



## SERVICE PROVIDER GUIDE

### Guidelines for Selecting a Mechanical Engineer

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#### Intent

This guide will help you learn more about what services are typically performed by Mechanical Engineers and help ensure you select a qualified professional that will compliment the project team on a sustainable or “green” project.

#### Background

Mechanical engineering is a design profession that requires specialized education, work experience, and a license issued by the State in which the project will be built. While each individual engineer working on the project may not need to be licensed, the engineering work must be performed “under the direction and control” of a licensed professional engineer as defined by state statute. There is both professional liability as well as responsibility to the general public under these statutes.

Some services a mechanical engineer might provide for a green or sustainable building project include the following:

- ❖ Design of Heating, Ventilation, and Air Conditioning (HVAC) systems
- ❖ Design of Plumbing and/or Fire Protection systems
- ❖ Design of specialized piping systems such as medical gasses, laboratory gasses, and waste liquids
- ❖ Analysis of the building’s heating, ventilation, or cooling loads
- ❖ Evaluation of energy efficiency impacts of various mechanical or lighting system applications as well as building design alternatives (energy analysis)
- ❖ Evaluation of water efficiency impacts of various equipment, systems and building options
- ❖ Testing, Adjusting, and Balancing of mechanical systems
- ❖ Commissioning of mechanical systems
- ❖ Life-cycle cost analyses
- ❖ Building and systems energy modeling and hourly simulation
- ❖ Sustainability consultation (typically by an engineer who is also a LEED™ Accredited Professional)
- ❖ Measurement and Verification or Testing of systems

There are many services that an engineer can provide; including some that might also be available from another consultant or specialist, such as energy analysis or commissioning. These are discussed in a separate part of this “Service Providers Guide”, however be aware that there are potential advantages and disadvantages to having the services provided by the mechanical engineer.

Firms specializing in commissioning or energy management may have more depth of knowledge and experience in evaluating a wider range of project energy issues and may also be able to provide the appearance that potential conflict of interest concerns have been addresses (not necessarily applicable to all projects). Some engineers prefer an independent commissioning or energy specialist be included on the team to provide a second pair of eyes that can potentially improve the integrated design and reduce the overall team liability.

#### Project Scope of Work

Have a clear project scope of work and description of the project and the sustainability and energy-efficiency goals and provide this to prospective consultants. This essential document

may alert engineers who do not have the requisite experience or interest to decide not to participate, thus assisting with the selection process.

### **Interview**

A major component in the success of any project will be the chemistry among the individuals involved in the project. Thus, it is recommended the interview be conducted by a team that includes those in your firm who will be working directly with the engineer. Also request that the engineering firm send to the interview those individuals who will be communicating with your personnel.

The interview will also allow you to judge the sincerity and knowledge of the interview team, however be aware that good interview skills do not necessarily translate to good design skills. Look for a personal commitment to the profession and in particular to green principals. That commitment to green principals can be extremely valuable, and may provide the added energy which is often needed to come up with creative solutions to making the green concepts work for the project.

Have a discussion of some cutting edge green or high efficiency mechanical systems. Develop an impression of the engineer's level of knowledge and expertise in these areas.

Talk about budget impacts of green and energy efficient design. This should be interesting as there is no consensus in this area. Two possibilities are that "green" can be accomplished at no additional cost, or that "green" always adds cost. There are conditions and circumstances that apply to each concept and the engineer should have some awareness of those factors. There is even disagreement over whether compromise is necessary, so there are plenty of topics to explore.

### **Integrated Design**

Many green or sustainable technologies involve energy efficiency. The success of the building in achieving energy efficiency goals is not solely dependent upon a good mechanical design. Rather it often requires that the design be better integrated into the building's other systems than for most traditional mechanical designs. Here are just a few examples to illustrate the concept:

- ❖ A project can have reduced energy use and a reduced mechanical system size by incorporating daylighting. The daylighting may have occupancy controls that can also be utilized in the control scheme of the mechanical system, and not to do so limits the ultimate energy consumption of the building. More importantly, if the daylighting design is not successful and as a result the lights are turned on when daylight is and was planned to be available, the mechanical system may not be adequate. One of the most important features that impacts the success of the daylighting design can be the controls and how they interact with the occupants. If they are annoying to the occupants or do not adequately respond to the actual daylight conditions, the system may fail. Thus, it is important that the engineer understands this and has an idea of how he/she will gain assurance from the rest of the design team that the daylighting will be adequate. It also means that selection of the lighting designer and architect is important to the success of the mechanical engineer.
- ❖ Thermal mass of the building may be used for storage of heating or cooling capacity. It may be intended to reduce the mechanical system capacity or to simply reduce the energy use of the mechanical system. The affected design disciplines, including the architect, structural engineer, and owner will need to carefully integrate their designs. The mechanical engineer will need an understanding of how this might be accomplished. Again, selection of other team members is important to the success of the mechanical engineer.

## **Drawings and Specifications**

Many green or sustainable technologies or energy efficient concepts are above and beyond the normal standard of care for the construction industry. The success of the building in achieving sustainability and energy efficiency goals will therefore be highly dependent upon having a process of education for the contractors as well as an effective methodology for enforcement of the project requirements.

## **Questions to Ask**

When selecting a mechanical engineer, review the general guidelines for selecting a green design professional. Then review the questions below specific to mechanical engineering (not including the energy analysis and commissioning specialties that are covered in other sections). This guide should help you create a more thorough selection process. Some of these questions relate to information discussed above.

### ***Q1: What are the potential savings from daylighting?***

The engineer should be aware of, and have an opinion on, the possibility of reducing the mechanical system size when daylighting is successfully employed. See above for further discussion.

### ***Q2: What factors influence the success of achieving the potential savings from daylighting?***

The engineer should want to know about the daylighting design process, who will complete the daylighting design, as well as discuss assurances that the daylighting design will be successfully implemented. See above for further discussion.

### ***Q3: Talk about some of the energy-efficient technologies for mechanical systems?***

There are a myriad of possibilities. Those that are suggested may give some insight into the budget restraints of the project in question. Some possibilities include ground-source heat pumps, variable volume air systems, variable pumping, thermal storage, solar heating (normally just for domestic hot water), evaporative cooling (direct and indirect), natural ventilation, radiant heating and cooling, distributed (as opposed to central) systems, high efficiency boiler technologies, air and water economizers, heat recovery, heat recovery ventilators.

### ***Q4: What computer programs does the engineer use for estimating heating and cooling loads?***

There are many possibilities here, including vendor programs like Carrier's HAP or Trane's Trace 700, software company load programs such as Elite's CHVAC or programs by Wright-Soft, free-ware programs like E-Quest, and energy simulation programs, as well as in-house load programs. You'll want to hear about how well the program can meet the project needs. A variable volume system will need a program that can find the block and building peak loads and not just sum the individual space loads. A building with daylighting may need the ability to make a lighting schedule. A building using thermal storage will need the ability for at least some level of mass factor in the thermal transmission calculations. Be cautious about using an energy simulation program for load determination unless there is familiarity with the accuracy of the particular program for that use.

### ***Q5: Does the engineer provide cost estimates (or cost opinions), and if yes, how are these developed***

Most experienced engineers will have familiarity with the cost of mechanical systems. However, the engineer does not control the factors that determine the ultimate cost, such as contractor mark-ups, how "hungry" the market is at bid time, and interaction with other trades. There will be times when bids do not match estimates and the ability to estimate costs will be valuable in evaluation of alternatives to bring the project back into budget or to modify the budget. This is particularly true of green and energy-efficient projects when the contractors are not familiar with

the technologies. The engineer also has an advantage in that he/she has a vision of the entire project, not just those parts that are shown on early stage drawings and documents. By comparison, some contractors will estimate based on what they see, which could lead to a project that is over budget when the design is completed.

***Q6: What is the engineer's experience with energy-efficient and/or green mechanical systems and projects?***

While not essential (after all, you may be looking for the creativity to do what has not been done before), all things being equal, experience is certainly valuable.

***Q7: Talk about some of the sustainable or green technologies for mechanical systems?***

Look for ideas that go beyond energy-efficiency. Many are only aware of energy-efficiency impacts of mechanical systems. While there will be controversy, there should be awareness of issues and technologies that may apply. Some examples include non-fiberglass duct insulation (cotton) and the need for fire resistance in them, non-PVC piping materials (one of the controversial issues), the embodied energy in various materials (such as whether aluminum in products is recycled or virgin – a potential difference of a factor of about ten), alternatives to CFCs and HCFCs as refrigerants.

***Q8: Who will be the person(s) performing the mechanical design and communicating with the rest of the project team?***

Ask to get the personal resume for all people who will be involved in the mechanical design as well as description of each person's core skills and value added to the project. See above discussion titled "Interview".

***Q9: What is the firm's project management approach?***

Be sure you are comfortable with the process used by the firm to ensure quality services and manage risk.

***Q10: Why should you hire this firm as the mechanical engineer for your project?***

Have them give you the reasons they think you should hire them. This will let you know if they understand the needs of your project and how their experience meets those needs. Answering this question may bring to light additional direct and indirect benefits they will bring to the project and help make the final decision.