

Renewable Energy Projects: Project Management Opportunities, Challenges, and Risks

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I. Introduction

When analyzing or working on a renewable energy project or a project that includes elements of renewable technologies, the project manager faces some unique efforts which transcend the usual project success iron triangle of schedule, product (quality), and costs. Project managers also face significant renewable technology challenges and risks, and at times, a severe lack of broad based knowledge pools.

Why Project Management?

In virtually every project management literature source, it is clearly and loudly proclaimed that the project management discipline is essential to the very survival of many businesses. It is through this discipline's methodologies and tools which assist firms to become or retain a globally competitive edge. Utilization of project management allows the firms to develop and provide their services and/or products at a higher quality, faster, and at lower costs. Any global firm which fails to remain competitive will cease to exist. Within this fast paced, competitive, business environment comes rapidly advancing opportunities, benefits, challenges, and risks to work as project managers that employ renewable energy components in their projects.

Why Renewables?

The renewable energy market, or "renewables", is not only the wave of the future, but a wave that is here and now. This wave is driven by drastic increasing energy costs, sustainability, environmentalism, terrorism, national security, global market effects, longevity, and public perception and attitude.

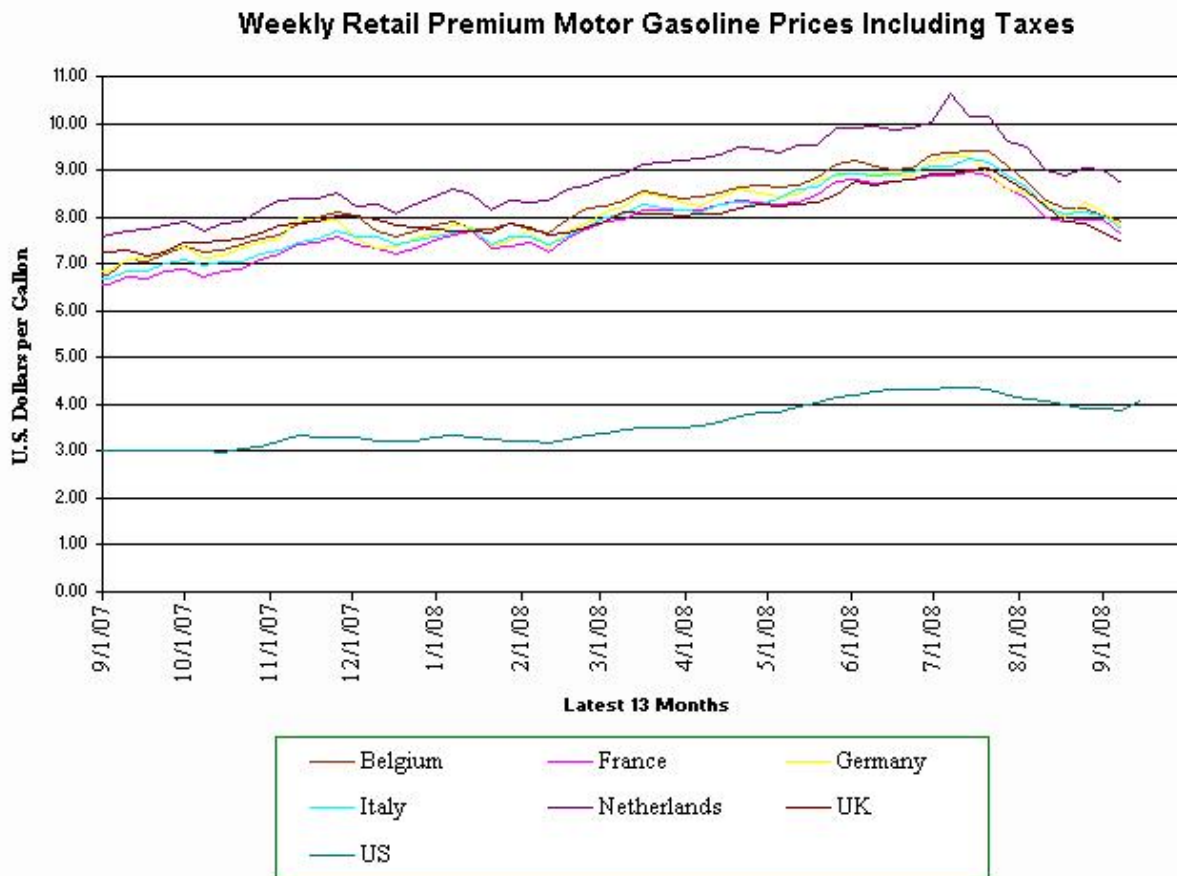


Figure 1: Gasoline Price Graph

As an example, Figure 1ⁱⁱ shows the international price of gasoline between January 1, 1997 and Sept, 1, 2008. A quick review shows two distinct trends. First, gasoline costs more in 2008 than in 2006. This cost increase went from \$2.16/gallon on January 1, 2007 to \$3.52 on Sept. 1, 2008. This is approximately a 63% price increase over a twenty-one month time frame. This is slightly down from the high of \$3.95 price, or approximately 83% increase, reached July 7, 2008.

Figure 1 also drives home the point that the United States gasoline price is significantly lower than other major world countries. The question is, will the U. S. gasoline price continue to lag behind the rest of the world or will it catch up? Home heating fuel, fossil-fueled power generation, and consumer goods prices are all increasing due to the high cost of fossil fuels.

These facts are, in turn, driving the political and business landscape changes to support achieving some measure of fossil fuel independence. Current political views, state and federal program funding, and business competitiveness support achieving this independence through renewable energy sources. Examples include tax incentives for firms and individuals who implement renewable energy programs or include these technologies in their overall projects. This, in turn, expands the needs of project managers to bring a firm skill set to this rapidly changing and advancing environment. So, what are renewables and what are the opportunities, challenges and risks?

II. Renewables

Numerous possible definitions exist for common renewable energy terms. This is typical of market trends of 'popular' ideas in present culture. As the market expands, these terms evolve and it can be difficult to agree on definition as many are based on perception. For the purposes of this article we define renewables within the context of common terminology.

Renewable Energy

Renewable energy is generated from non-fossil fuels. Examples include:

- Solar
- Wind
- Geothermal
- Wave Motion

Renewable energy means little without technology supporting generation, transmission, and delivery for consumption. Renewable energy technology takes into account storage, integration, and monitoring, through hardware and software.

Clean Energy

Clean energy can be generated by renewable or fossil sources, but its focus is generation, delivery, and consumption that support conservation and protecting humans and the environment. It is associated with environmentally conscious methods and products and includes 'smart' implementation. Cost effectiveness was not the primary driver of clean energy, which is now the driver for focusing on renewables.

"Green"

The term 'Green' is becoming extremely popular and common in today's culture. Possible definitions vary widely, as it can be used to describe an organic or healthy lifestyle, environmental consciousness, or employment of tools and techniques that support clean and renewable energy. Given this, it is likely that Green really encompasses a spectrum of ideas, technology, techniques, and the renewable-to-clean energy bridge. Green may well be a blend of conservations, renewables, efficiency, and cost effectiveness. Green does not specify the generation and distribution of energy, but focuses on application and consumption.

For example, Green is a term commonly used in construction today. Some feel this includes energy conservation, renewable energy integration, efficiency, and long-term cost-effectiveness. Some believe Green involves environmentally sound products and techniques, such as non-VOC insulation and recycled flooring.

These broad interpretations can create a complicated and confusing landscape for the project manager that must employ some facet of Renewable, Clean, or Green into their project. It is important to have well defined objectives and resources available to research and select correct options. This landscape can appear daunting which places even more value on preparedness and a strategy for including these in a project management plan.

Project Management Aspects

Cleland and Ireland discuss how project managers depend on the four competencies of knowledge, skill, ability and motivation.ⁱⁱⁱ Yet project success is affected by a range of internal and external project influences.

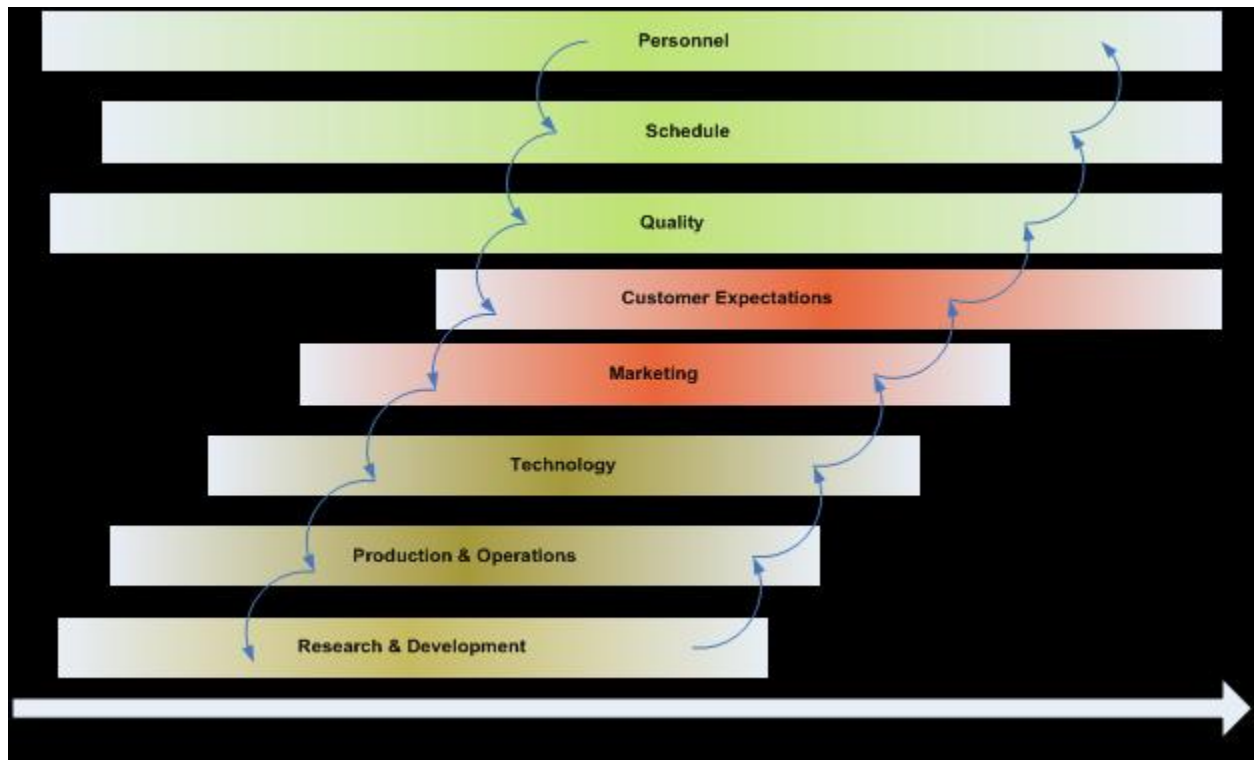


Figure 2: Project Management Influencing Elements

Figure 2 pictorially identifies some renewable project elements which significantly influence these unique projects. Renewable project success is tightly hinged to each and every one. The next sections will briefly highlight the challenges and some opportunities which exist in many of these elements.

Schedule Challenges

The schedule forms one corner of the project success triangle with quality and cost. As a key success/failure measurement it is often in conflict with the attributes of quality and cost. When projects are delayed additional costs are incurred. The project customer may also want the project to be completed earlier than originally scheduled, which typically increases the project cost as well. In the end, project schedules are often altered in an effort to balance the other project needs.

Ask yourself how much time and effort establishing the project baseline schedule required. Then look back and see if you actually met the original or baseline schedule. Did you meet the baseline schedule, or was the schedule influenced by events such as the hurricane which left you without power for several weeks or the prime vendor failed to deliver the essential component on time.

In renewable projects each and every one of these issues, and others, tend to be magnified. Typically the project is dealing with emerging technologies, evergreen project fields, evolving manufacturing techniques and/or cutting edge implementation needs. These factors generate significant schedule risks which can easily exceed other project experiences. Little precedence exists for incorporating certain renewable aspects into new or existing projects. It can be difficult to prepare for the unknown and it can require significant preparation and planning for contingencies. The project manager must increase the complexity factors when dealing with renewable project schedules.

Product and Quality Challenges

Projects are to deliver a specific product which meets the customer's quality defined characteristics. Yet projects that include renewables face many challenges in meeting the customer's quality needs. Some of these challenges originate in

the ability to clearly identify what the customer's quality characteristics are. It is not uncommon to find that the customer has stated as well as unstated quality expectations. Another issue is being able to establish measurable quality measurements. If the project team is provided with detailed engineering specifications they can develop testing processes which will establish the quantitative metrics. This quantitative pass/fail attribute can be much easier to deal with than qualitative project quality standards. A quantitative standard for renewables may be that a building product must be environmentally sound. This is an attribute rife with potential issues as definitions can be unclear and what may be highly pleasing to one will be found objectionable to another.

While green and renewable project standards are becoming more common, i.e. LEED certification for construction, the project team must be constantly aware of the new or changing standards and certifications to ensure the project meets the requirements. This is especially difficult if the project is utilizing cutting edge technologies where the intended metrics are not fully developed, or the complexity of the system fully understood. In this situation the project is challenged in meeting the customer's alluded to or hoped for quality desires and expectations. While all projects need to actively manage the customer's expectations, a project that includes new renewable technologies and methods may require additional attention and an ongoing management of expectations.

Research and Development

The renewable project team may find themselves deeply ingrained in the very fabric of research and development (R&D). While R&D projects have been around for some time, managing them can be a major headache. As an example, you are the project manager engaged to deliver a construction renewable product which utilizes at least 50% renewable technologies. Your background is firmly grounded in construction with an extensive skill set and knowledge on how to handle construction risks. Unless the designed renewable components are well established and previously deployed, this renewable project has just thrust you into the role of a research and development (R&D) project manager, as well as a construction project manager.

In this dual hat role, R&D as well as construction project management, your skill set must now include how to manage R&D project risks as well as construction project risks. The project manager is faced merging the project management skill sets and project types within a construction environment. This results in required extra resources such as research time and product and technique evaluation, all resulting in cost.

Production and Operations

Employing facets of renewable energy in a production or operational state requires additional resources to address key aspects of a successful integration into the project. These can include research time for new technologies and methods available in the renewable arena, evaluation of these technologies and methods, and training time for operational staff. Employing renewables in this aspect of a project can yield excellent long-term benefits, but it requires an initial investment of time, resources, and planning within project management to ensure success.

Marketing

The renewables market is highly aggressive at the present time. New technologies, evolving processes, and policies, must be considered when incorporating any facet of renewables in a project. Clearly identifying a realistic timeframe that considers analysis time, prediction, and evolution from research to applied solutions is critical. Accounting for reasonable goals and resource availability within the timeframe prevents moving targets and last-minute project shifts to encompass frequent technology changes. One must also consider pricing changes and weigh market acceptance and cost reductions against the need to employ cutting edge solutions today.

Conversely, marketing a project that includes renewables can provide benefits given the popularity in today's market. To successfully market an idea or project, a project manager should consider leveraging as well as planning for a role in this fast-paced market. Involving definitions can be a challenge as well as dedicating resources to maintain knowledge and understanding of trends. Benefits, however, can be many, and the market has great potential.

Personnel Challenges

Finding and successfully staffing a major technology project is usually an issue. When a market is 'hot' the talent pool is usually severely challenged to meet the requirement demands. At the present time the fossil fuel industry is creating many employment opportunities for engineers, project managers and support staff. Renewable projects must not only compete

with the fossil fuel industry demands they also face an even greater challenge of finding qualified and experienced resources.

As the need to expand renewable projects continue to increase it puts even greater pressure on the shallow resource pool that has the qualifications and experience to deliver. There doesn't appear to be sufficient skilled personnel to fill the current need, let alone rapidly expanding requirements. Renewable projects find that they have employed every type of renewable technology they can yet fall short of the need. Renewable project managers are challenged, more than usual, with resource management. This problem, however, will likely evolve into a job 'boom' for those seeking positions and employees in the renewable energy field. On the job training, industry-wide programs, and high school and university-level programs, are becoming increasingly more prevalent in today's market. Today's personnel challenge will lead to many opportunities for both employees and employers in the future.

Technology Issues

Renewables face a host of technology challenges such as very short life cycles, imprecise system integration methods, and cutting edge laboratory systems that have not been proven in real world situations.

This generates the myriad of technology and project challenges within a volatile technological solution system. The project manager must be able to provide guidance and direction for their team in how to handle this. You must ensure the project team clearly and continuously deploys a risk mitigation program specifically programmed to capitalize on the positive risk which may occur and mitigate the negative risk which might occur as well.

Testing and Validation Requirements

While technology based projects tend to exhibit testing challenges, in general, renewable projects raise the risk bar, significantly. The core question becomes, how can the project manager ensure that the testing program validates the complex system design, under all conditions?

While this is an issue surrounding all technology based, complex projects, renewable projects compounds the issues. This elevated risk level is associated with greater variability of external and internal environments, fewer successful testing programs to draw from, and often, a lack of detailed testing knowledge base or personnel who can develop the testing programs. If you are in the renewables market you don't have an option to not test. You not only must test but the test must be at an extensive level of detail. This testing will include physical testing, cause and effect failure mode analysis, and system dynamics modeling. The final goal is not only to ensure the customer feels confident with the final product but that the project team feels confident that the system will safely, effectively and efficiently perform as designed under all possible worse case scenarios.

Testing and validating complex systems is a significant project management challenge. Being able to definitively state that the system will perform as designed in a safe manner is a major challenge.

Costs

The decision to use renewable energy components in a project is often based on long-term cost benefits, along with other benefits. Benefits may include tax breaks, favorable public relations and press, and the ability to use stronger technological solutions that are sustainable. In the long run, employing renewables can provide a better way to do business. However, each of the previously briefly discussed project challenges can create a need for resources that has a negative impact on the project costs. While the risk literature defines risk as potentially positive and negative events most projects encounter and deal with negative risks and challenges at a much higher rate than positive risks. Managing the project costs not only requires good earned value analysis capabilities but advanced forecasting skills and negotiation skills. Improved, new or different cost control skills are needed in the renewable market.

Conclusion

Renewable are here and here to stay. The outcome is an expanding project management opportunity wave. This wave requires project managers with different and extended skill sets and capabilities. As Lew Ireland correctly identifies, "Project manager roles continue to expand into such areas as the business development arena ..."^{iv} Renewable project managers require these expanded roles to capitalize on the opportunities, challenges, and risks that this environment needs.

Emerging technologies, evergreen project fields, evolving manufacturing techniques and/or cutting edge implementation needs are factors in the renewable project environment that magnify normal project challenges of schedule, cost and quality issues, and others. Despite the many challenges facing project managers, employing renewables into the various aspects of a project can provide significant benefits. As the world moves forward, more projects will involve renewables. As a project manager it is critical that you should expand your skill set for these new opportunities.

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Dr. Morgan Henrie, PMP and President of MH Consulting, Inc., provides project management expertise and training to the Oil and Gas as well as telecommunication industry. Since its 1997 inception, his MH Consulting has managed projects both nationally and internationally. Prior to starting MH Consulting he provided a variety of services to Alyeska Pipeline Service Co. located in Anchorage, Alaska.

At the same time he has presented project management training courses in Alaska, Virginia, and the Russian Far east. He has written and presented more than a dozen papers, both nationally and internationally, that include the leading project management conferences, i.e. Project Management Institute and the International Project Management Association (Europe), as well as engineering and management conferences. His papers that have been either printed by or are accepted for publication in project management, knowledge management and oil and gas journals.



From an academic perspective he is a PhD from Old Dominion University currently researching culture and communications within multi-national projects. He holds a MS Project Management from The George Washington University, as well as BSEE and BA in Technology Management.

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He has taught university level Project Management Courses for Old Dominion University and University of Alaska Anchorage American-Russian center. I've also presented graduate level training courses within the Russian Far East in support of U. S. Department of Labor educational grants.

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ⁱ Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under Contract DE-AC04-94AL85000.  

ⁱⁱ <http://www.eia.doe.gov/emeu/international/prices.html#Motor>, accessed Sept 16, 2008

ⁱⁱⁱ Cleland, David I. and Lewis R. Ireland, "Project Manager's Portable Handbook 2nd." McGraw-Hill, New York. 2004.

^{iv} "Business Development: The Expanding Role of the Project Manager," Dr. Lew Ireland, <http://asapm.org/asapmag/articles/PrezSez04-08.pdf>