

## PHASE 4: BUILD AND OPERATE



### Construction

The division of responsibilities between the developer and the contractor during construction and commissioning is dependent on the type of contract in use. However, the basic tasks to be performed during the construction and commissioning phase are the same regardless if they are carried out by the developer or the contractor.

The construction of a bioenergy plant is a complex process that requires extensive knowledge and considerable experience in technical, environmental, project planning and construction management. Successful construction of a bioenergy plant requires the project to be managed in line with general construction project management best practice.

A biomass-to-energy plant includes a number of scope items outside of the plant itself, the following additional tasks need to be considered:

- temporary works
- site construction area
- fuel reception, yard and storage
- emission monitoring
- solid waste transport and storage
- make-up and cooling water
- sewer connection
- electricity and power distribution
- grid connection
- offices, stores and workshop
- communications infrastructure
- security.

A construction site management plan should be in place to plan and coordinate daily on-site activities during construction.

For smaller projects or for those with only one contractor, several roles may be carried by the same individual. The developer's construction site organisation should, at a minimum, include the following roles:

- construction site manager
- environment, health and safety manager
- quality manager
- site documentation and control.

The developer's construction site organisation should be independent of on-site contractors. In addition, the contractor will have their own construction site organisation in place and the two parties should work together.

The developer's company is usually engaged in other types of business (different from bioenergy plant construction and operation) and may not have qualified personnel for this type of task in the organisation. They should engage external experts independent of the contractor to ensure their interests are represented.



## Commissioning and project handover

### Commissioning

When all equipment has been installed, the project moves into the commissioning stage. During the commissioning stage, it is important that all equipment is tested in a logical and systematic way. A well-prepared commissioning plan ensures that commissioning is conducted in a systematic and safe way.

The commissioning phase aims to demonstrate that all installations are complete and comply with contractually-specified requirements, have completed electrical safety checks and are safe to operate.

The commissioning phase includes, at a minimum:

- program and timeline
- roles and responsibilities
- communication plan
- development of training materials
- classroom training (as per training plan written in late planning stage)
- plant training (as per training plan written in late planning stage)
- cold testing (including instrumentation and control system aspects)
- hot/wet testing
- functional test and trial operation
- performance test and availability analysis
- success criteria
- production of handover documentation.

During this period it is also common to construct a list of defects and a plan for who will fix them and pay for the work. If the plant is well-designed and quality control during construction was good, this list may be minor in nature. However, this is often not the case and resolution may require engagement of legal advice.

Operating staff are trained during the commissioning phase so they become familiar with the equipment, and ensure efficient and safe operation and maintenance.

As the operations team become skilled in operating the plant and learn its strengths and limitations, it is common for some process improvements and optimisations to be made during the late commissioning phase.

## Handover

Documents which need to be handed over include:

- commissioning report, showing compliance with all design and compliance specifications and detailing any defects that have been rectified
- As Build diagrams of plant
- operations manuals
- unit process control procedures
- evidence of training identified in the training plan (including Safety and Critical Compliance Operational Procedures)
- certificates of occupancy
- site emergency management plan
- maintenance schedules for equipment (often in order to maintain warranty)
- defined job descriptions and training and assessment manuals for each job.



## Operate

The profitable operating life of a biomass-to-energy plant depends on the biomass, operational profile and maintenance history. Major overhauls or rehabilitation of key systems and components may take place during the operating period.

Plant operation includes several tasks and responsibilities, such as:

- scheduling of power and heat production and fuel supply
- operating and monitoring all functions of the energy-producing plant and equipment
- operation of biomass reception and handling, including weight measuring and quality control
- operation and handling of systems for waste by-products
- supervision of plant operations
- planning and scheduling of necessary maintenance work.

During operations it is essential that operators have access to a comprehensive and well-structured system which contains the relevant documentation and operation and maintenance manuals. These are essential for reliable and efficient operation and maintenance. The tender specifications should define the structure, quality, timing and extent of the equipment suppliers' documentation. Documentation which operations staff should become familiar with should include:

- general description of plant and functional description of individual systems
- drawings of layout and diagrams with a clear tag number system for systems and components
- operation manuals for each system
- detailed descriptions of all major equipment and components with precise and understandable maintenance manuals
- performance data and technical guarantees with correction curves for variations in preconditions, such as ambient temperature
- copies of technical and literature data from equipment suppliers.

Clear instructions from plant management to operators and maintenance staff are essential for a safe working environment.

The operation of a bioenergy plant comprises of a series of daily, weekly, monthly and annual tasks to maintain its safe and optimal production. These tasks must be completed, monitored and reviewed on a regular basis. Detailed records of completed tasks ensure the plant operates effectively and that warranties and guarantees can be enforced.