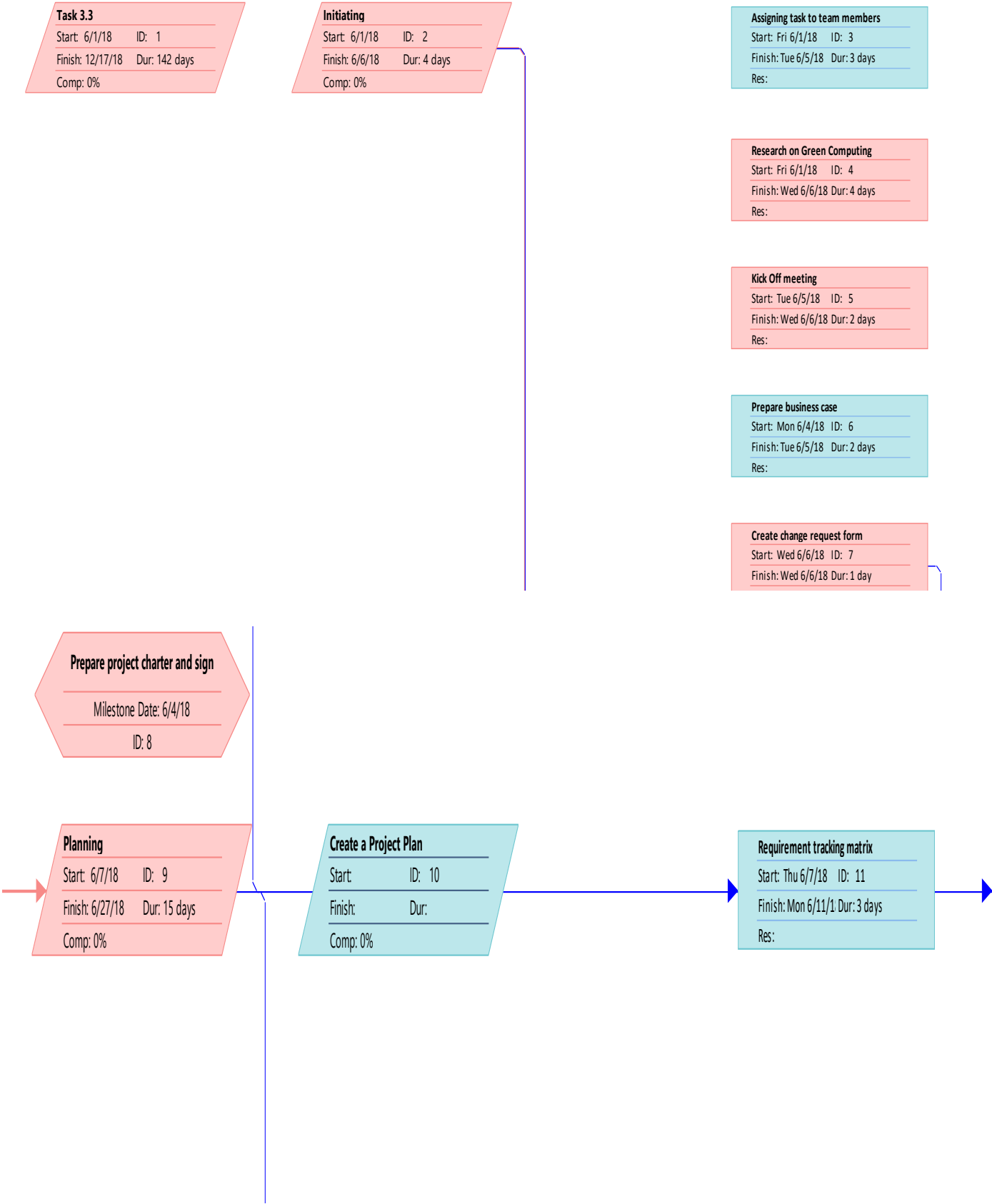
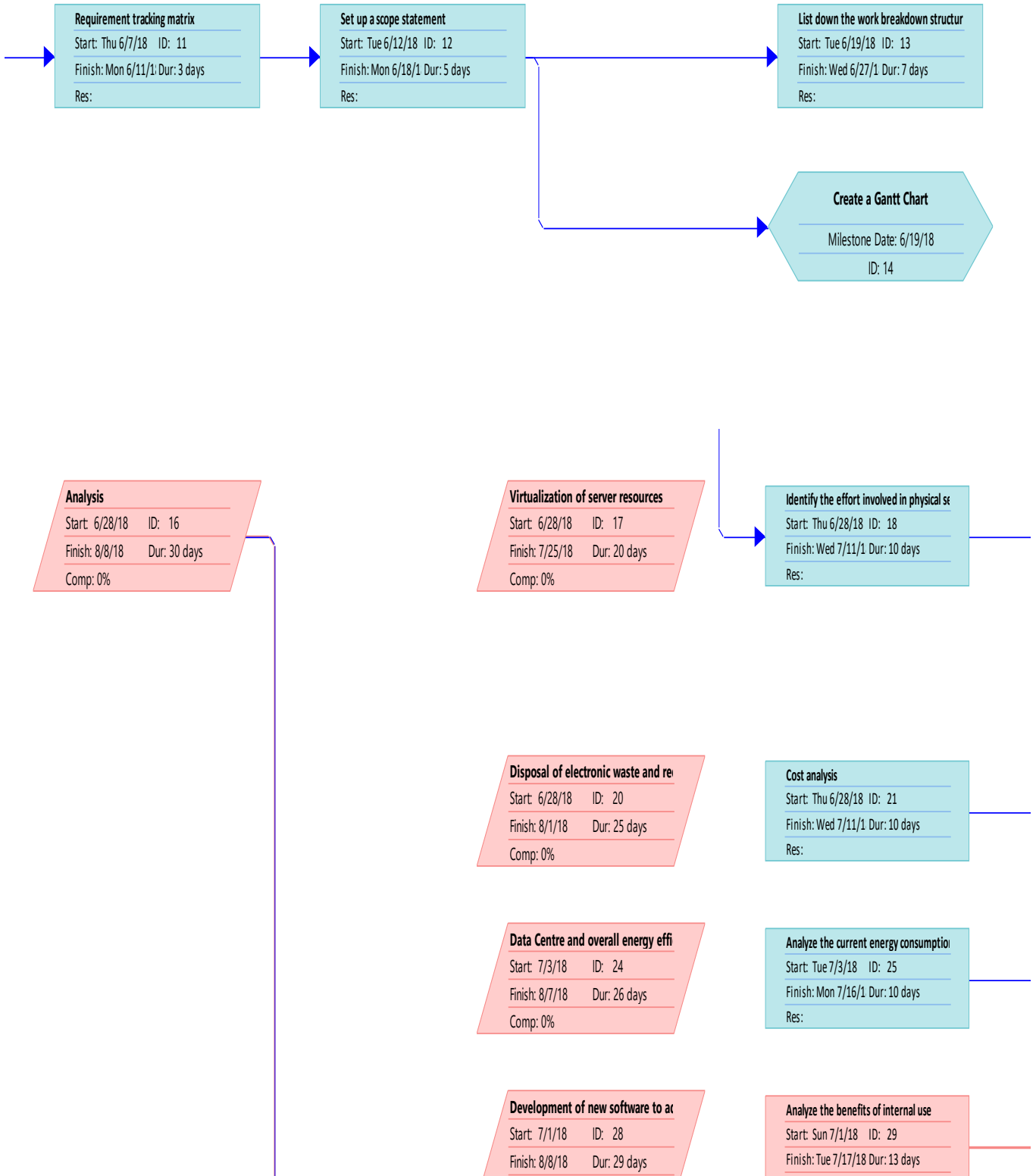
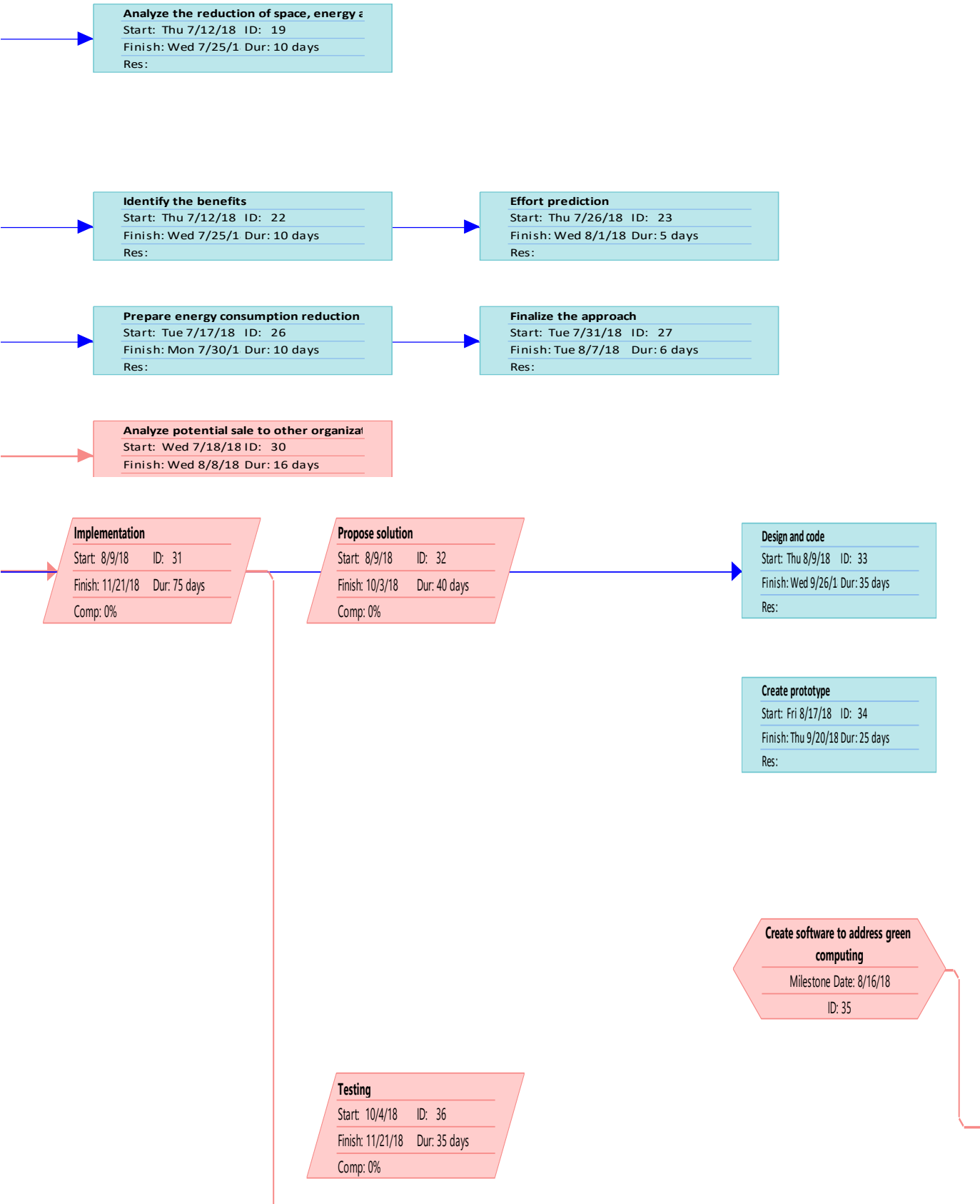


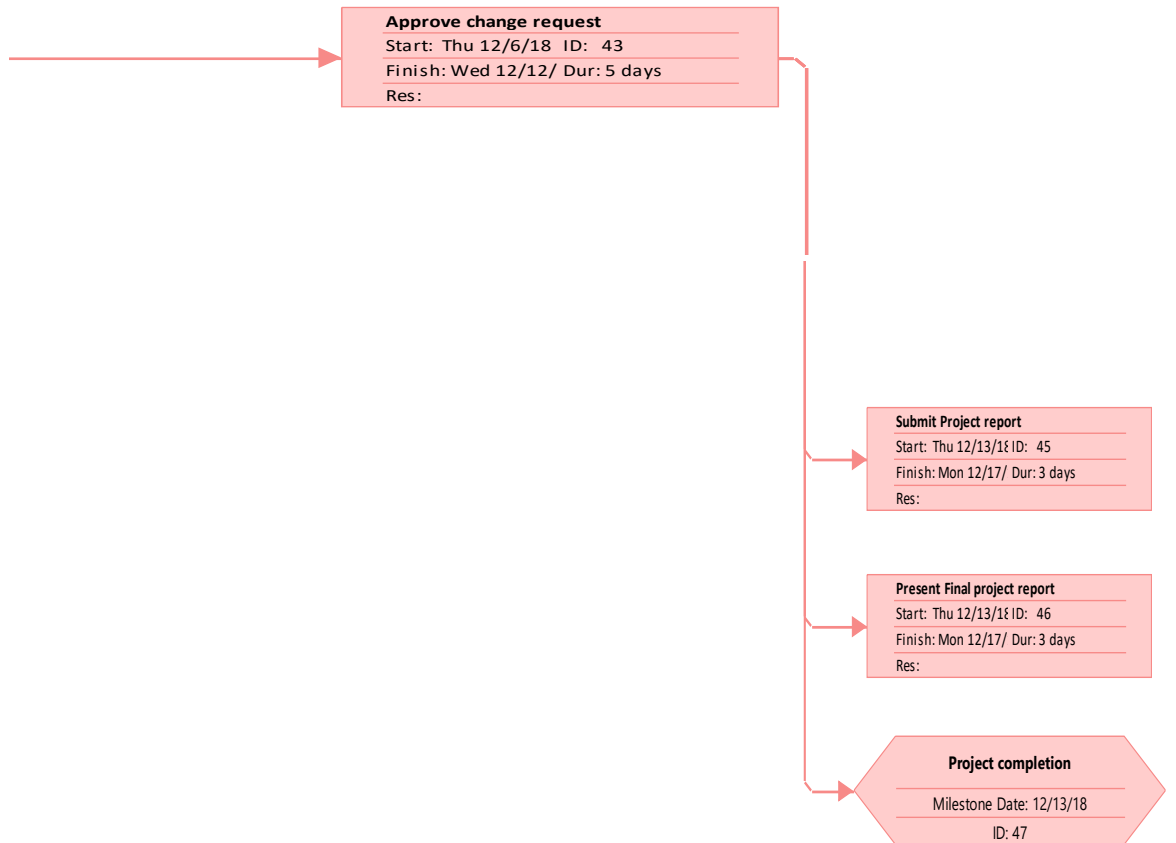
Figure 4: Gantt Chart

Network Diagram









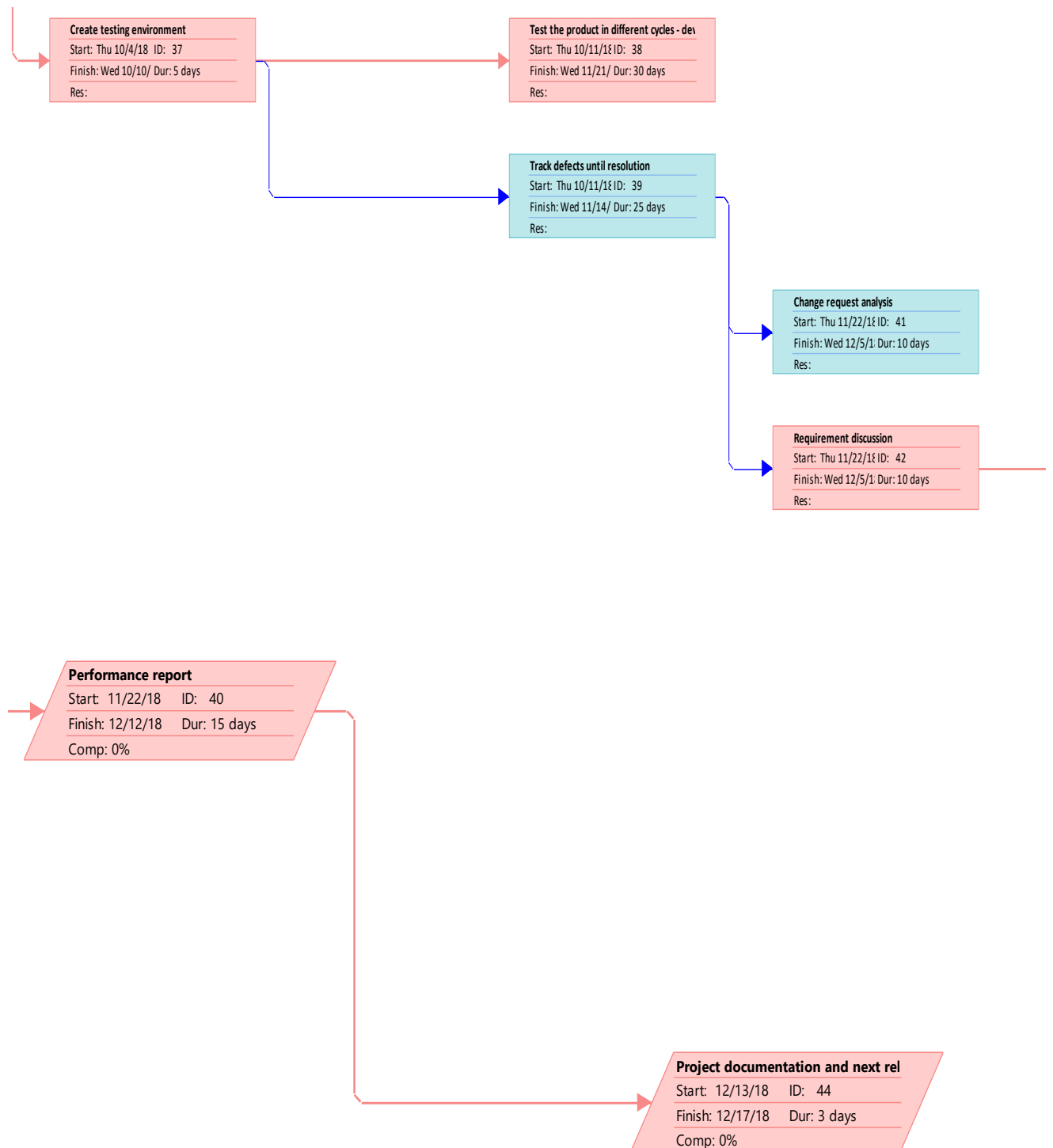


Figure 5: Network diagram

TASK 3.4: HOURS MATRIX

Though every project will always have a Project Manager who assigns tasks to his/her team members; sometimes certain tasks are overlooked. Assigning tasks to a team is an indispensable element of any leader's responsibilities. Effective delegation in management is what makes a team function as a well-oiled machine.

Once you've identified tasks that can be delegated to other members of your team, you need to consider who the best person is to take them on. Make sure that the individual you select has the skills needed to tackle the task, and that it's not too easy for them. Another important part of the selection is to determine the values and character traits a person has because the critical responsibility is to assign right task to the right people. It is very important to assign the right task to the right person. It affects the efficiency and speed of the project. Moreover, if different people are working on the different tasks at the same time, it makes the process faster.

It's not enough to assign a task to a team member. You need to give people full authority over the work, so they feel engaged to complete it successfully. You also must make sure that when you transfer a task, the assigned person has taken complete responsibility for it.

In that case, following are the criteria from which the decision can be made.

1. Who is being under or overworked?
2. Who is the most skilled?
3. Who has worked on the similar project or task in the past with the required skills?
4. Whom to assign congruent activities?
5. Who is the best to work in a team?

Given below is the chart that shows the numbers of hours needs to be worked on each task and who will be responsible for each task.

Task Name	Duration (Hours)	Resource Name	Ben (Sponsor)	Ruchika Narang (Project Manager)	Sanchit Singh (Program Manager)	Preranareddy Ananth (Outside Consultant)	Girish Garg (Systems Analyst)	Abhinay Sariswal (Green Computing Analyst)	Teresa (Senior System Analyst)	James (Senior Consultant)	Le (Green Computing Expert)	Matt (Senior Technical Specialist)	TTL Hours Required (By New On-boarded Members)	Over-sourced Labor	TTL Target Hours to Work
Project Name: Green Computing Research															
WBS Categories / Hour															
1. Initiating															
1.1 Assigning task to team members	24			24									24		24
1.2 Research on Green Computing	32					16	10	6	8	11	13	7	71		71
1.3 Kick Off meeting	16			16									16		16
1.4 Prepare business case	16			16									16		16
1.5 Prepare project charter and sign	8			6	2								8		8
1.6 Create change request form	24			8	16								24		24
2. Planning													0		0
2.1 Create a Project Plan													0		0
2.1.1 Requirement tracking matrix	24			14	10								24	15	39
2.1.2 Set up a scope statement	40			30	10								40	15	55
2.1.3 List down the work breakdown structure	56			46	10								56	15	71
2.1.4 Create a Gantt Chart	56			36	20								56	15	71
2.2 Create a backup plan	120			60	60								120	20	140
3. Analysis													0		0
3.1 Virtualization of server resources													0		0
3.1.1 Identify the effort involved in physical server virtualization	80					27	26	27	2	11	15	10	118	15	133
3.1.2 Analyze the reduction of space, energy and capital	80					27	26	27	3	11	15	10	119	15	134
3.2 Disposal of electronic waste and recycling													0		0
3.2.1 Cost analysis	80			80									80	15	95
3.2.2 Identify the benefits	80			80									80	10	90
3.2.3 Effort prediction	40			40									40	20	60
3.3 Data Centre and overall energy efficiency													0		0
3.3.1 Analyze the current energy consumption	80					20	20	40	6	8	13	10	117	10	127
3.3.2 Prepare energy consumption reduction plan	80					20	20	40	6	8	13	10	117	10	127
3.3.3 Finalize the approach	48					20	10	18	6	8	13	10	85	10	95
3.4 Development of new software to address green computing													0		0
3.4.1 Analyze the benefits of internal use	96					30	30	36	20	16	14	8	154	15	169
3.4.2 Analyze potential sale to other organizations	128				30	32	34	32	5	5	5	5	148	10	158
4. Implementation													0		0
4.1 Propose solution													0		0
4.1.1 Design and code	280					70	150	60	3	5	4	2	294	10	304
4.1.2 Create prototype	200				30	50	80	40	7	5	9	4	225	20	245
4.1.3 Create software to address green computing	280					50	140	90	4	6	11	3	304	20	324
4.2 Testing													0		0
4.2.1 Create testing environment	40					10	20	10	4	5	6	9	64		64
4.2.2 Test the product in different cycles - development, training, UAT	240			40	20	30	115	35	7	4	6	9	266	20	286
4.2.3 Track defects until resolution	200			30	30	40	70	30	7	8	7	8	230	20	250
5. Performance report													0		0
5.1 Change request analysis	80			30	50								80		80
5.2 Requirement discussion	80			50	30								80		80
5.3 Approve change request	40			20	20								40		40
6. Project documentation and next release plan													0		0
6.1 Submit Project report	24			17	7								24		24
6.2 Present Final project report	24			16	8								24		24
6.3 Project completion	24			24									24		24
Subtotal															
Reserve															
Total	2720												3168	300	3468

Figure 6: Hours matrix

TASK 3.5: CONTINGENCY STRATEGIES

1. PERT analysis:

The project evaluation and review technique (PERT) is a network analysis technique used by managers to calculate the time duration required for completing a certain task or the overall project. It helps in tracking the time-period consumed in doing a certain activity and also calculates the optimistic time and the most likely time to complete that particular task allotted, thus helping in proposing the future strategies to be followed in order complete the project in the desired time.

2. Resource allocation:

Resource allocation involves bringing in extra hands to complete the project within the desired frame of time. We can allot pending tasks to these resources so that the current team can continue to focus on their scheduled tasks. This strategy can bring back the project on track, if not affected by the budget issues.

3. Swapping of resources:

Swapping of resources is a very useful technique to bring back the falling project on schedule. All the members of the team are not equally skilled, and the project mostly lags the schedule because of few less productive resources. Therefore, we can assign some other tasks to these resources which they are good at and can bring other resources who are productive in doing the tasks we are focusing on.

4. Determining Priorities:

The ideal way of completing the project on time is by prioritizing the remaining tasks and by allocating skilled and productive resources to the completion of these tasks. This technique will help to cover most of the tasks on time.

5. Reaffirming the roles and responsibilities:

It is very important to clarify the roles and responsibilities with every team member working under the project. Sticking to those roles and performing their duties timely will help in completing the project before the deadline. It will also eliminate any confusion among the team members related to their roles and the tasks they are expected to perform.

PART 4 PROJECT COST MANAGEMENT

TASK 4.1: PROJECT COST ESTIMATE

COST ESTIMATE																	
Project Name: Green Computing Research		Date: June 28th, 2018															
Task Name	Internal Labor (By New On-boarded)	\$/hour	Teresa (Senior System Analyst)	\$/hour	James (Senior Consultant)	\$/hour	Le (Green Computing Expert)	\$/hour	Matt (Senior Technical Specialist)	\$/hour	Internal \$ Total	External Labor	\$ / Hour	External \$ Total	Total \$ Labor	Non - Labor \$	Total Cost
WBS Categories / Hour																	
1. Initiating																	
1.1 Assigning task to team members	24	\$ 100.00									\$ 2,400.00			\$ -	\$ 2,400.00		\$ 2,400.00
1.2 Research on Green Computing	32	\$ 100.00	8	\$ 90.00	11	\$ 90.00	13	\$ 90.00	7	\$ 80.00	\$ 6,640.00			\$ -	\$ 6,640.00		\$ 6,640.00
1.3 Kick Off meeting	16	\$ 100.00									\$ 1,600.00			\$ -	\$ 1,600.00		\$ 1,600.00
1.4 Prepare business case	16	\$ 100.00									\$ 1,600.00			\$ -	\$ 1,600.00		\$ 1,600.00
1.5 Prepare project charter and sign	8	\$ 100.00									\$ 800.00			\$ -	\$ 800.00		\$ 800.00
1.6 Create change request form	24	\$ 100.00									\$ 2,400.00			\$ -	\$ 2,400.00		\$ 2,400.00
2. Planning											\$ -			\$ -	\$ -		\$ -
2.1 Create a Project Plan											\$ -			\$ -	\$ -		\$ -
2.1.1 Requirement tracking matrix	24	\$ 100.00									\$ 2,400.00	15	\$ 200.00	\$ 3,000.00	\$ 5,400.00		\$ 5,400.00
2.1.2 Set up a scope statement	40	\$ 100.00									\$ 4,000.00	15	\$ 200.00	\$ 3,000.00	\$ 7,000.00		\$ 7,000.00
2.1.3 List down the work breakdown structure	56	\$ 100.00									\$ 5,600.00	15	\$ 200.00	\$ 3,000.00	\$ 8,600.00		\$ 8,600.00
2.1.4 Create a Gantt Chart	56	\$ 100.00									\$ 5,600.00	15	\$ 200.00	\$ 3,000.00	\$ 8,600.00		\$ 8,600.00
2.2 Create a backup plan	120	\$ 100.00									\$ 12,000.00	20	\$ 200.00	\$ 4,000.00	\$ 16,000.00		\$ 16,000.00
3. Analysis											\$ -			\$ -	\$ -		\$ -
3.1 Virtualization of server resources											\$ -			\$ -	\$ -		\$ -
3.1.1 Identify the effort involved in physical server virtualization	80	\$ 100.00	2	\$ 90.00	11	\$ 90.00	15	\$ 90.00	10	\$ 80.00	\$ 11,320.00	15	\$ 200.00	\$ 3,000.00	\$ 14,320.00		\$ 14,320.00
3.1.2 Analyze the reduction of space, energy and capital	80	\$ 100.00	3	\$ 90.00	11	\$ 90.00	15	\$ 90.00	10	\$ 80.00	\$ 11,410.00	15	\$ 200.00	\$ 3,000.00	\$ 14,410.00		\$ 14,410.00
3.2 Disposal of electronic waste and recycling											\$ -			\$ -	\$ -		\$ -
3.2.1 Cost analysis	80	\$ 100.00									\$ 8,000.00	15	\$ 200.00	\$ 3,000.00	\$ 11,000.00		\$ 11,000.00
3.2.2 Identify the benefits	80	\$ 100.00									\$ 8,000.00	10	\$ 200.00	\$ 2,000.00	\$ 10,000.00		\$ 10,000.00
3.2.3 Effort prediction	40	\$ 100.00									\$ 4,000.00	20	\$ 200.00	\$ 4,000.00	\$ 8,000.00		\$ 8,000.00
3.3 Data Centre and overall energy efficiency											\$ -			\$ -	\$ -		\$ -
3.3.1 Analyze the current energy consumption	80	\$ 100.00	6	\$ 90.00	8	\$ 90.00	13	\$ 90.00	10	\$ 80.00	\$ 11,230.00	10	\$ 200.00	\$ 2,000.00	\$ 13,230.00		\$ 13,230.00
3.3.2 Prepare energy consumption reduction plan	80	\$ 100.00	6	\$ 90.00	8	\$ 90.00	13	\$ 90.00	10	\$ 80.00	\$ 11,230.00	10	\$ 200.00	\$ 2,000.00	\$ 13,230.00		\$ 13,230.00
3.3.3 Finalize the approach	48	\$ 100.00	6	\$ 90.00	8	\$ 90.00	13	\$ 90.00	10	\$ 80.00	\$ 8,030.00	10	\$ 200.00	\$ 2,000.00	\$ 10,030.00		\$ 10,030.00
3.4 Development of new software to address green computing											\$ -			\$ -	\$ -		\$ -
3.4.1 Analyze the benefits of internal use	96	\$ 100.00	20	\$ 90.00	16	\$ 90.00	14	\$ 90.00	8	\$ 80.00	\$ 14,740.00	15	\$ 200.00	\$ 3,000.00	\$ 17,740.00		\$ 17,740.00
3.4.2 Analyze potential sale to other organizations	128	\$ 100.00	5	\$ 90.00	5	\$ 90.00	5	\$ 90.00	5	\$ 80.00	\$ 14,550.00	10	\$ 200.00	\$ 2,000.00	\$ 16,550.00		\$ 16,550.00
4. Implementation											\$ -			\$ -	\$ -		\$ -
4.1 Propose solution											\$ -			\$ -	\$ -		\$ -
4.1.1 Design and code	280	\$ 100.00	3	\$ 90.00	5	\$ 90.00	4	\$ 90.00	2	\$ 80.00	\$ 29,240.00	10	\$ 200.00	\$ 2,000.00	\$ 31,240.00		\$ 31,240.00
4.1.2 Create prototype	200	\$ 100.00	7	\$ 90.00	5	\$ 90.00	9	\$ 90.00	4	\$ 80.00	\$ 22,210.00	20	\$ 200.00	\$ 4,000.00	\$ 26,210.00		\$ 26,210.00
4.1.3 Create software to address green computing	280	\$ 100.00	4	\$ 90.00	6	\$ 90.00	11	\$ 90.00	3	\$ 80.00	\$ 30,130.00	20	\$ 200.00	\$ 4,000.00	\$ 34,130.00		\$ 34,130.00
4.2 Testing											\$ -			\$ -	\$ -		\$ -
4.2.1 Create testing environment	40	\$ 100.00	4	\$ 90.00	5	\$ 90.00	6	\$ 90.00	9	\$ 80.00	\$ 6,070.00			\$ -	\$ 6,070.00		\$ 6,070.00
4.2.2 Test the product in different cycles - development, training, UAT	240	\$ 100.00	7	\$ 90.00	4	\$ 90.00	6	\$ 90.00	9	\$ 80.00	\$ 26,250.00	20	\$ 200.00	\$ 4,000.00	\$ 30,250.00		\$ 30,250.00
4.2.3 Track defects until resolution	200	\$ 100.00	7	\$ 90.00	8	\$ 90.00	7	\$ 90.00	8	\$ 80.00	\$ 22,620.00	20	\$ 200.00	\$ 4,000.00	\$ 26,620.00		\$ 26,620.00
5. Performance report											\$ -			\$ -	\$ -		\$ -
5.1 Change request analysis	80	\$ 100.00									\$ 8,000.00			\$ -	\$ 8,000.00		\$ 8,000.00
5.2 Requirement discussion	80	\$ 100.00									\$ 8,000.00			\$ -	\$ 8,000.00		\$ 8,000.00
5.3 Approve change request	40	\$ 100.00									\$ 4,000.00			\$ -	\$ 4,000.00		\$ 4,000.00
6. Project documentation and next release plan											\$ -			\$ -	\$ -		\$ -
6.1 Submit Project report	24	\$ 100.00									\$ 2,400.00			\$ -	\$ 2,400.00		\$ 2,400.00
6.2 Present Final project report	24	\$ 100.00									\$ 2,400.00			\$ -	\$ 2,400.00		\$ 2,400.00
6.3 Project completion	24	\$ 100.00									\$ 2,400.00			\$ -	\$ 2,400.00		\$ 2,400.00
Subtotal											\$ -			\$ -	\$ -		\$ 371,270.00
Reserve											\$ -			\$ -	\$ -		\$ 74,254.00
Total	2720	\$ 3,300.00	88	\$ 1,260.00	111	\$ 1,260.00	144	\$ 1,260.00	105	\$ 1,120.00	\$ 311,270.00	300	\$ 4,000.00	\$ 60,000.00	\$ 371,270.00	-	\$ 445,524.00

Figure 7: Project cost estimate

TASK 4.2: PROJECT COST BASELINE

COST BASELINE								
Project Name: Green Computing Research Project	Date: June 28th, 2018							
Task Name	Month							Total Cost
	1	2	3	4	5	6	7	
WBS Categories / Hour								
1. Initiating								
1.1 Assigning task to team members	\$ 2,400.00							\$ 2,400.00
1.2 Research on Green Computing	\$ 6,640.00							\$ 6,640.00
1.3 Kick Off meeting	\$ 1,600.00							\$ 1,600.00
1.4 Prepare business case	\$ 1,600.00							\$ 1,600.00
1.5 Prepare project charter and sign	\$ 800.00							\$ 800.00
1.6 Create change request form	\$ 2,400.00							\$ 2,400.00
2. Planning	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
2.1 Create a Project Plan	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
2.1.1 Requirement tracking matrix	\$ 2,700.00	\$ 2,700.00						\$ 5,400.00
2.1.2 Set up a scope statement	\$ 3,500.00	\$ 3,500.00						\$ 7,000.00
2.1.3 List down the work breakdown structure	\$ 4,300.00	\$ 4,300.00						\$ 8,600.00
2.1.4 Create a Gantt Chart	\$ 4,300.00	\$ 4,300.00						\$ 8,600.00
2.2 Create a backup plan	\$ 8,000.00	\$ 8,000.00						\$ 16,000.00
3. Analysis	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
3.1 Virtualization of server resources	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
3.1.1 Identify the effort involved in physical server virtualization		\$ 8,000.00	\$ 6,320.00					\$ 14,320.00
3.1.2 Analyze the reduction of space, energy and capital		\$ 8,000.00	\$ 6,410.00					\$ 14,410.00
3.2 Disposal of electronic waste and recycling		\$ -	\$ -	\$ -				\$ -
3.2.1 Cost analysis		\$ 1,650.00	\$ 8,000.00	\$ 1,350.00				\$ 11,000.00
3.2.2 Identify the benefits		\$ 1,650.00	\$ 7,200.00	\$ 1,150.00				\$ 10,000.00
3.2.3 Effort prediction		\$ 1,650.00	\$ 5,100.00	\$ 1,250.00				\$ 8,000.00
3.3 Data Centre and overall energy efficiency		\$ -	\$ -	\$ -				\$ -
3.3.1 Analyze the current energy consumption			\$ 8,200.00	\$ 5,030.00				\$ 13,230.00
3.3.2 Prepare energy consumption reduction plan			\$ 9,000.00	\$ 4,230.00				\$ 13,230.00
3.3.3 Finalize the approach			\$ 5,300.00	\$ 4,730.00				\$ 10,030.00
3.4 Development of new software to address green computing		\$ -	\$ -	\$ -				\$ -
3.4.1 Analyze the benefits of internal use		\$ 1,100.00	\$ 12,500.00	\$ 4,140.00				\$ 17,740.00
3.4.2 Analyze potential sale to other organizations		\$ 1,100.00	\$ 12,100.00	\$ 3,350.00				\$ 16,550.00
4. Implementation	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
4.1 Propose solution	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
4.1.1 Design and code				\$ 24,500.00	\$ 6,740.00			\$ 31,240.00
4.1.2 Create prototype				\$ 23,200.00	\$ 3,010.00			\$ 26,210.00
4.1.3 Create software to address green computing				\$ 27,300.00	\$ 6,830.00			\$ 34,130.00
4.2 Testing				\$ -	\$ -	\$ -	\$ -	\$ -
4.2.1 Create testing environment1					\$ 2,600.00	\$ 3,470.00		\$ 6,070.00
4.2.2 Test the product in different cycles - development, training, UAT					\$ 27,600.00	\$ 2,650.00		\$ 30,250.00
4.2.3 Track defects until resolution					\$ 24,800.00	\$ 1,820.00		\$ 26,620.00
5. Performance report	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
5.1 Change request analysis						\$ 2,300.00	\$ 5,700.00	\$ 8,000.00
5.2 Requirement discussion						\$ 2,300.00	\$ 5,700.00	\$ 8,000.00
5.3 Approve change request						\$ 1,200.00	\$ 2,800.00	\$ 4,000.00
6. Project documentation and next release plan	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
6.1 Submit Project report							\$ 2,400.00	\$ 2,400.00
6.2 Present Final project report							\$ 2,400.00	\$ 2,400.00
6.3 Project completion							\$ 2,400.00	\$ 2,400.00
Subtotal	\$ 38,240.00	\$ 45,950.00	\$ 80,130.00	\$ 100,230.00	\$ 71,580.00	\$ 13,740.00	\$ 21,400.00	\$ 371,270.00
Reserve	\$ 7,648.00	\$ 9,190.00	\$ 16,026.00	\$ 20,046.00	\$ 14,316.00	\$ 2,748.00	\$ 4,280.00	\$ 74,254.00
Total								\$ 445,524.00

Figure 8: Project cost baseline

TASK 4.3: TRACKING THE PERFORMANCE

Total Cost	\$500,000.00						
PV	\$160,000.00						
EV	\$150,000.00						
AC	\$180,000.00						
Cost Variance	\$ (30,000.00)						
Schedule Variance	\$ (10,000.00)						
CPI	0.83						
SPI	0.94						
		3.2 Months					
		0.12%	0.26%		32.00%	32.00%	
	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Total
Budget At Completion	\$ 83,333.33	\$ 83,333.33	\$ 83,333.33	\$ 83,333.33	\$ 83,333.33	\$ 83,333.33	\$ 500,000.00
Earned Value	\$ 25,000.00	\$ 25,000.00	\$ 25,000.00	\$ 25,000.00	\$ 25,000.00	\$ 25,000.00	\$ 150,000.00
Actual Cost	\$ 30,000.00	\$ 30,000.00	\$ 30,000.00	\$ 30,000.00	\$ 30,000.00	\$ 30,000.00	\$ 180,000.00
Planned Value	\$ 100.00	\$ 220.00	\$ 26,666.67	\$ 26,666.67	\$ 26,666.67	\$ 26,666.67	\$ 106,986.67
Cost Variance	\$ (5,000.00)	\$ (5,000.00)	\$ (5,000.00)	\$ (5,000.00)	\$ (5,000.00)	\$ (5,000.00)	\$ (30,000.00)
Schedule Variance	\$ 24,900.00	\$ 24,780.00	\$ (1,666.67)	\$ (1,666.67)	\$ (1,666.67)	\$ (1,666.67)	\$ 43,013.33
CPI	0.83	0.83	0.83	0.83	0.83	0.83	\$ 5.00
SPI	250.00	113.64	0.94	0.94	0.94	0.94	\$ 367.39
Estimate to Completion	\$ 70,000.00	\$ 70,000.00	\$ 70,000.00	\$ 70,000.00	\$ 70,000.00	\$ 70,000.00	\$ 420,000.00
Estimate at Completion	\$100,000.00	\$100,000.00	\$100,000.00	\$100,000.00	\$100,000.00	\$100,000.00	\$ 600,000.00
Variance at Completion	\$ (16,666.67)	\$ (16,666.67)	\$ (16,666.67)	\$ (16,666.67)	\$ (16,666.67)	\$ (16,666.67)	\$ (100,000.00)

Figure 9: Earned value analysis

- a. The cost variance of our project is - \$ 30,000. This indicates that the cost has exceeded the allotted budget by \$ 30,000. The schedule variance is - \$ 10,000 indicating that the earned value is lower than the planned value by \$ 10,000. The CPI is 83% and the SPI is 94%, which means that we are 6% behind schedule.

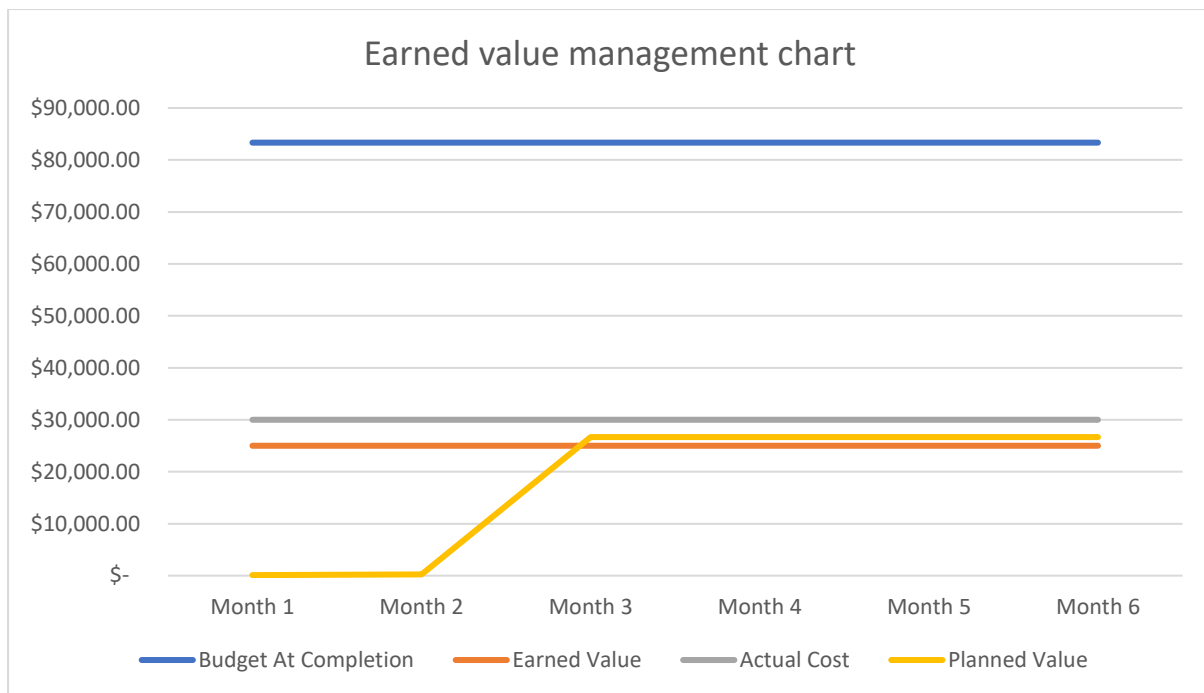


Figure 10: EVM (Earned value management) chart

- b. The graph shows the pictorial representation of the performance of the project. The data given best explains the current performance of the project after 3 months because it is a quantitative analysis rather than a qualitative statistical analysis. While looking at the overall progress, we took 0.2 months more than that of the projected plan at the beginning. Also, another crucial factor is that it implies that the project will be over budgeted by \$100k.
- c. It is very important for us to take extra steps to ensure that the project is completed not only on time but also within the budget, if not, this will be a failure. The project sponsor should be made aware and support should be taken from the senior management to keep make sure that the project does not exceeding the budget.

TASK 4.4: CORRECTIVE ACTIONS TO MINIMIZE THE COST

1. **Consultant cost:** A significant time was lost due to the communication gap within the consultant's organization which contributed to the delay in specific activities. We detected the problem and increased our involvement with the consultant. We set expectations from the project manager representing the consultant to send us regular updates on the status and progress of the tasks. We asked each vendor to create a task matrix for tracking the ongoing activities to avoid similar cost incurred due to delay. This measure reduced the expected delay by quite a significant margin.
2. **Weekly meetings:** We scheduled a recurring weekly meeting on every Wednesday whose attendees included the critical stakeholders from the organizations involved in the implementation of the Green Computing Project, and the developers who wanted to discuss the issues encountered during development of vital requirements with the significant vendors. The meeting allowed an open-ended discussion where problems were troubleshoot on a high level, and the attendees expressed their opinion regarding the matter. The meeting helped in clearing the communication gap and enabled us to set task-level priorities for the respective vendors.
3. **Travel cost:** The travel cost seemed to exceed the expected value during the kick-off phase. There were costs involved when the employees had to travel and coordinate with vendors for essential implementation strategies. There were also instances when the vendors had to visit our team for similar situations. We modified the approach and reduced this cost by organizing online web meetings. We assigned significant responsibilities to employees who worked diligently to be on top of the major tasks involved in completing the project. The weekly meeting was leveraged as a strategy that enabled effective coordination and cost-cutting.