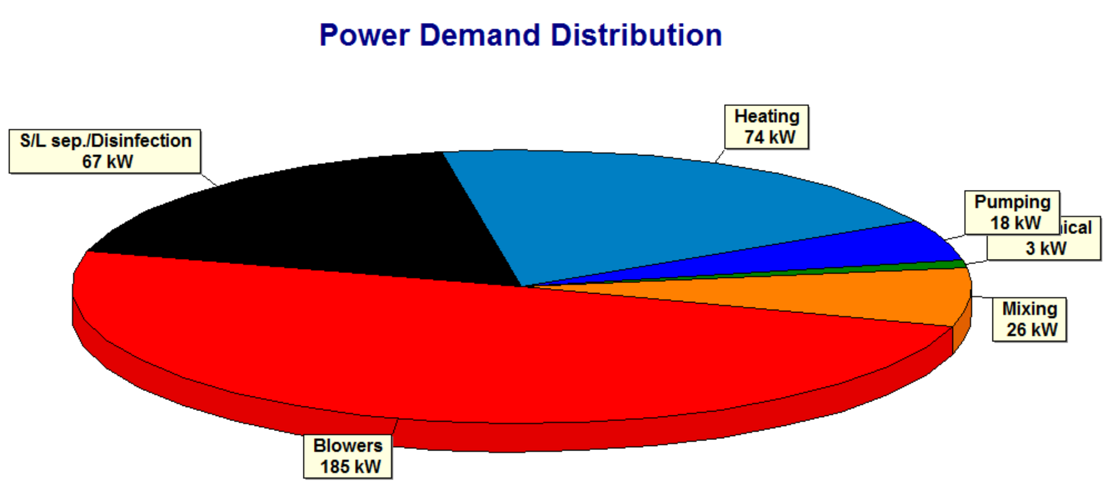
# New Developments in PetWin 5.2

**April 25, 2017**

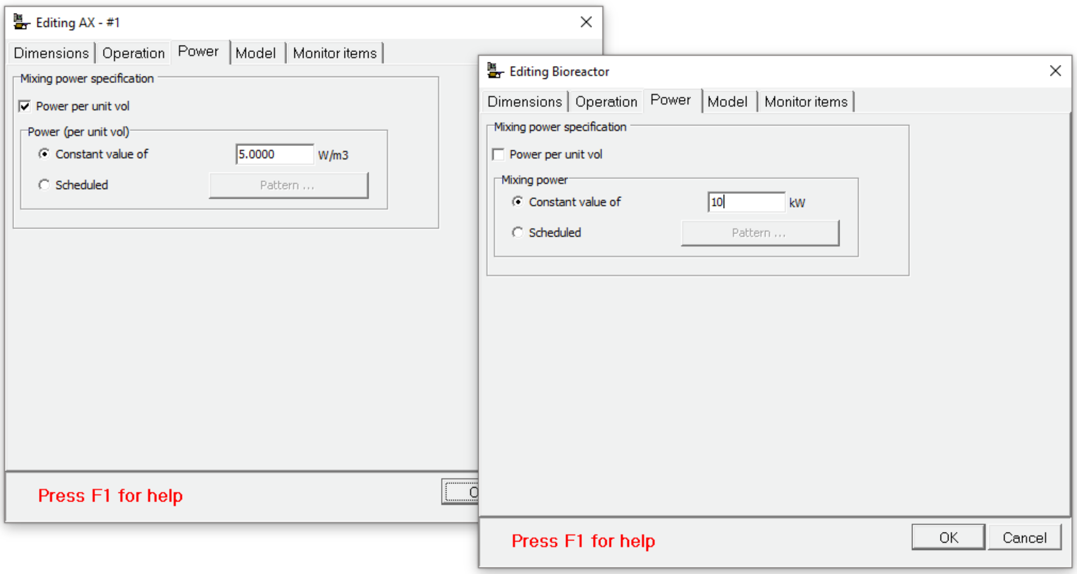
PetWin 5.2 contains many exciting new updates. PetWin 5.2 enables users to capture a plant-wide inventory of power demand. For example, PetWin will calculate blower power requirements, taking into account factors such as inlet air temperature and relative humidity, pressure losses in the air delivery system, *etc.* Pumping power may also be tracked, accounting for detailed factors such as pipe material and diameter for dynamic head losses. Miscellaneous mechanical power for various treatment flowsheet elements also may be tracked. To compliment this new functionality, PetWin also includes the facility to easily implement up to three different electricity tariff rates over the day, and these patterns can be different across two "seasons" (*e.g.* summer and winter). With the additional ability to explore onsite power generation and heat recovery via CHP, tracking of other costs including consumables (*e.g.* methanol and metal salts) and sludge disposal, PetWin 5.2 has expanded capability as a plant management tool.

## Power Requirements – General Considerations

PetWin now tracks power requirements for a number of categories or sources. For example, Blower Power, Mixing Power, Mechanical Power, Pumping Power, Heating Power, Surface aeration Power, Solid Liquid Separation/Disinfection Power, and Heating Ventilation and Cooling Power. This categorization allows the power requirements to be easily displayed and itemized.

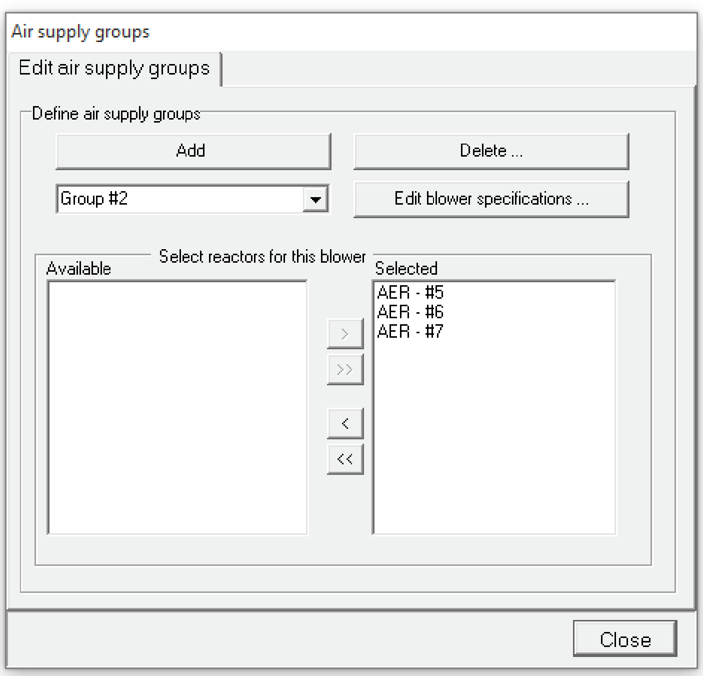


Power is tracked for elements *via* their Power tabs. All elements can track power demand on either a unit volume/flow basis, or a direct user-input kW (or hp) basis. Each of these options can be constant, or vary with time as shown below:




## Power Requirements – Aeration

Aeration is often the single biggest consumer of power in a wastewater treatment plant. PetWin allows you to specify whether an aerated element is part of a group of bioreactors / aerated zones that is supplied by a common blower, by defining as many **Air supply groups** as you like, as shown below:

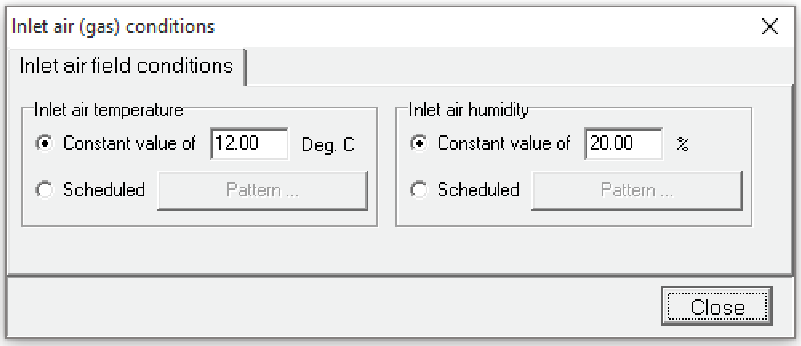


The total air delivered by a blower to a group of reactors is automatically totalized and used to calculate the blower power requirements. You can choose between three methods for calculating blower power requirements:

1. Adiabatic / polytropic power equation (default method);
2. Linear power equation (power is linearly related to air flow and pressure change);
3. User defined equation (users can implement complex equations to account for situations such as "main" and "standby" blowers).

The power calculations account for a number of important aeration system parameters, including:

- Blower inlet air conditions (temperature and relative humidity)

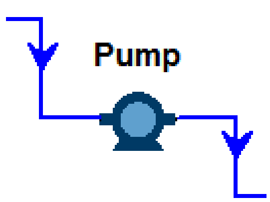



- Blower efficiency (which can be set up to vary with air flow)
- Total pressure loss through the air delivery system (*e.g.* piping and valves)
- Pressure loss across the diffusers (which can be set up to vary with air flow)

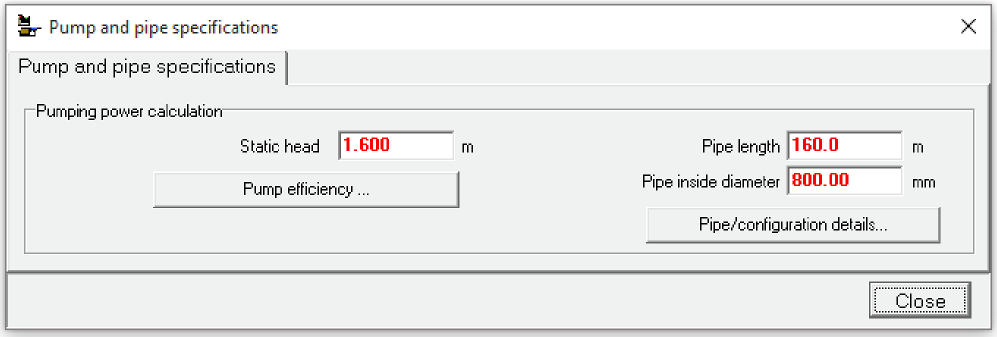
The PetWin 5.2 manual contains more detail and examples on the topic of aeration power requirements.

## Power Requirements – Pumping

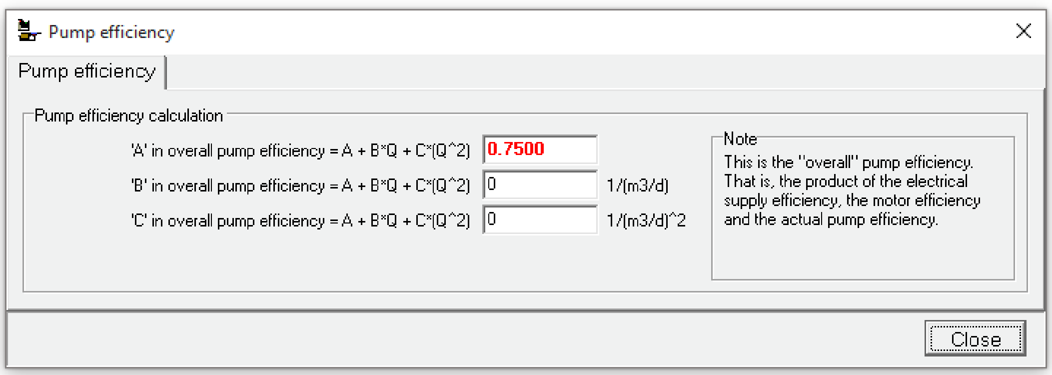
Power requirements to pump various flows for a process flowsheet are tracked via the **new** pump element in PetWin. Pumping power can either be calculated or specified as a constant or scheduled demand for Pump elements.

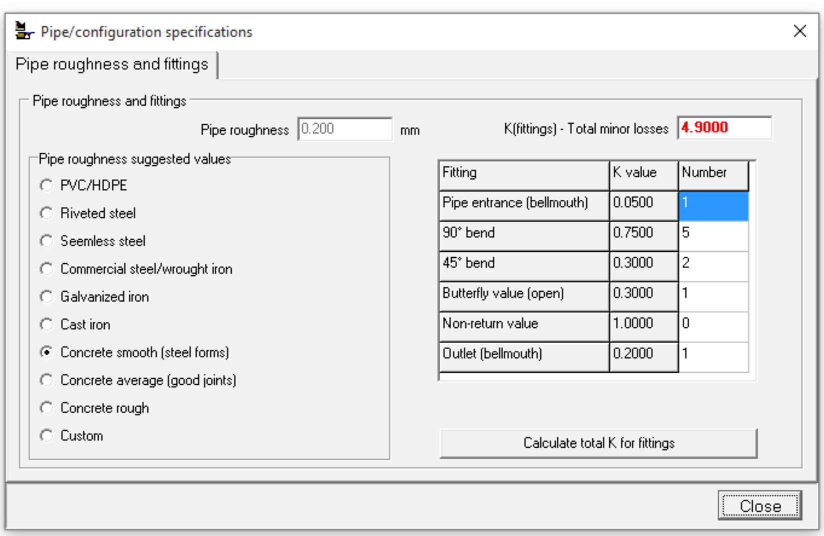


If you choose to have PetWin calculate the power, PetWin will sum all flows entering the pump element for use in its power calculation. Furthermore, you can enter the static head, pipe length and pipe inside diameter:



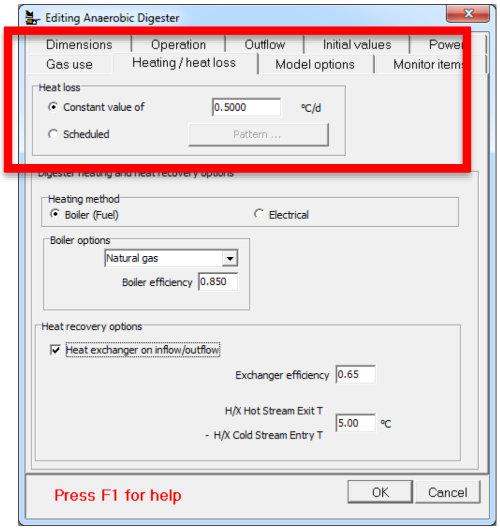

You can also provide information on the pump efficiency (*i.e.* whether it is constant or varies with flow) and the pipe characteristics used for calculation of total dynamic head (*e.g.* pipe roughness and minor loss coefficients), as shown below (PetWin also can account for the impact of high solids concentrations on a pumped stream's viscosity if desired):



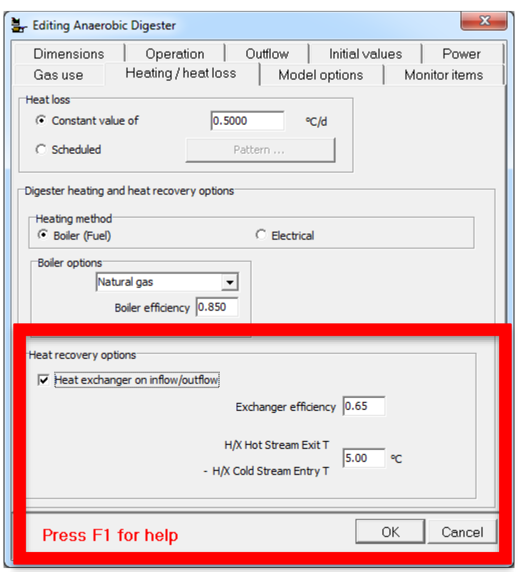



## Heating Requirements – Anaerobic Digester & Thermal Hydrolysis Unit

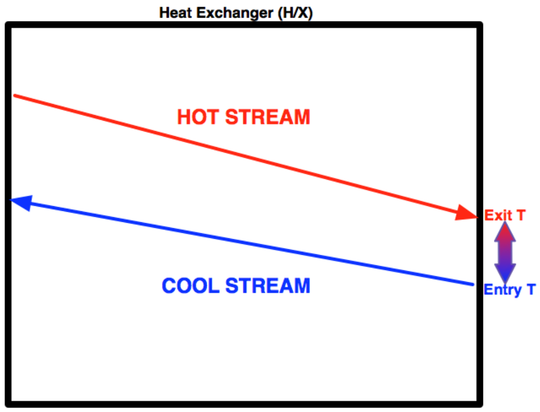
The heating power requirement is determined for Anaerobic Digester and Thermal Hydrolysis flowsheet elements. Typically, the main component of the heating power is the amount of energy required to heat an influent stream to the desired operating temperature specified in the Anaerobic Digester and/or Thermal Hydrolysis unit elements. Additional heating power may be required in an Anaerobic Digester element to overcome a specified digester heat loss, which can vary with time as shown below:




The heating power requirement is provided from a fuel or electrical source [see later], but there are also options in PetWin for heating power recovery within the Anaerobic Digester and Thermal Hydrolysis Unit elements:




When the option to include a heat exchanger is specified, PetWin assumes that the hot digester (or THU) output stream is used to heat the cool incoming stream in a counter-current heat exchanger. Users can enter the efficiency of the exchanger as well as the temperature difference between the heat exchanger's hot exit stream and cold entry stream. A schematic representing the difference in temperature between the hot exit and cold entry streams for the heat exchanger is shown below:

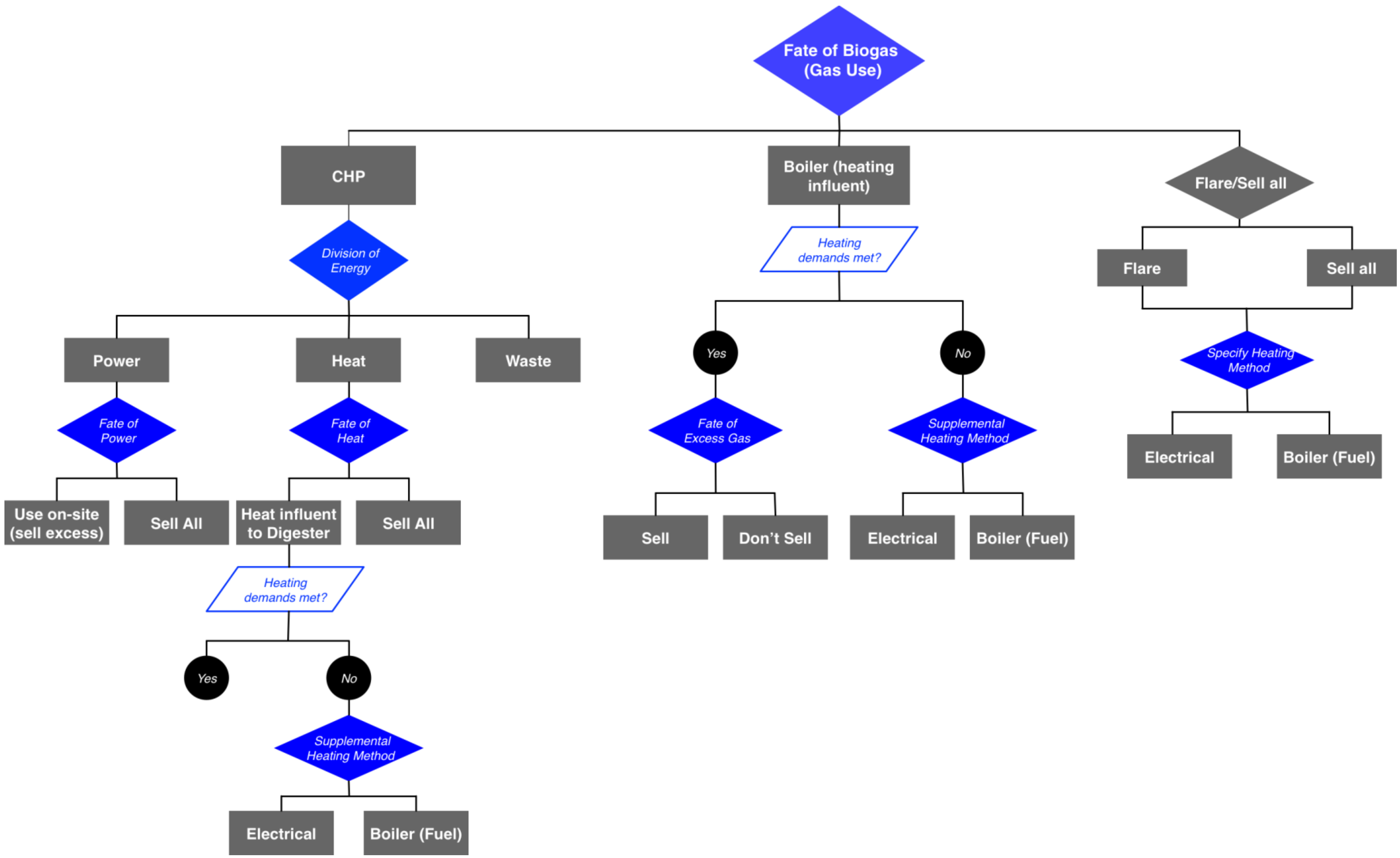



It is possible to choose between two heating methods for anaerobic digesters and thermal hydrolysis units:

1. Electrical heating which will incur an electricity cost, or
2. Heating *via* an external fuel source used in a boiler (*i.e.* natural gas, heating oil, diesel, or a custom fuel) which will incur a cost for fuel.

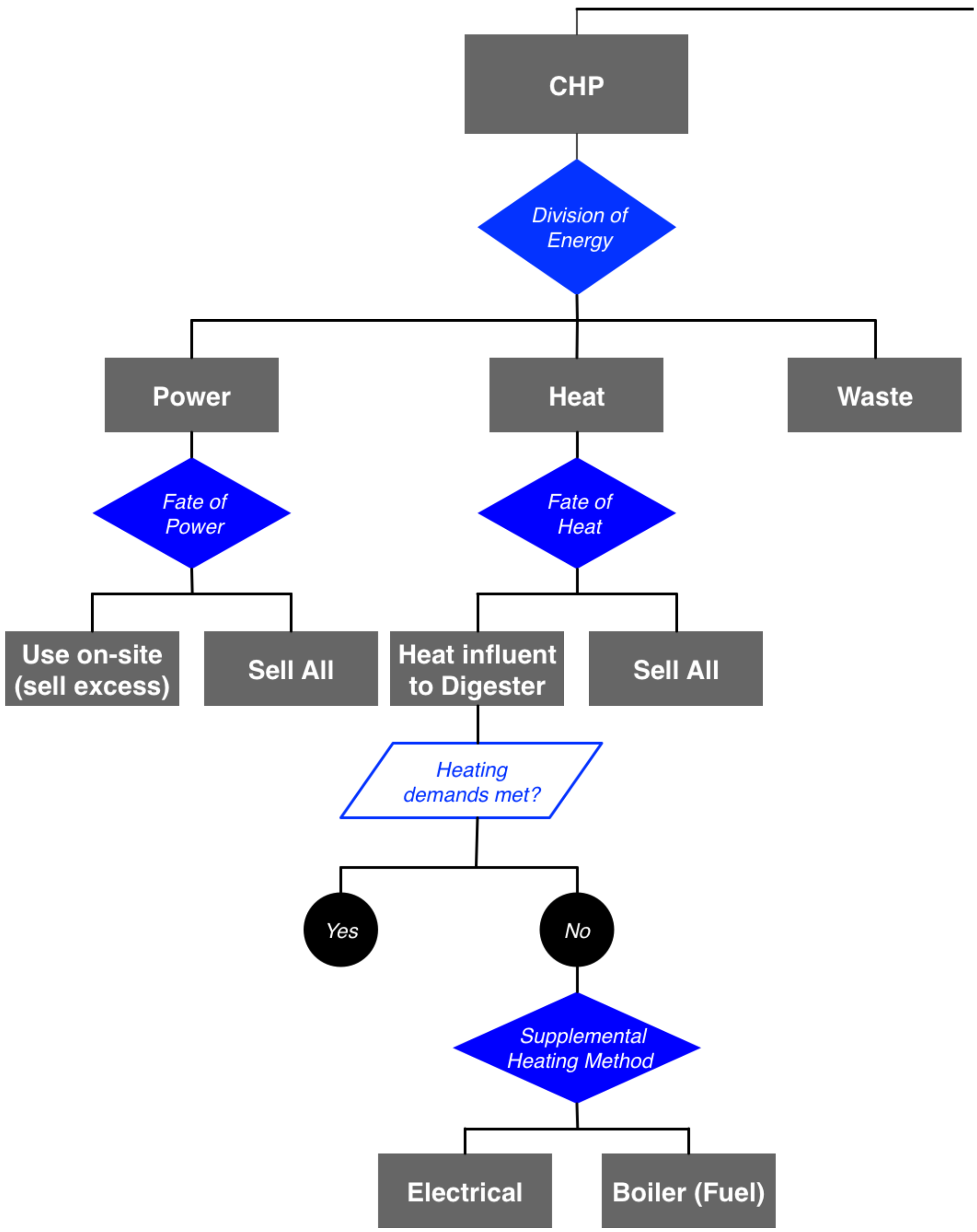
PetWin 5.2 also allows you to choose how biogas generated in an anaerobic digester is used. The overall multiple options for biogas use are shown in the following diagram (and options for additional heating needs are identified):

## *Potential Uses for Digester-Generated Biogas in PetWin 5.2*

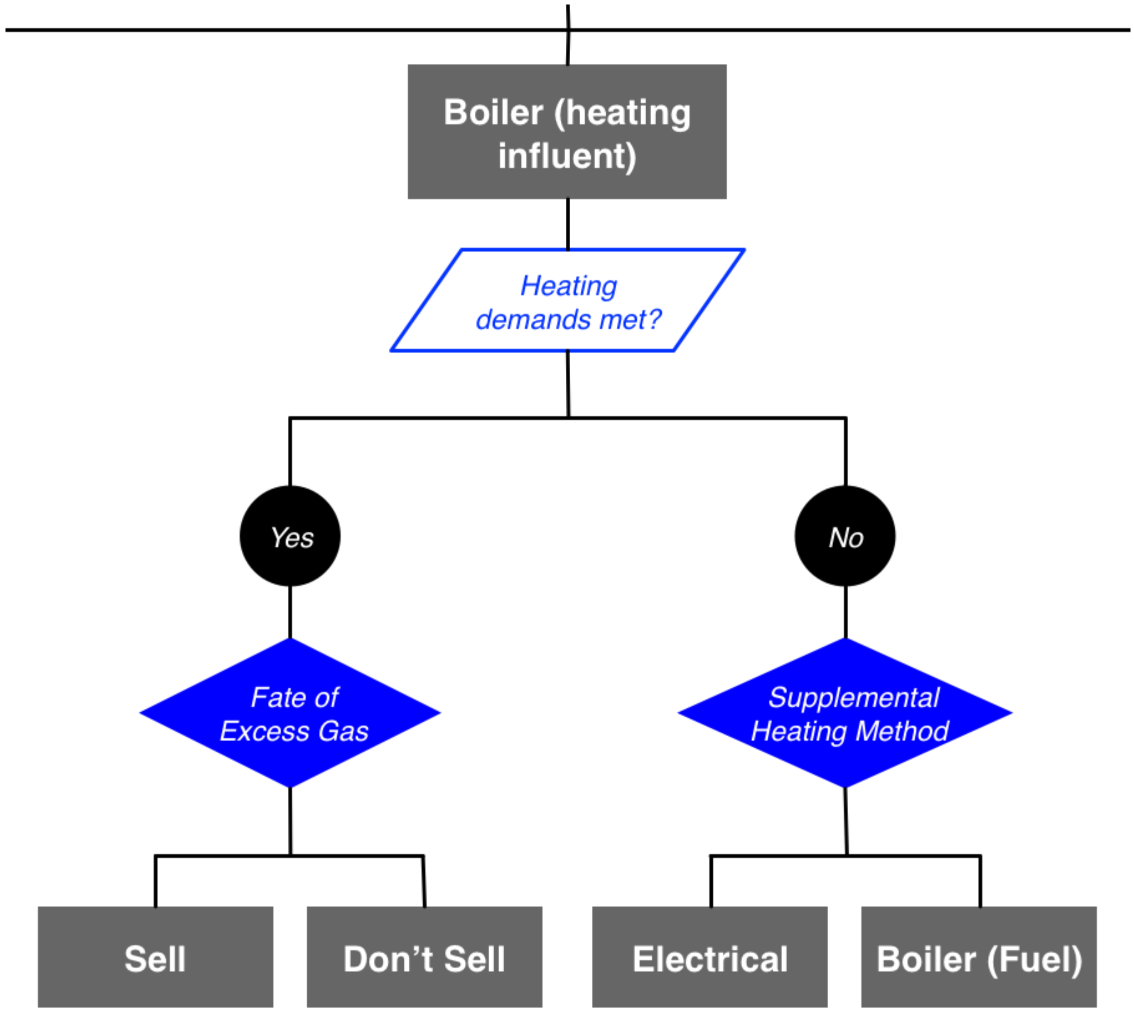


Digester biogas may be used in three main ways:

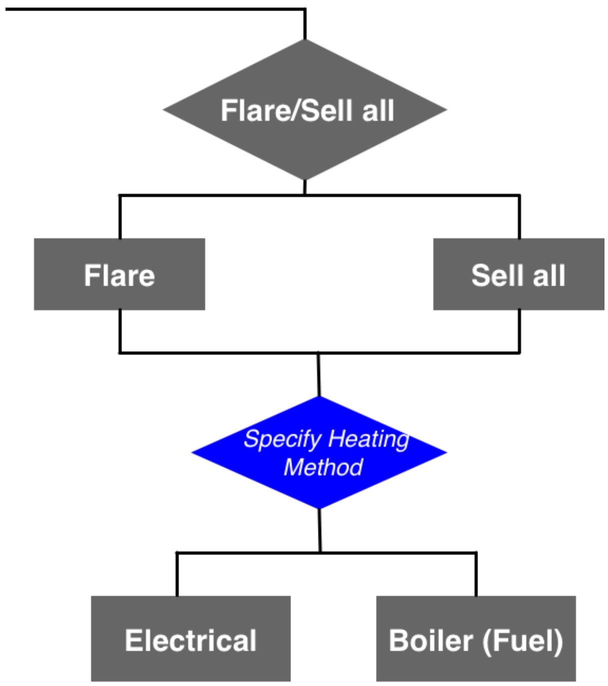
1. Using the biogas in a Combined Heat & Power (CHP) engine. This pathway includes options for selling all or left-over generated power; using or selling non-waste heat, and the method used for additional digester heating if required (*i.e.* electrical or use of external fuel).



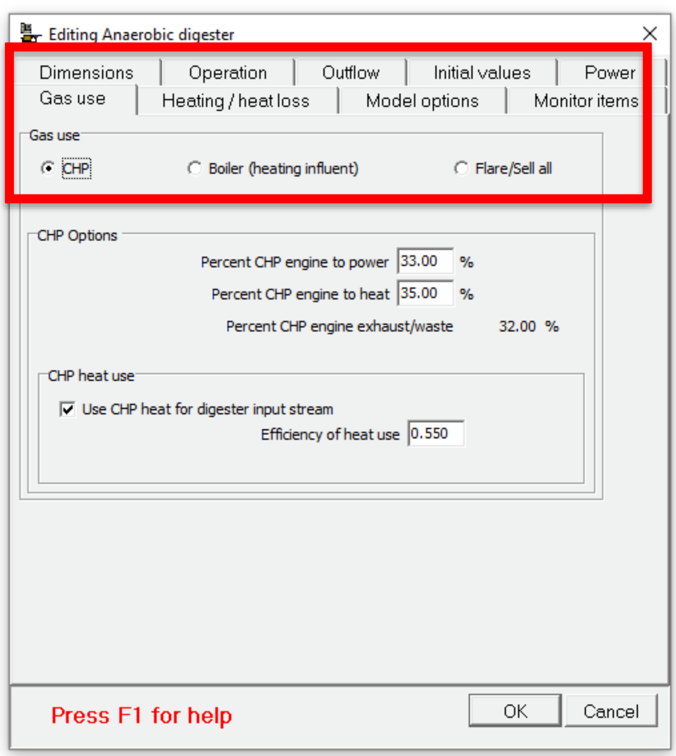
2. Burning the biogas in a boiler for heating and supplementing *via* electrical or external fuel sources if insufficient gas is available. If there is any excess biogas after satisfying heating demands, there is an option to sell it.



3. Either flaring off or selling all of the gas. For either option, the method used for digester heating (*i.e.* electrical or use of external fuel) must be specified.




The above pathways are selected using the new Anaerobic digester **Gas use** tab:



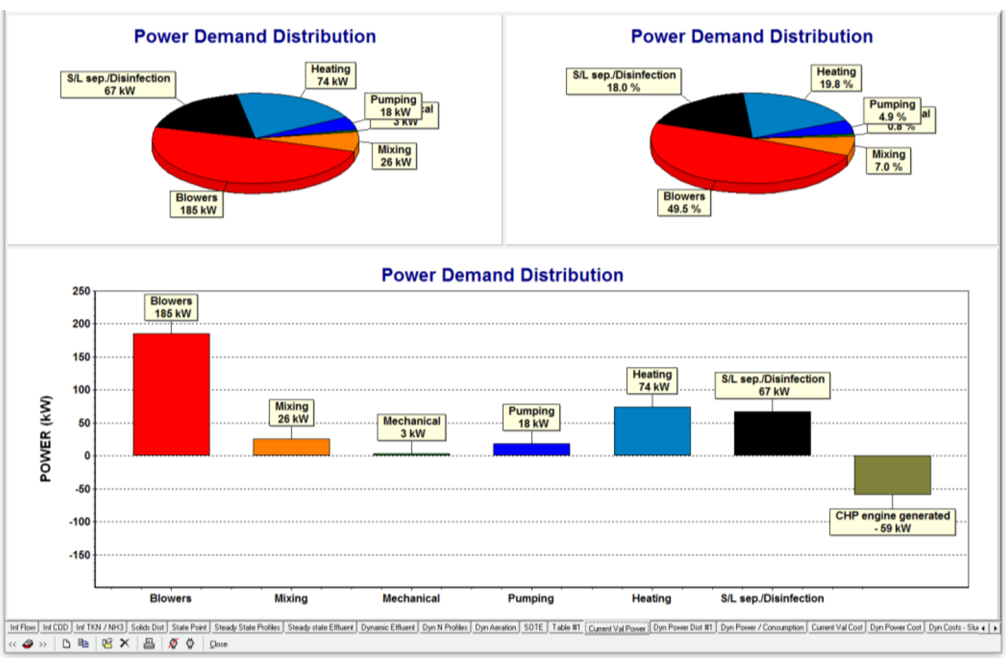
## Power Requirements – New Output Functionality

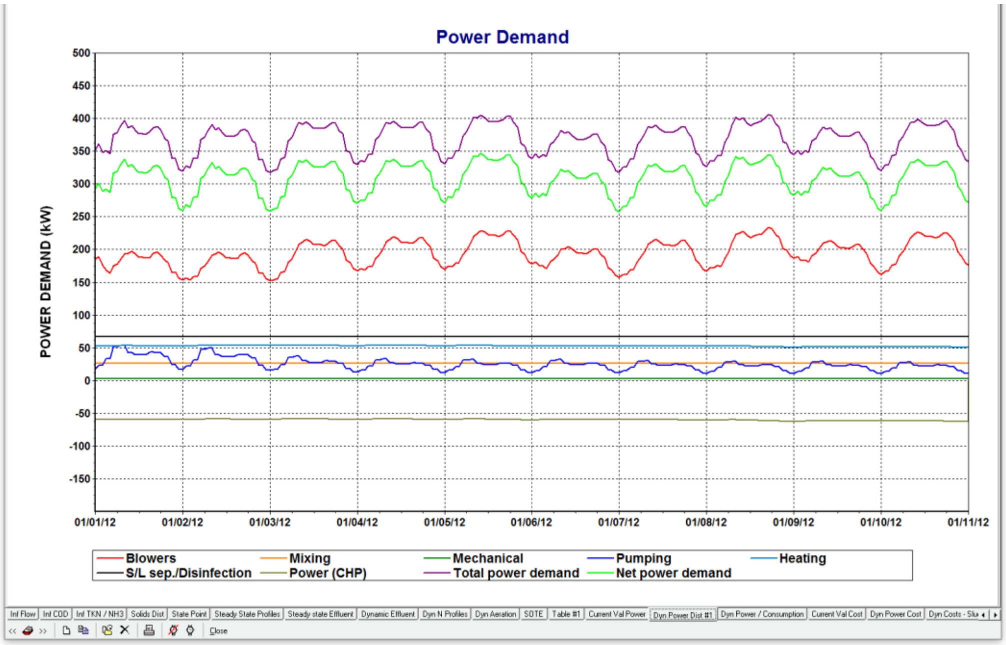
Power/Energy use plots can be generated semi-automatically in PetWin. These include:

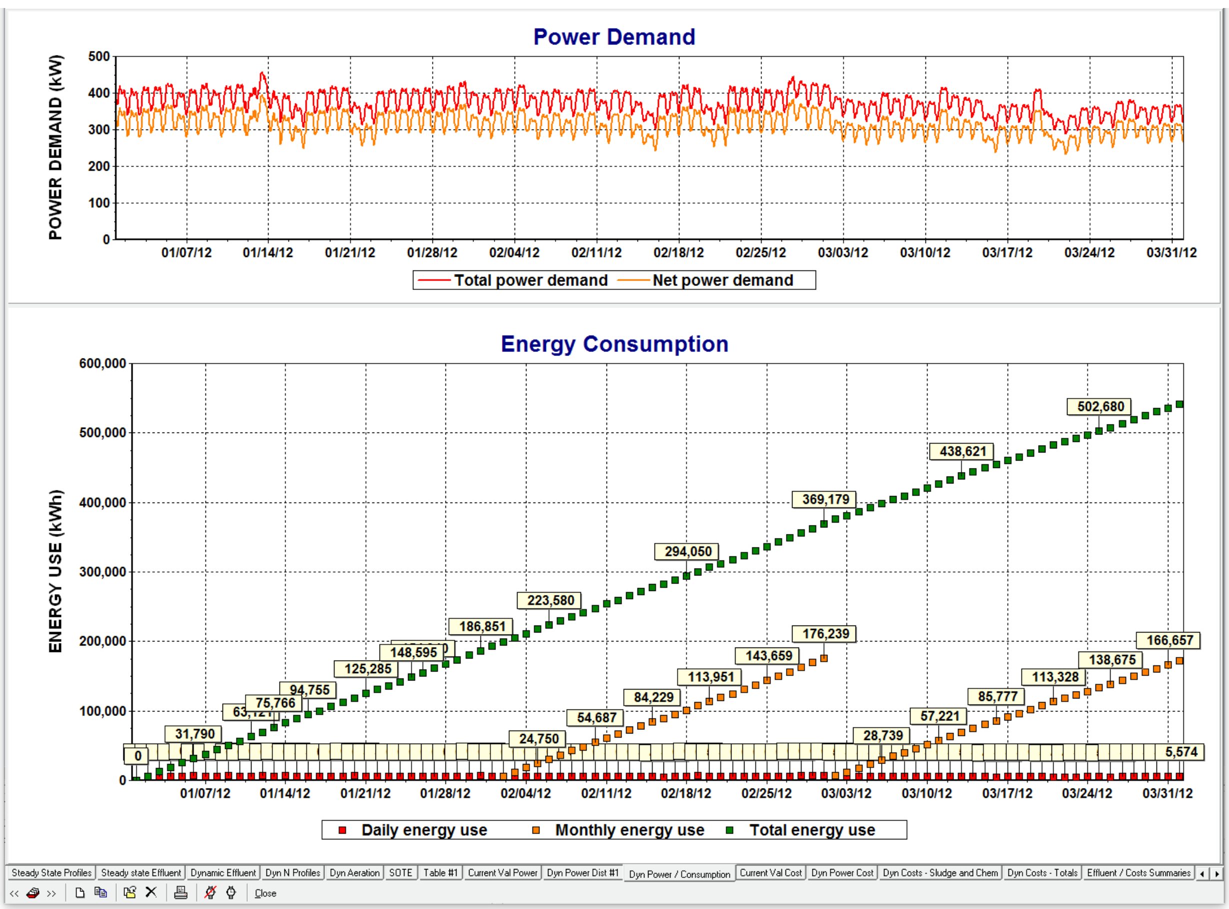
- **Power Demand Distribution** plots
  - Pie plot of instantaneous power demand
  - Bar plot of instantaneous power demand

- **Time Series plots**
  - Instantaneous power by category
  - Total and net instantaneous power
  - Energy consumption (Daily)
  - Energy consumption (Monthly)
  - Energy consumption (Yearly)
  - Energy consumption

For power demand distribution and time series plots, you are only required to select the elements that you want included in the plots. PetWin then performs the necessary calculations (such as plotting daily, monthly, yearly, and total overall cumulative energy consumption) and generates the plot. You then may customize the appearance of the chart using PetWin's powerful chart and series formatting tools.






In addition to these plots, you can also add pre-defined power tables to the album:

Album Database View

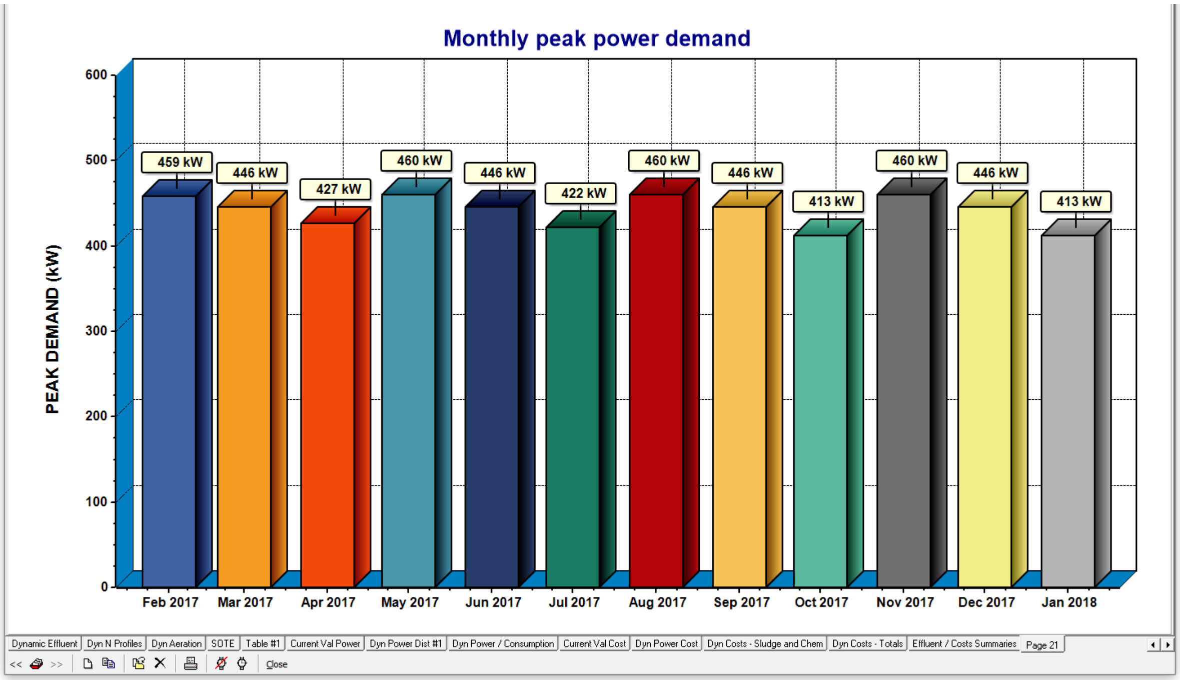
| Power Categories | Power Demand [kW] | Cost (Power consumption) [$/hour] |
|---|---|---|
| Blowers | 210.82 | 21.50 |
| Mixing | 26.00 | 2.65 |
| Mechanical | 3.00 | 0.31 |
| Pumping | 18.39 | 1.88 |
| Heating | ----- | ----- |
| S/L sep./Disinfection | 67.24 | 6.86 |
| ----- | ----- | ----- |
| Total of tabulated | 325.45 | 33.19 |
| ----- | ----- | ----- |
| HVAC | 150.00 | 15.30 |
| Service Charge | ----- | 0.05 |
| Peak Demand Charge | ----- | 5.47 |
| ----- | ----- | ----- |
| System total | 475.45 | 54.01 |
| Power (CHP) | -59.43 | ----- |
| ----- | ----- | ----- |
| System net | 416.02 | 47.95 |

You can add pre-defined air supply group (*i.e.* blower) tables to the album. These tables show the breakdown of power requirements for different air supply groups that have been defined, along with various calculated values used in the blower power calculations (*e.g.* intake pressure, discharge pressure, intake airflow):

Album Database View

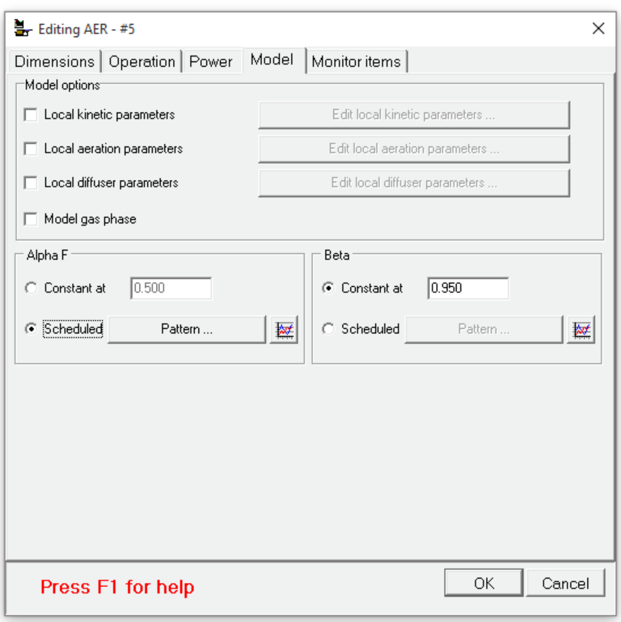
| Air supply group | Power [kW] | Intake pressure [kPa] | Discharge pressure [kPa] | Intake airflow [Humid m3/hr (field)] |
|---|---|---|---|---|
| Group #1 | 146.30 | 97.83 | 148.98 | 9034.42 |
| Group #2 | 64.52 | 97.83 | 148.98 | 3983.97 |
| Unaerated | 0 | 97.83 | 148.98 | 0 |
| ----- | ----- | ----- | ----- | ----- |
| Total | 210.82 | ----- | ----- | 13018.38 |

Finally, you can add a chart that shows the peak 15-minute power demand for each month over the most recent 12 months of simulation; this facilitates calculating and checking demand charges for the subsequent month:




## Variable Alpha & Beta

PetWin has the ability to vary the alpha and beta parameters used in its aeration calculations with time. Emerging research and measurement experience has indicated that alpha follows influent loading patterns to some degree. You can use this option to fine-tune calibration of PetWin's aeration model. The small chart buttons can be used to rapidly plot a time series of alpha and/or beta.

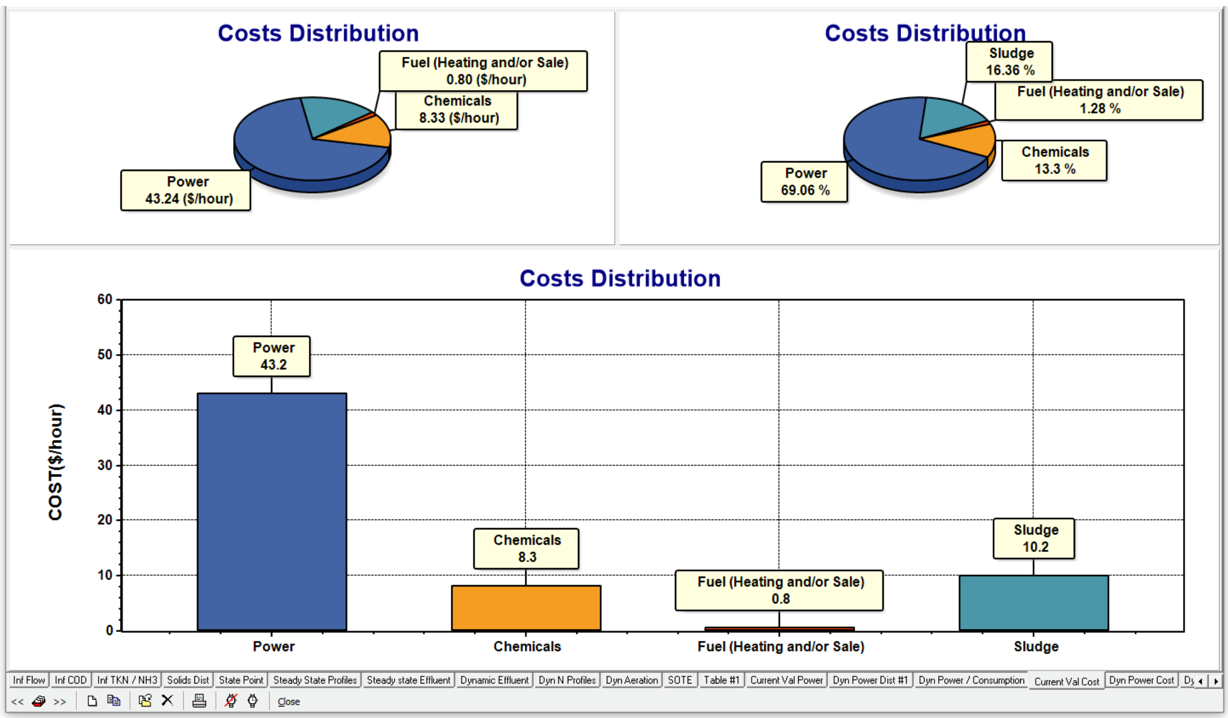



Alpha and beta can also be plotted from the general time and current value series dialogue boxes.

## Costing Calculations

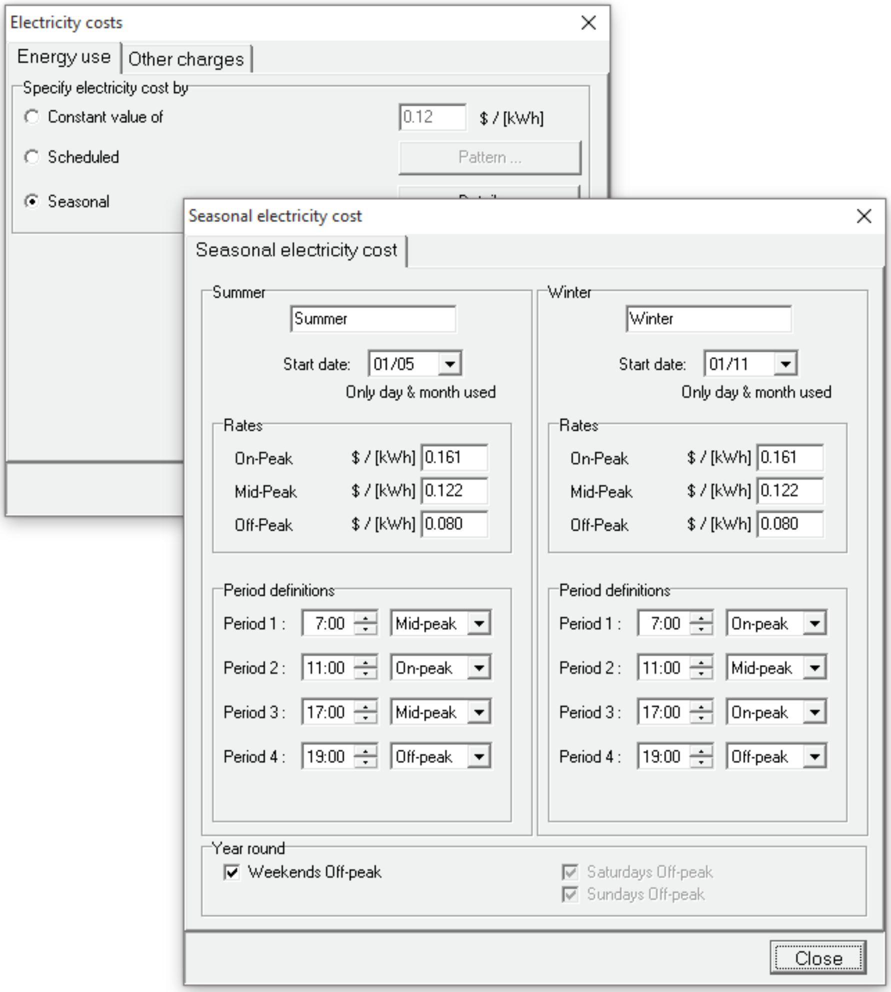
PetWin 5.2 has the facility to track and totalize operating costs using localized currency units in four separate categories:

1. Costs associated with energy consumption.
2. Costs associated with consumption of chemicals / consumables.
3. Costs associated with sludge disposal.
4. Costs associated with fuel consumption.

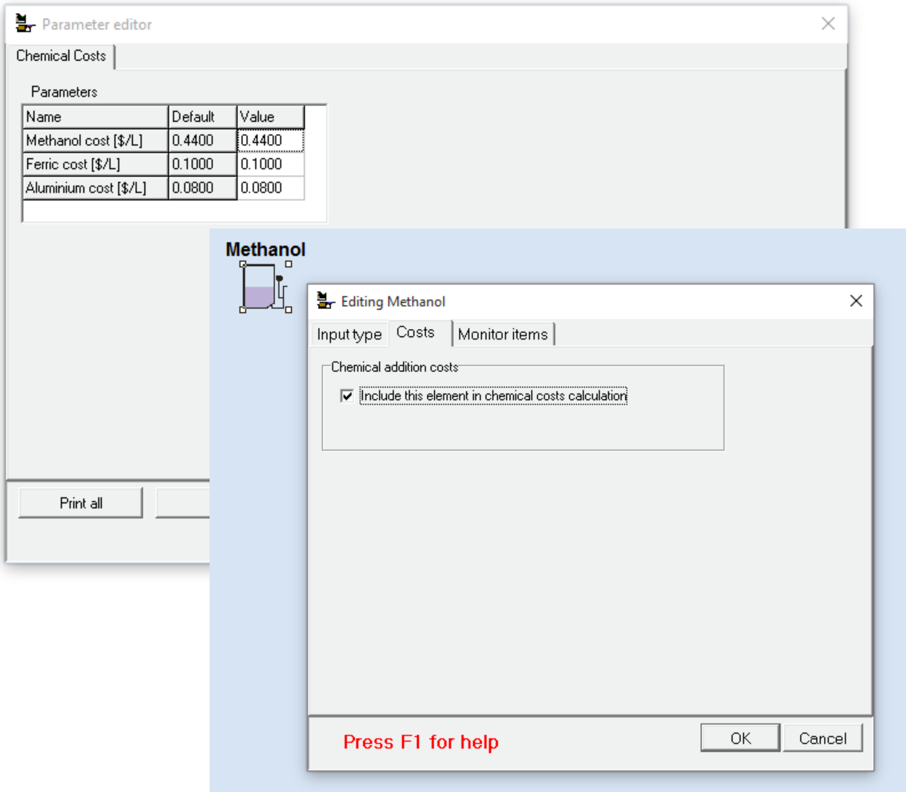



Electricity costs are an important consideration in any operating cost analysis, and PetWin makes it easy to input and account for complex factors such as varying daily rate structures for different seasons and peak demand charges. For example, suppose you want to implement an electricity rate structure such as the one shown below (HydroOne, 2015):

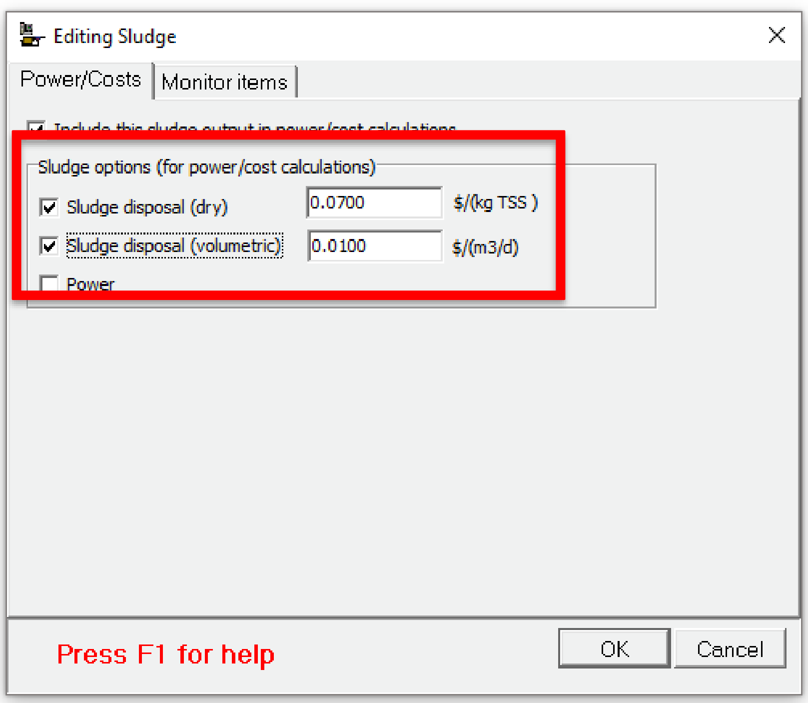
Doing this is simple in PetWin – selecting the seasonal rates option offers a convenient interface for setting up different daily electricity rate structures for different seasons.



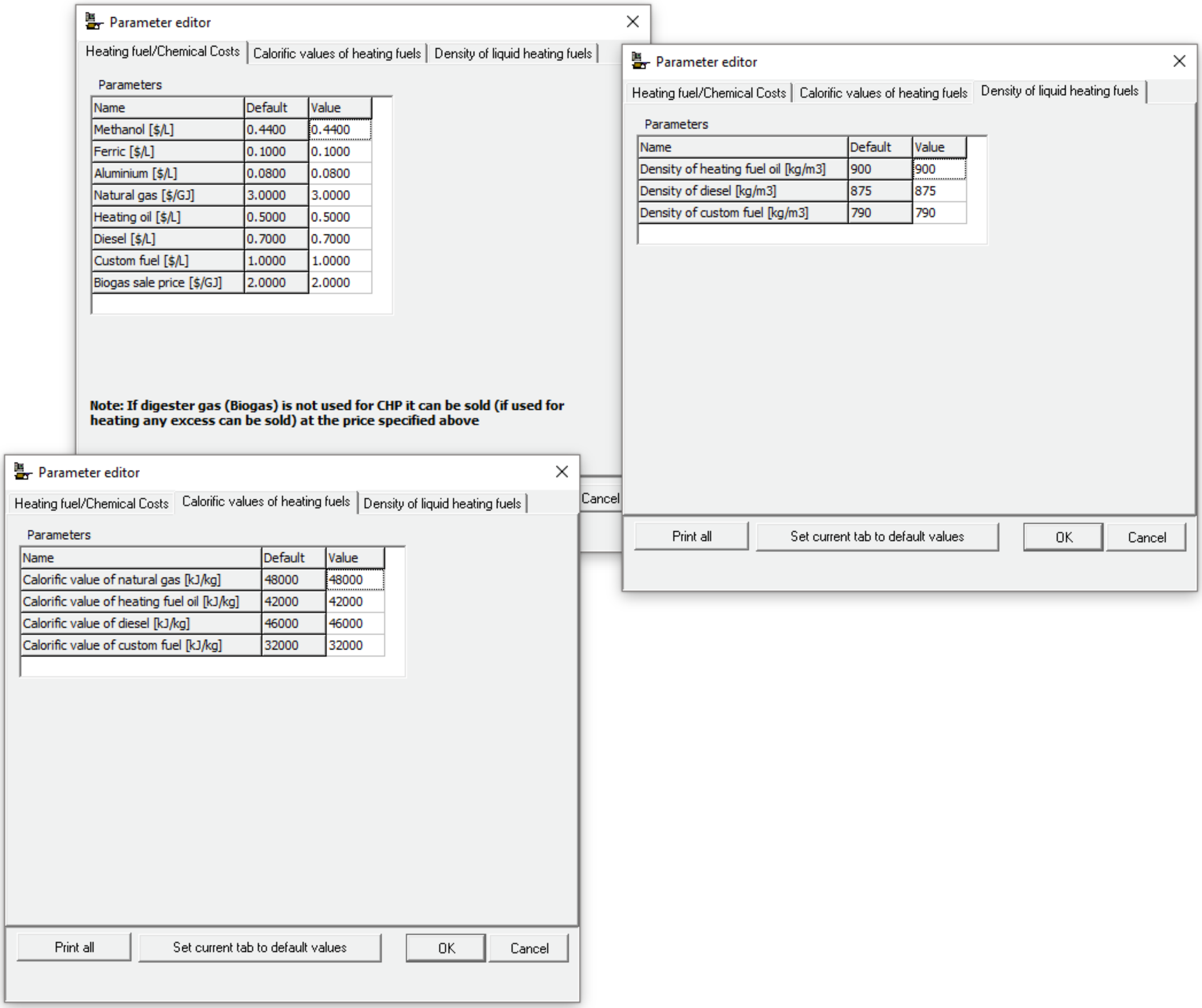

Chemical costs are tracked in PetWin on a global basis for consumables such as methanol or metal salts on a cost per unit volume basis, as shown below. Also, you have the option to include individual elements from your flowsheet in the overall project cost tracking by checking or un-checking the option to include that element on its **Costs** tab.




Sludge disposal costs can be calculated on a unit volume and/or unit mass basis:



Cost, energy content, and liquid density for a variety of heating fuels may be specified *via* the **Project > Costs/Energy > Fuel/Chemical** menu:

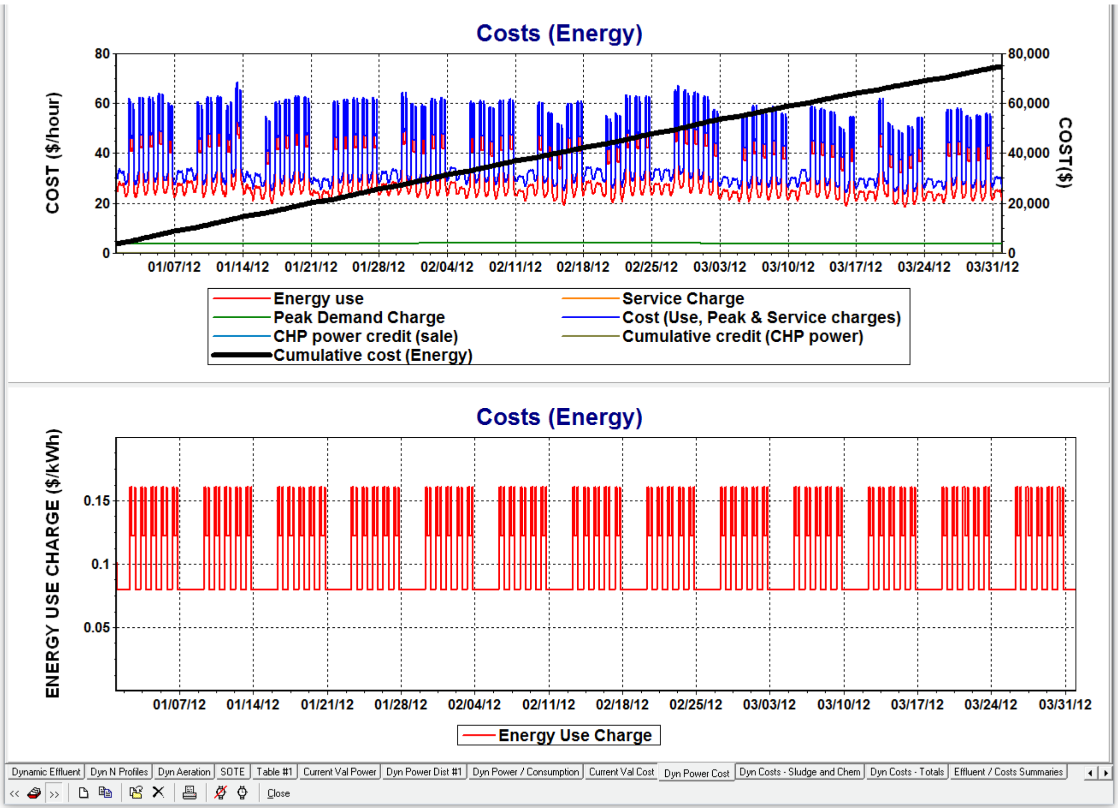



There are three potential “cost credit” or “revenue streams” in PetWin 5.2:

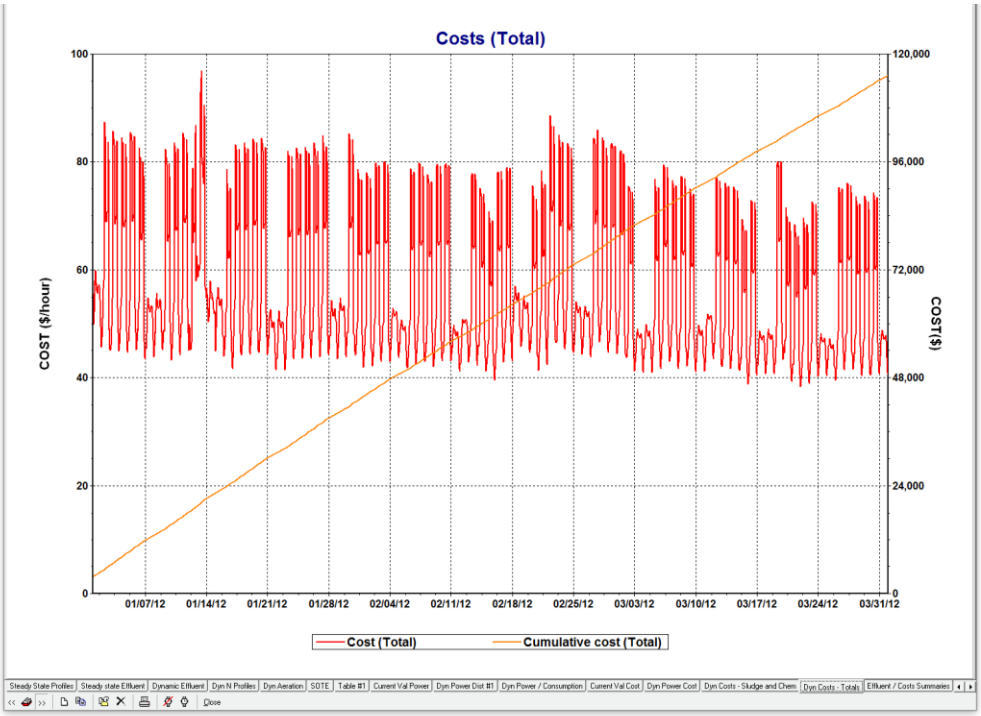
1. Sale of CHP power back to the electricity grid.
2. Sale of CHP-generated heat.
3. Anaerobic digester biogas.

## Costing Output

PetWin enables you to look at a detailed dynamic breakdown of “instantaneous” cost for power and energy, taking into account the complexity of varying daily energy costs. Furthermore, PetWin will automatically keep a running tally of the total energy costs to date:




Similarly, PetWin will track both the “instantaneous” and running total costs for the entire facility, including energy, sludge handling, and chemicals:




## Speed Improvements

PetWin 5.2 contains significant improvements in both steady state and dynamic simulation speed, particularly for (a) large flowsheets incorporating many elements; and (b) systems incorporating biofilm elements (*e.g.* media bioreactors in MBBR and IFAS configurations, submerged aerated filters, trickling filters, *etc.*).

## Speed Improvements - Steady State Simulation

The basic methodology for steady state simulations remains unchanged. That is, PetWin uses a “hybrid” solver that combines a Decoupled Linear Search (DLS) method and a Modified Newton-Raphson (MNR) method. The solver typically starts with a few iterations of DLS, and then switches to MNR to finish. The MNR is much more efficient at obtaining solutions, but it is computationally intensive. For example, in previous versions of PetWin, the MNR could take up to several minutes per iteration for systems with large, complex flowsheets. Given that several iterations often are required, this translated into steady state solution times of 20-30 minutes for very large systems.

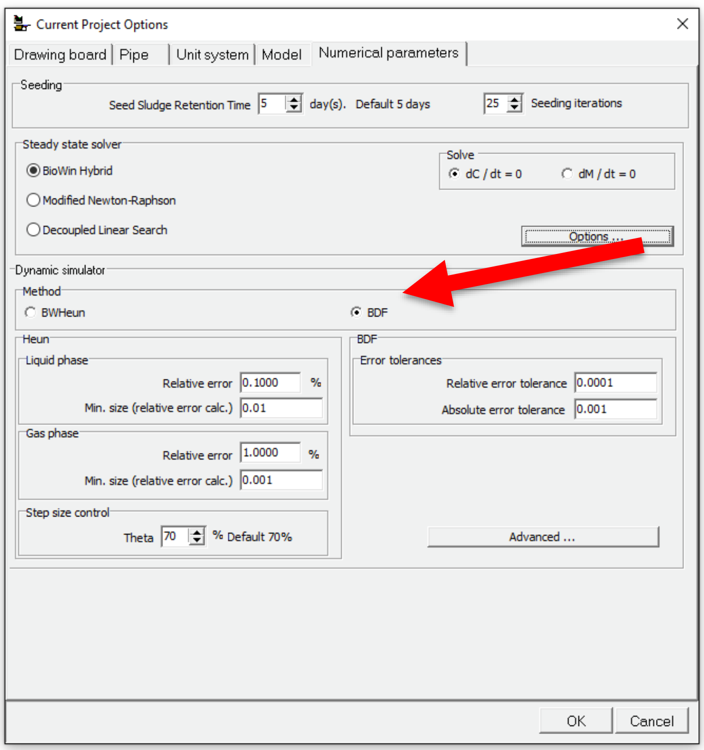
In PetWin 5.2, the numerical engine underlying the MNR method has been replaced, resulting in huge gains for large flowsheets. **For example, in our internal testing we have systems that were taking ~200 seconds per iteration reduce to ~4 seconds per iteration, *i.e.* 50 times faster!**

## Speed Improvements - Dynamic Simulation

PetWin 5.2 uses a new dynamic integration method known as BDF (Backwards Differentiation Formula). The BDF method is faster than the previous method for large, complex flowsheets and flowsheets incorporating biofilm-based elements. Our PetWin 5.2 testing has indicated:

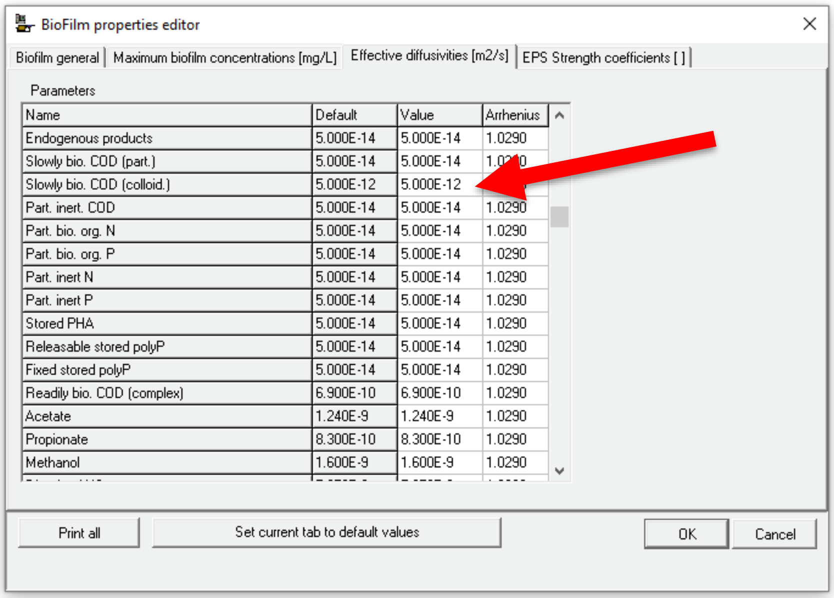
- **Large systems not incorporating biofilm reactors run 3 – 6 times faster**
- **Systems incorporating biofilm reactors run 10 – 50+ times faster**

If you open the **Project > Current Project Options > Numerical parameters** tab shown below, the BDF method should be selected as the default method – even for a file you created in a previous version of PetWin. The "old" PetWin method (BWHeun) is also still available because the new BDF method is not yet available for simulation of SBR systems.

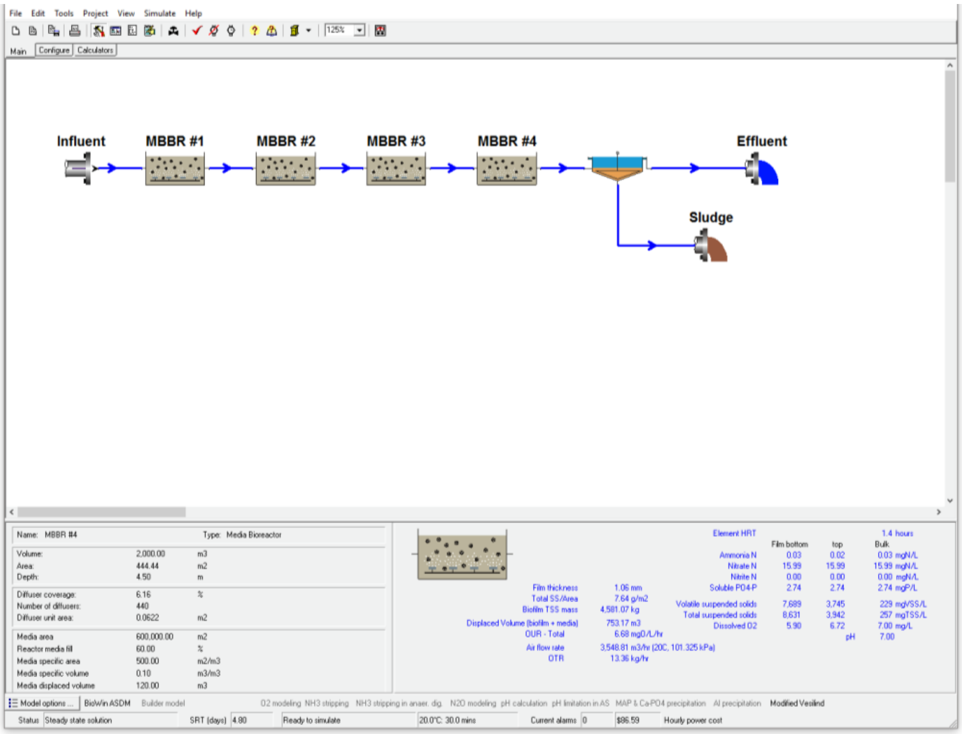


## Model Change – Diffusion of Colloidal Material in Biofilms

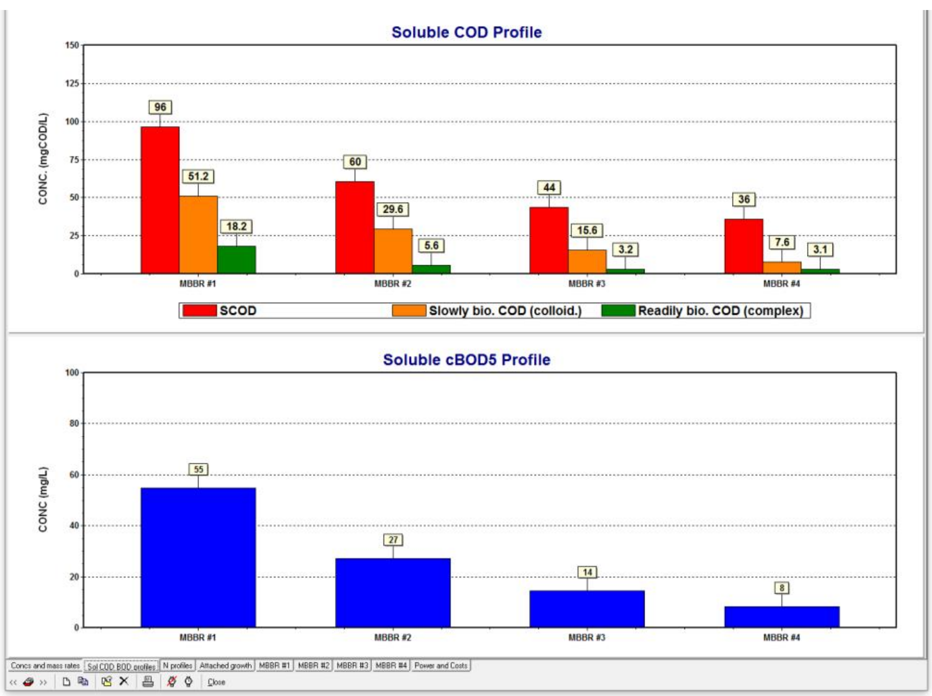
PetWin's biofilm model has always incorporated a diffusion rate for colloidal material into the biofilm layers. This parameter can be found on the **Project > Parameters > Biofilm > Effective diffusivities** tab shown below:




In previous versions of PetWin, the default value assigned for the effective diffusivity of colloidal material was 5.0 x $10^{-12}$. This value is greater than the one assigned to particulate material (*e.g.* particulate degradable COD has a value of 5.0 x $10^{-14}$), but lower than soluble material (*e.g.* soluble readily biodegradable COD has a value of 6.9 x $10^{-10}$). The fate of colloidal material in biofilm systems is directly impacted by this parameter value. For example, consider the system below consisting of four moving bed bioreactor (MBBR) units in series:

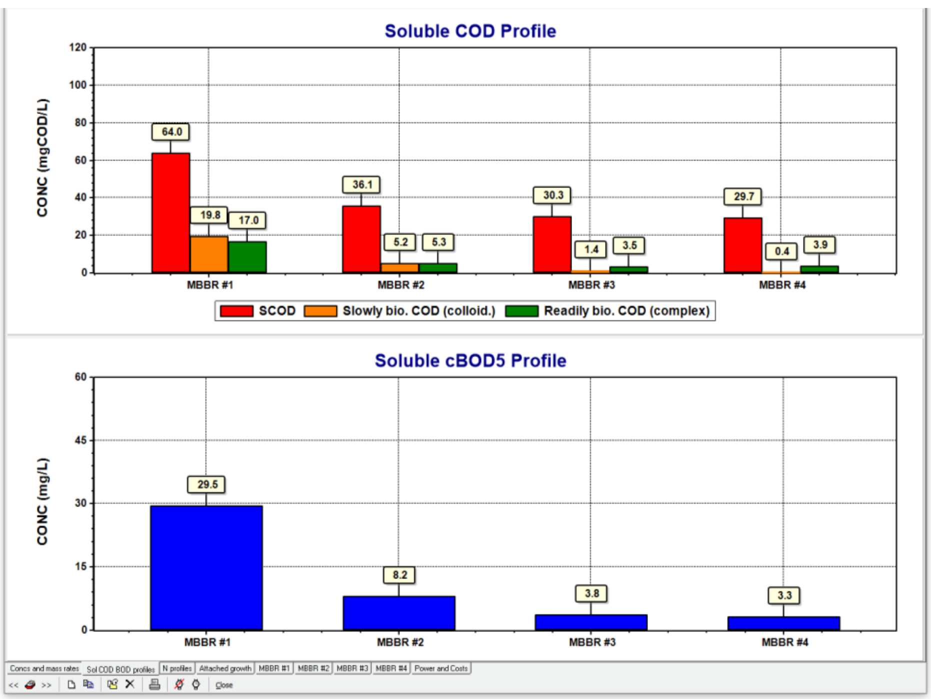



Using the default diffusivity parameters, the soluble COD and BOD profiles are as follows:



Note that soluble BOD is not significantly reduced until the end of the third MBBR unit (bottom chart). This can be explained by looking at the top chart. Although the uptake of soluble readily biodegradable material is nearly complete by the end of the second unit, the uptake of colloidal material is not as rapid and much of the soluble BOD leaving the second and third MBBR units is due to colloidal material.

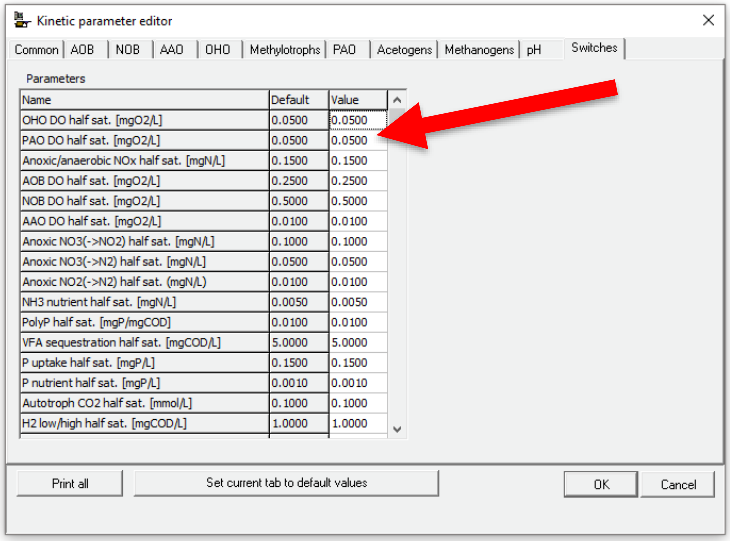
Our investigations into performance of systems like the one pictured above suggests that the soluble BOD is removed to a greater extent by the end of the second stage. As a result, in PetWin 5.2 the default value assigned for the effective diffusivity of colloidal COD material has been ***increased*** to $5.0 \times 10^{-10}$. This value is closer to, but slightly less than, the value assigned to soluble material (recall that soluble readily biodegradable COD has a value of $6.9 \times 10^{-10}$). This results in more complete removal of colloidal material by the end of the second stage, and gives the soluble BOD profile shown below:




## Model Change – Dissolved Oxygen Half-Saturation Constant for Phosphorus Accumulating Organisms

In previous versions of PetWin, the phosphorus accumulating organisms (PAO) used the same dissolved oxygen (DO) half-saturation model parameter as the ordinary heterotrophic organisms (OHO). This reflected conventional wisdom which suggested that PAOs did not take up phosphorus effectively at low DO concentrations. However, current research (Jimenez *et al.*, 2014) suggests that PAOs are in fact able to take up phosphorus effectively at very low DO concentrations. To reflect these findings, PetWin now incorporates a separate dissolved oxygen (DO) half-saturation model parameter for PAOs. This improves the model's ability to track biological phosphorus removal behavior in systems operating under low DO /

simultaneous nitrification-denitrification conditions. This parameter is found *via* the **Project > Parameters > Kinetic > Switches** tab shown below:




## Model Change – Compression Settling of Solids

In PetWin users can define a solids concentration that represents the maximum compactability of solids in a model settling tank unit (*i.e.* a limit on underflow TSS concentration). In earlier versions, as the solids concentration in a layer of a model settling tank approached the maximum compactability value, that layer would "re-suspend" solids into the layer above; in this way the constraint on maximum compactability was maintained. This approach was not always satisfactory because (a) under certain conditions it resulted in unstable behavior, and (b) it did not properly reflect what physically occurs as solids transition from the hindered settling regime to compression settling.

In PetWin 5.2, the approach for modelling settling behavior at high solids concentrations and imposing a maximum compactability has changed. The following section discusses the new approach used at high solids concentrations, as well as the approach that has always been used to model settling at low concentrations.

Sludge settling velocity is modeled according to the Vesilind equation for hindered settling. The settling velocity in a given layer is given by:

$$V_{S,i} = V_0 \, e^{-KX_i} \qquad (1)$$

where $V_0$ = maximum settling velocity (m/d), $K$ = hindered settling parameter (m3/kg TSS), and $X_i$ = total suspended solids (TSS) concentration (kgTSS/m3) in layer i.

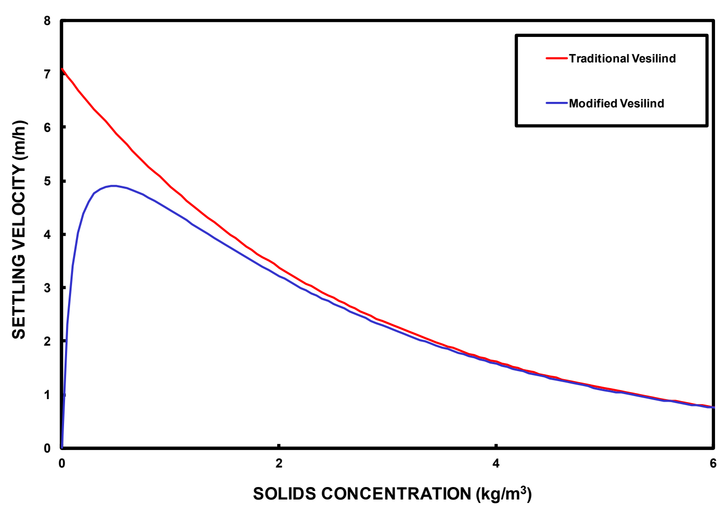
A criticism of Eq. 1 is that it over-predicts settling velocities at low concentrations. Furthermore, the standard Vesilind equation does not account for compression settling. PetWin employs switching functions to switch off the sludge settling velocity expression at very low solids concentrations, and also as the solids concentration approaches the maximum solids compactability in the lower layers of the settling tank. This provides a simplified method of modeling the poorly flocculating solids in the upper layers of the settling tank, and compression setting in the lower layers. As the solids concentration in the upper layers approaches a user-definable concentration (the upper layer settling velocity switch), the settling velocity approaches zero, and solids are carried upwards by the overflow stream (resulting in solids in the settling tank effluent). As the solids concentration in the lower layers approaches the user-definable maximum compactability, the settling velocity is quickly and smoothly reduced to zero.

The complete settling velocity equation used by PetWin is:

$$V_{S,i} = V_0\, e^{-KX_i} \cdot \left(\frac{X_i}{K_S + X_i}\right) \cdot \left(\frac{1}{1 + e^{-Compression\ Settling\ Transition\ Factor \cdot (X_{MAX} - X_i)}}\right) \quad (2)$$

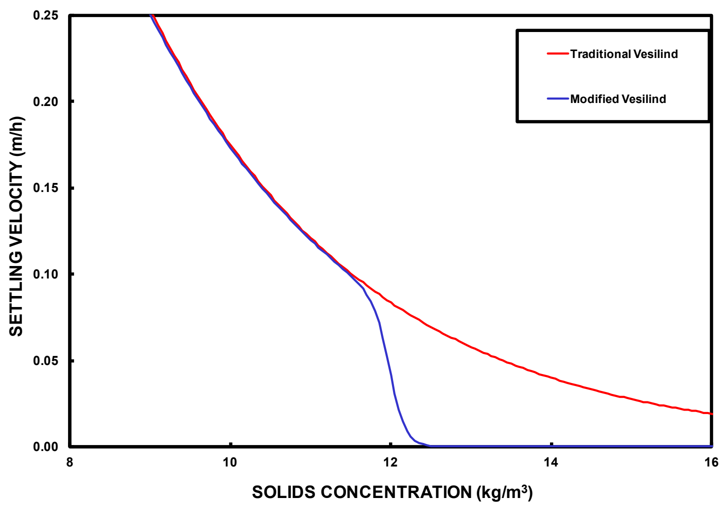
Where $K_S$ is the upper layer settling velocity switch, $X_{MAX}$ is the maximum compactability, and other variables are the same as in Eq. 1.

The switching function effect at low concentrations for a given combination of settling velocity parameters is shown in the figure below:




You can increase the suspended solids concentration at which settling velocity is decreased by increasing the $K_S$ parameter. Varying the $K_S$ parameter is a possible way to vary the predicted effluent suspended solids.

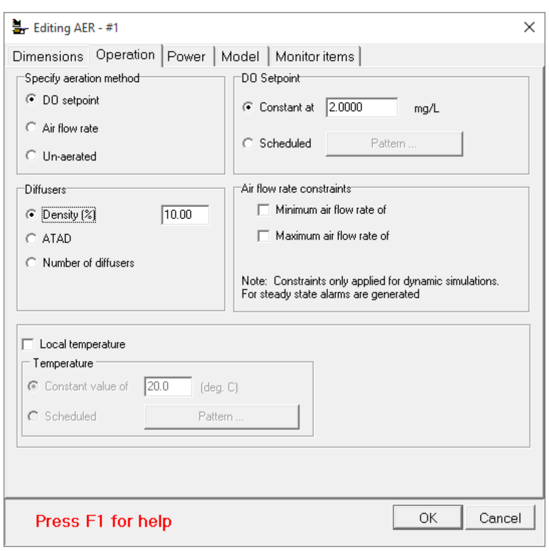
The switching function effect at high concentrations in the lower layers of the settling tank for a given combination of settling velocity parameters is shown in the figure below. Lowering the $X_{MAX}$ parameter is a way to simulate poorly compressible bulking sludge.




## Usability Improvements

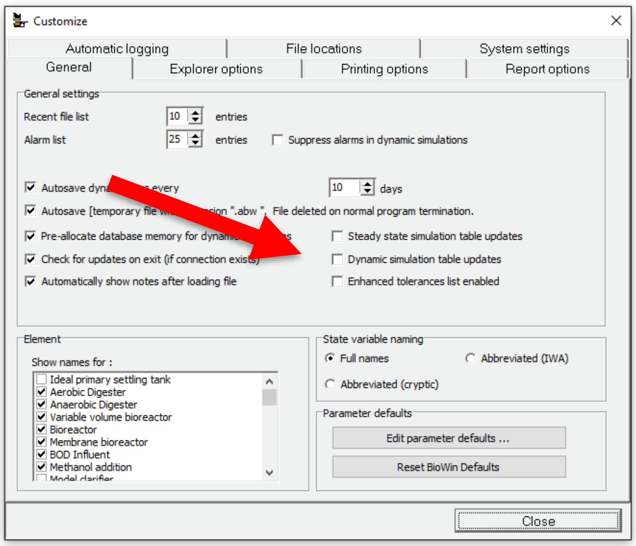
In addition to the new features above, a number of usability improvements have been made, including:

- Input diffuser coverage as diffuser density, ATAD, or diffuser count. PetWin automatically converts from one basis to another.

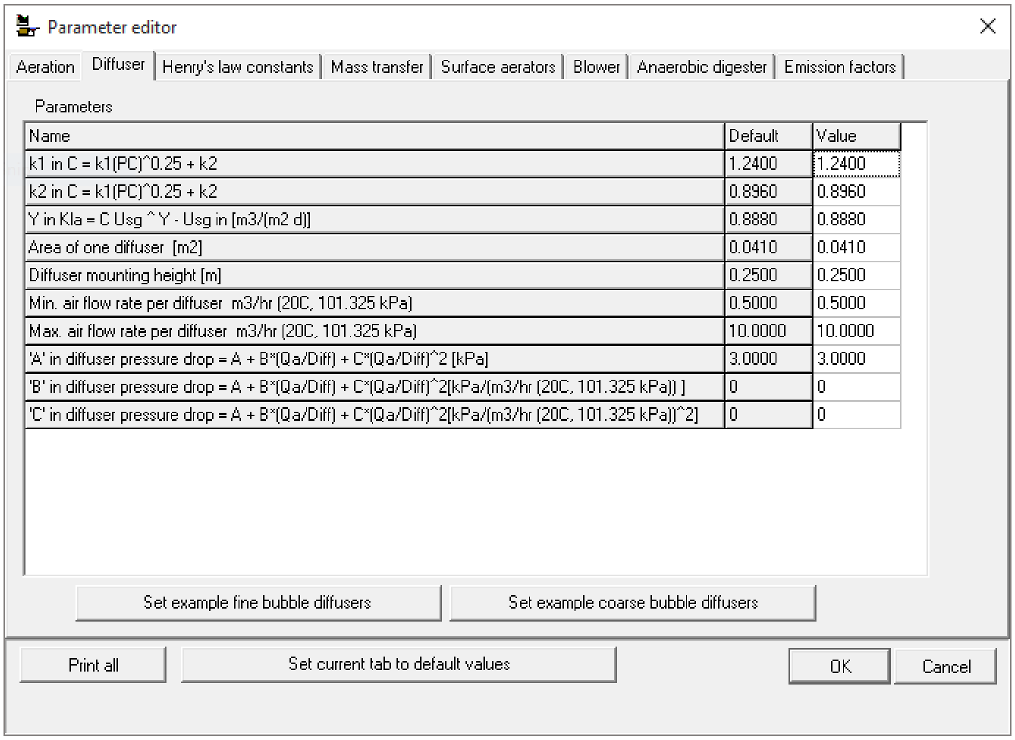


- You can choose whether or not the Notes window is displayed when you open a PetWin file, by checking or unchecking the **Automatically show notes after loading file** box under **Tools > Customize > General**

- Users of previous versions of PetWin reported a "sluggish" behavior in PetWin files that incorporated very large tables in the PetWin Album. This is no longer the case, so long as the user does not set PetWin to update tables continually during simulations. The **Steady state simulation table updates** and **Dynamic simulation table updates** checkboxes ***should remain at the default unchecked state***.



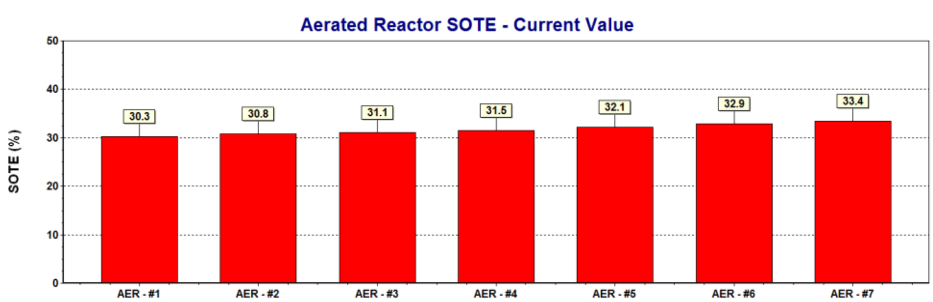

- Diffuser parameters are now globally applied to all bioreactors by default (although they can still be localized if desired). There is now a Diffuser tab under **Project** > **Parameters** > **Aeration/Mass transfer…** that can be used to easily set up the same diffuser characteristics across all bioreactors from one interface.

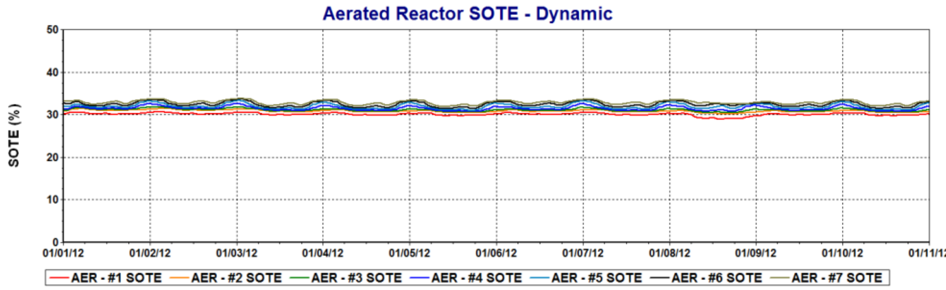



| Name | Default | Value |
|---|---|---|
| k1 in C = k1(PC)^0.25 + k2 | 1.2400 | 1.2400 |
| k2 in C = k1(PC)^0.25 + k2 | 0.8960 | 0.8960 |
| Y in Kla = C Usg ^ Y - Usg in [m3/(m2 d)] | 0.8880 | 0.8880 |
| Area of one diffuser [m2] | 0.0410 | 0.0410 |
| Diffuser mounting height [m] | 0.2500 | 0.2500 |
| Min. air flow rate per diffuser m3/hr (20C, 101.325 kPa) | 0.5000 | 0.5000 |
| Max. air flow rate per diffuser m3/hr (20C, 101.325 kPa) | 10.0000 | 10.0000 |
| 'A' in diffuser pressure drop = A + B*(Qa/Diff) + C*(Qa/Diff)^2 [kPa] | 3.0000 | 3.0000 |
| 'B' in diffuser pressure drop = A + B*(Qa/Diff) + C*(Qa/Diff)^2[kPa/(m3/hr (20C, 101.325 kPa)) ] | 0 | 0 |
| 'C' in diffuser pressure drop = A + B*(Qa/Diff) + C*(Qa/Diff)^2[kPa/(m3/hr (20C, 101.325 kPa))^2] | 0 | 0 |

- The diffuser parameters can now be quickly toggled between values representative of fine or coarse bubble diffusers, using the **"Set example fine bubble diffusers"** or **"Set example coarse bubble diffusers"** buttons.

- PetWin has new default fine bubble diffuser parameters that are more representative of current diffuser materials and performance.






- Right-clicking on any pattern input to PetWin (e.g. flow, RAS) now offers two options: **Copy** (which copies the pattern ***without*** headings and can be used to copy a pattern from one place to another within PetWin), and **Copy all** (which copies the pattern ***with*** headings and can be used to copy a pattern from PetWin into a Word, PowerPoint, or Excel table).

- A progress bar now shows at the bottom of the simulation control box while PetWin places numerical seed values in all flowsheet elements. This will only be readily evident on large flowsheets with many elements.

- Alarms will be generated for anion/cation limitation conditions.

- Right-click menu for adding a chart contains short-cuts for adding time series and current value series.

- The gas phase is now shown for MBR mass balance windows.

- Parameter temperature correction factors are now highlighted in red if they have been changed from default values.
- Improved plotting series naming for multi-layer elements (*e.g.* SAF).

- It is now possible to display a Rates window for a SAF element.

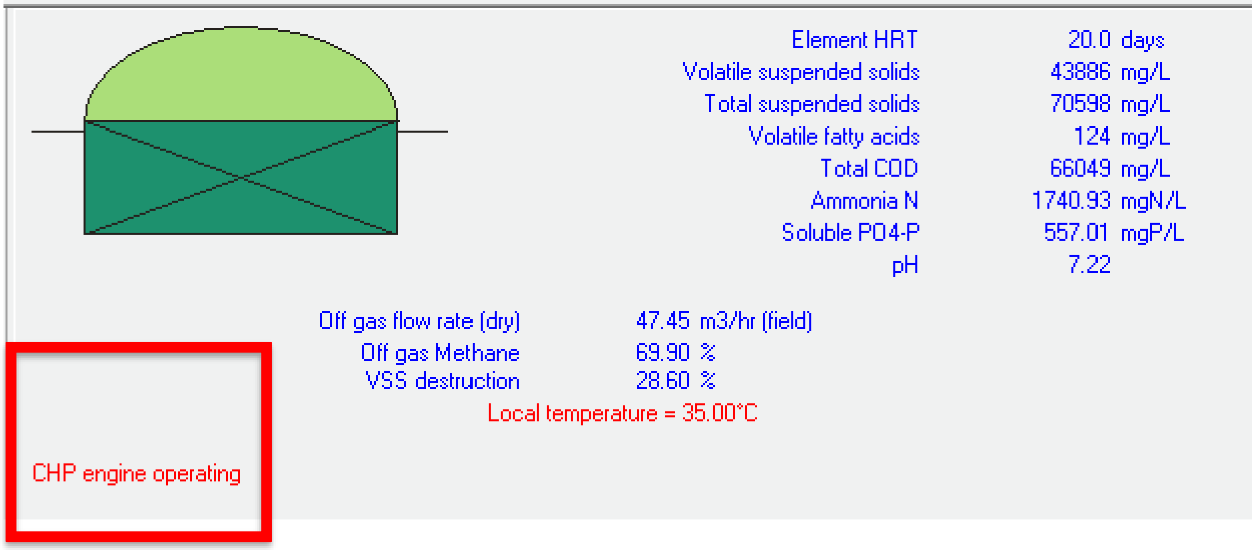
- Tighter numerical adherence to splitters with “zero” fractions and rates specified for a stream.

- Anaerobic digesters and variable volume bioreactors may now be set to “constant” volume.

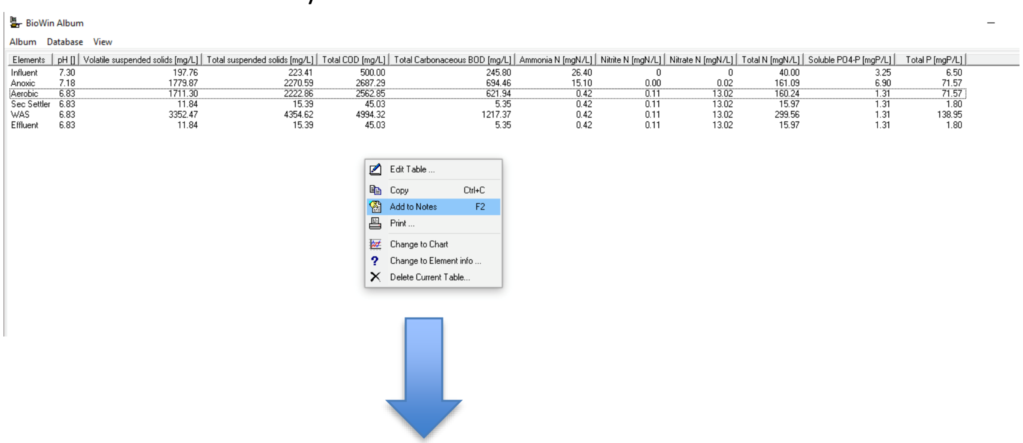
- Biofilm details tables in the Album may now be copied to the clipboard for exporting to Excel.

- Pop-up hints have been added to clarify pipe minor loss calculations in pump flowsheet elements.

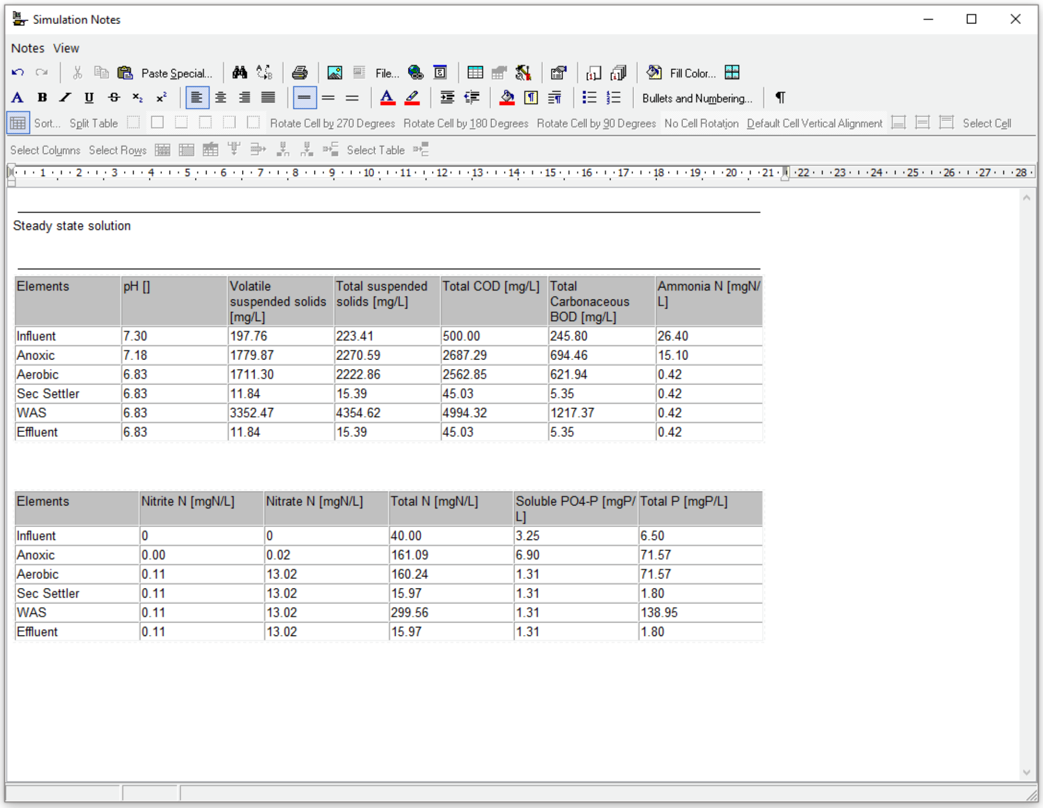
- If a CHP engine is associated with an anaerobic digester element, red text is shown in the fly-by pane as a visual indicator.




- Improved handling of how PetWin Album tables and charts are added to the PetWin Notes editor *via* the right-click **"Add to notes"** command. For example, tables are automatically formatted before being pasted to the Notes editor and tables with many columns are automatically divided into smaller tables that will fit the Notes editor:



| Elements | pH [] | Volatile suspended solids [mg/L] | Total suspended solids [mg/L] | Total COD [mg/L] | Total Carbonaceous BOD [mg/L] | Ammonia N [mgN/L] | Nitrite N [mgN/L] | Nitrate N [mgN/L] | Total N [mgN/L] | Soluble PO4-P [mgP/L] | Total P [mgP/L] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Influent | 7.30 | 197.76 | 223.41 | 500.00 | 245.80 | 26.40 | 0 | 0 | 40.00 | 3.25 | 6.50 |
| Anoxic | 7.18 | 1779.87 | 2270.59 | 2687.29 | 694.46 | 15.10 | 0.00 | 0.02 | 161.09 | 6.90 | 71.57 |
| Aerobic | 6.83 | 1711.30 | 2222.86 | 2562.85 | 621.94 | 0.42 | 0.11 | 13.02 | 160.24 | 1.31 | 71.57 |
| Sec Settler | 6.83 | 11.84 | 15.39 | 45.03 | 5.35 | 0.42 | 0.11 | 13.02 | 15.97 | 1.31 | 1.80 |
| WAS | 6.83 | 3352.47 | 4354.62 | 4994.32 | 1217.37 | 0.42 | 0.11 | 13.02 | 299.56 | 1.31 | 138.95 |
| Effluent | 6.83 | 11.84 | 15.39 | 45.03 | 5.35 | 0.42 | 0.11 | 13.02 | 15.97 | 1.31 | 1.80 |




Steady state solution

| Elements | pH [] | Volatile suspended solids [mg/L] | Total suspended solids [mg/L] | Total COD [mg/L] | Total Carbonaceous BOD [mg/L] | Ammonia N [mgN/L] |
|---|---|---|---|---|---|---|
| Influent | 7.30 | 197.76 | 223.41 | 500.00 | 245.80 | 26.40 |
| Anoxic | 7.18 | 1779.87 | 2270.59 | 2687.29 | 694.46 | 15.10 |
| Aerobic | 6.83 | 1711.30 | 2222.86 | 2562.85 | 621.94 | 0.42 |
| Sec Settler | 6.83 | 11.84 | 15.39 | 45.03 | 5.35 | 0.42 |
| WAS | 6.83 | 3352.47 | 4354.62 | 4994.32 | 1217.37 | 0.42 |
| Effluent | 6.83 | 11.84 | 15.39 | 45.03 | 5.35 | 0.42 |

| Elements | Nitrite N [mgN/L] | Nitrate N [mgN/L] | Total N [mgN/L] | Soluble PO4-P [mgP/L] | Total P [mgP/L] |
|---|---|---|---|---|---|
| Influent | 0 | 0 | 40.00 | 3.25 | 6.50 |
| Anoxic | 0.00 | 0.02 | 161.09 | 6.90 | 71.57 |
| Aerobic | 0.11 | 13.02 | 160.24 | 1.31 | 71.57 |
| Sec Settler | 0.11 | 13.02 | 15.97 | 1.31 | 1.80 |
| WAS | 0.11 | 13.02 | 299.56 | 1.31 | 138.95 |
| Effluent | 0.11 | 13.02 | 15.97 | 1.31 | 1.80 |

- The software package that PetWin uses for its charting engine (TeeChart) has updated to a new version. The functionality is similar to what it was in previous PetWin versions, but the interface has changed somewhat.

Further details on all new features in PetWin 5.2 can be found in the Help manual.