



# WendeWolf® Solar Sludge Dryer System

## Project Components & Requirements, and MAK Water's Typical Scope

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## Document Objective

The objective of this document is to:

- Provide practical information on the requirements of a Solar Sludge Drying (SSD) project using WendeWolf® technology
- Outline MAK Water's typical scope of work for a SSD project

This document should be read in conjunction with IST-Anlagenbau documents:

- General Description of WendeWolf® system
- Minimum Requirements on services for the WendeWolf® system

## Overview of Typical Solar Sludge Drying Facility and Project

### Process Design Considerations

The footprint for a SSD facility is dependent upon project-specific requirements including:

- Sludge quantities to be treated
- Location-specific climate data
- Dewatered cake INPUT percent Dry Solids (%DS) content
- Dried product OUTPUT %DS content
- Whether monthly INPUT rate is fixed or variable
- Whether OUTPUT target %DS is based on Minimum Monthly %DS or Annual Average %DS
- Whether dried product must be stored temporarily inside the drying hall(s), and the required duration for storage
- Systems selected for dewatered cake in-loading and dried product out-loading
- Requirements for staging of works
- Site constraints

### Facility Components

A Solar Sludge Drying facility consists of:

1. Greenhouse building(s) that contain the drying halls. The greenhouse building comprises steel/aluminium structure complete with roof & wall cladding, plus active & passive ventilation, as detailed below
2. WendeWolf® system comprises mechanical & electrical components as detailed below

3. Greenhouse building civil works including excavation, access, drainage, building floor, concrete footings for greenhouse building, dwarf walls both sides of the hall (for WendeWolf® machine to run on) and concrete aprons (for vehicular access into the building)
4. In-loading & out-loading systems - manual (typical) or automated (if required) – see below
5. Power supply to WendeWolf® system and automated in-loading system (if required)

MAK Water's typical scope covers items 1 & 2, and design guidance for items 3, 4 and 5.

## Greenhouse Building Design & Configuration Considerations

The process design will determine the required drying area for the project, and therefore the number and size of drying halls. The maximum overall greenhouse building length for a WendeWolf® drying hall is 130m, and the approx. width per hall is 12m.

Depending on the required number and size/length of drying halls, there are several ways to configure the greenhouse(s)/drying halls. For example, where two (2) drying halls are required, these can be configured as two (2) separate/standalone greenhouse buildings or as a single greenhouse building comprising two (2) halls. Having a pair of drying halls in a single greenhouse building structure is less expensive and results in a slightly smaller footprint than two (2) standalone greenhouse buildings.

For effective solar drying the maximum possible light transmission is required. For design of our WendeWolf® SSD system we use minimum light transmission of 80%.

## Operational Aspects

In-loading of dewatered cake and out-loading of dried product can be manual or automated. The greenhouse building design will be affected depending on the selected in-loading and out-loading method.

### In-loading of dewatered cake

The WendeWolf machine spreads the dewatered cake that is brought into the drying hall, across the width of the drying area. The amount of hall space taken up by spreading, will depend on the size and number of in-loading piles. A minimum of two (2) in-loading piles is preferred, while three (3) piles offers the best outcome. A single pile utilises more hall length to spread across the entire width than two or three pile. The operation/control of the WendeWolf® machine, will depend on the method of cake in-loading.

Manual in-loading via skip or truck is common. The WendeWolf® machine is moved via manual control from the in-loading area to allow for skip/truck movements during in-loading.

Automated in-loading can include any type of conveyor system. A slew belt-conveyor system will occupy some of the drying hall area. An overhead screw conveyor system will occupy less drying hall area. The operation & control of an automated in-loading system will be interlocked with the operation & control of the WendeWolf® machine.

### Out-loading of dried product

The out-loading of dried product from the hall is not a continuous process, and can therefore be scheduled to occur in batches. Consequently manual out-loading is most common. Typical

operation involves a bobcat (or similar) scooping the dried product from the end section of the drying hall, and loading it onto a truck for removal.

The WendeWolf® machine can be also used to stockpile dried product up to 80cm high. This feature is useful where weather conditions preclude removal of dried product from the hall for a month or more. Where stockpiling is required, the hall design will be affected to allow for storage area.

Automated out-loading systems are uncommon. For example it can involve a screw conveyor that moves the dried product from the drying hall into an elevated bin outside the drying hall for later removal by truck. The WendeWolf® machine or bobcat (or similar) can be used to move the dried product from the drying hall floor onto the conveying system.

## MAK Water's Typical Scope

### WendeWolf® System

Design, supply, installation, start-up, commissioning and training for *standard* WendeWolf® sludge solar dryer system(s).

Each WendeWolf system contains the following equipment per drying hall:

- 1x WendeWolf® machine i.e. Tiller and Turner assembly
- Control Hardware and Software, including 1x Operation Switchboard & 1x Machine Switchboard
- Festoon system that includes power cable
- Ventilation fans, quantity depending on hall length
- Safety Ropes with emergency stop pull switches (2x on WendeWolf machine, 1x at each hall entry)
- One (1) set of Meteorology Instruments installed inside each drying hall
- 1x set of Position Labels

Common equipment for the complete SSD facility include:

- 1x complete set of Meteorology instruments installed outside the drying hall(s)
- 1x Main Switchboard (for power distribution to each WendeWolf® Operation Switchboard, ventilation fans, greenhouse vents, greenhouse roof cladding blowers and other miscellaneous equipment as required)
- Associated materials, cabling, & fasteners

### Greenhouse Building(s)

Design, supply, installation, commissioning and certification of engineered greenhouse(s) for site-specific environmental conditions for rain & wind loadings, suitable for the WendeWolf® system as following:

- 4m internal clearance

- All structural steel hot dip galvanized to AS/NZS 4680
- Ridge in heavy duty pre-galvanised plate
- Heavy duty gutters in pre-galvanised plate
- Rain heads and downpipes to ground level
- Roof cladding (preferred): inflatable twin-skin ETFE clear film, 100 micron outer and 60 micron inner thickness (other material options available)
- Wall cladding (preferred): along full length both sides of the building, terminating 500mm from the floor level. Material clear 8mm double-wall plexiglas (other material options available)
- End walls cladding (preferred): Material clear 8mm double-wall plexiglas (other material options available)
- Sliding doors fitted into the end walls: two (2) doors per hall, one (1) on either end of the hall, 3.2m x 2 piece x 4m high sliding doors with a 6.4m opening, and top and bottom tracks. Material 16mm triple-wall polycarbonate (other material options available)
- Blowers for inflation of twin-skin ETFE roof cladding
- Rack & pinion roof vent system, one per span along the entire length of the hall
- Vent motors for operation of active vents

## Freight & Delivery

- Included

## Design & Documentation and Project Management

- Detailed drawings of the greenhouse building
- Building design certification c/w computations by registered structural engineer
- Building Certificate of Compliance
- Our *standard* AS/NZ-accepted QA, safety and construction documentation
- WendeWolf® documentation including Scope of Supply, system Design & Control, Machine Details, Motor Data (and O&M Manual at project completion)
- Main Switchboard design & drawings
- O&M Manuals for all equipment & systems
- Project management services under our Integrated Management System with certification to ISO 9001:2008 (quality)

## Commissioning & Training

- Included

## Exclusions

- A. Design and construction of all civil elements including excavation, access, drainage, building floor, concrete footings for greenhouse building (per our design), 850 mm high dwarf walls 11.3 m apart on both sides along the length of the hall (for WendeWolf® machine to run on) and concrete aprons (for vehicular access into the building)
- B. Supply and installation of 3-ph 415VAC power supply to our Main Switchboard
- C. Provision of cake in-loading and dried product out-loading. If automated systems are selected, these will have interfaces with the building and WendeWolf® control system.
- D. Integration of controls with main plant PLC/SCADA. Our offered WendeWolf® control system is standalone for each hall.

Note: MAK Water can provide/include items C. and D. if required.