**Back calculation:**

We Are Agrisolar, and we are looking for a software developer because we want to build our own software for calculation and simulation of solar pumping system. I will write a description of the software we need as much as I could.

P.S. this software will be web-based as the client will put some data and the software will make a selection between various items and do a simulation based on a suggested trial, then the customer will have the option to alter these number to some limit, and then the simulation will happen again based on that.

The items which will be selected and the simulation will be based on these inputs:

IN1 = water requirements through the day (m3/day)

IN2 = dynamic head (m)

**IN3= cable length.**

IN4 = location (from a drop menu with specific options)

IN5 = mounting structure (from a drop menu with specific options)

IN6 = modules to be used (from a drop menu) and one of the options is ass new module and if that’s the case 3 new inputs will appear:

IN6,1 = voltage open circuit (Voc)

IN6,2 = Voltage at max. Power point

IN6,3 = max power.

The steps of the simulation will be divided into 3 process,

1st: selecting the pump:

**First step:**

* Q= IN1/6.5
* Hd = IN2

**Second step:+++-**

Each pump will have a range of the two variables (Q and Hd) like this sample

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| pump Rang |  |  |  |  |
| Pump name | Q(min) | Q(Max) | H(max) | H(min) |
| 46-7 | 35 | 55 | 57 | 44 |
| 46-9 | 35 | 55 | 70 | 56 |
| 46-12 | 35 | 55 | 111 | 78 |
| 60-6 | 50 | 75 | 45 | 26 |
| 60-8 | 50 | 75 | 62 | 37 |
| 60-10 | 50 | 75 | 77 | 47 |
| 60-12 | 50 | 75 | 92 | 56 |
| 77-3 | 70 | 93 | 34 | 25.5 |
| 77-4 | 70 | 93 | 45.8 | 34 |
| 77-5 | 70 | 93 | 58 | 43.6 |
| 77-6 | 70 | 93 | 69 | 51.8 |

From these two number select the pumps that fall in those ranges (there could more than one, and up to four pumps) each pump will have several table ay different head like this:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| SP77\_6 | | H=85 | | P(motor)=22kw |
|
|
| Q | eta(PUMP) | eta(total) | P1 | p2 |
| 0 | 0.1 | 0.1 | 10.92 | 8.593 |
| 6 | 15.3 | 12.1 | 11.38 | 9.013 |
| 12 | 29 | 23.1 | 11.94 | 9.513 |
| 18 | 40.6 | 32.6 | 12.71 | 10.19 |
| 24 | 50 | 40.3 | 13.71 | 11.05 |
| 30 | 57.1 | 46.3 | 14.93 | 12.09 |
| 36 | 62.4 | 50.7 | 16.34 | 13.28 |
| 42 | 66.3 | 54 | 17.91 | 14.59 |
| 48 | 69.1 | 56.3 | 19.63 | 15.99 |
| 54 | 71.2 | 58 | 21.46 | 17.46 |
| 60 | 72.8 | 59.2 | 23.37 | 18.98 |
|  |  |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| SP77\_6 | | H=80 | | P(motor)=22kw |
|
|
| Q | eta(PUMP) | eta(total) | P1 | p2 |
| 0 | 0.1 | 0.1 | 10.1 | 7.885 |
| 6.5 | 17 | 13.4 | 10.57 | 8.318 |
| 13 | 31.8 | 25.2 | 11.17 | 8.858 |
| 19.5 | 44.1 | 35.2 | 12.02 | 9.602 |
| 26 | 53.5 | 43.1 | 13.12 | 10.56 |
| 32.5 | 60.4 | 48.9 | 14.46 | 11.7 |
| 39 | 65.3 | 53 | 16 | 13 |
| 45.5 | 68.7 | 55.9 | 17.69 | 14.41 |
| 52 | 71.1 | 58 | 19.51 | 15.9 |
| 58.5 | 72.9 | 59.4 | 21.44 | 17.45 |
| 65 | 74.2 | 60.3 | 23.46 | 19.05 |

**Third step:**

We select the table with the H = IN2, and if the IN2 is between two tables select the nearest, and a factor will be multiplying by Q and this factor will be (H/IN2)

**Fourth step:**

We will use the numbers of the P2 column and the Q column to form a polynomial equation as follow:

|  |  |
| --- | --- |
| Coeff | Value |
| c5 | 1.12294E-06 |
| c4 | -0.000296321 |
| c3 | 0.030474244 |
| c2 | -1.540625948 |
| c1 | 40.90674043 |
| b | -407.0073525 |

2nd process: selecting the radiation data:

**Fourth step**:

For each location in IN3 there will be as many data as the options in IN4

And the table will look like this

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Avg |
| 5:22 | 0 | 0 | 0 | 0 | 0 | 34 | 45 | 0 | 0 | 0 | 0 | 0 | 7 |
| 5:37 | 0 | 0 | 0 | 0 | 44 | 53 | 62 | 0 | 0 | 0 | 0 | 0 | 13 |
| 5:52 | 0 | 0 | 0 | 0 | 63 | 70 | 98 | 40 | 0 | 0 | 0 | 0 | 23 |
| 6:07 | 0 | 0 | 0 | 63 | 99 | 107 | 141 | 69 | 0 | 0 | 0 | 0 | 40 |
| 6:22 | 0 | 0 | 52.08 | 103 | 140 | 151 | 190 | 109 | 68 | 0 | 0 | 0 | 68 |
| 6:37 | 0 | 0 | 101.37 | 148 | 186 | 199 | 241 | 156 | 113 | 39 | 0 | 0 | 99 |
| 6:52 | 0 | 67 | 152.52 | 199 | 235 | 250 | 295 | 208 | 164 | 110 | 0 | 0 | 140 |
| 7:07 | 83 | 120 | 209.25 | 253 | 286 | 302 | 350 | 263 | 220 | 166 | 36 | 0 | 191 |
| 7:22 | 144 | 175 | 267.84 | 308 | 338 | 356 | 405 | 320 | 278 | 226 | 111 | 43 | 248 |
| 7:37 | 199 | 232 | 327.36 | 364 | 390 | 409 | 460 | 379 | 338 | 287 | 165 | 145 | 308 |
| 7:52 | 254 | 290 | 386.88 | 420 | 441 | 462 | 514 | 437 | 398 | 348 | 222 | 200 | 364 |
| 8:07 | 308 | 349 | 445.47 | 475 | 491 | 514 | 566 | 495 | 458 | 409 | 280 | 256 | 421 |
| 8:22 | 360 | 406 | 502.2 | 528 | 540 | 565 | 616 | 551 | 516 | 468 | 339 | 311 | 475 |
| 8:37 | 409 | 462 | 557.07 | 579 | 586 | 613 | 664 | 606 | 572 | 525 | 398 | 365 | 528 |
| 8:52 | 456 | 515 | 609.15 | 628 | 630 | 659 | 710 | 658 | 626 | 580 | 454 | 417 | 579 |
| 9:07 | 500 | 566 | 657.51 | 674 | 672 | 703 | 752 | 708 | 676 | 631 | 508 | 467 | 626 |
| 9:22 | 541 | 614 | 703.08 | 717 | 710 | 743 | 791 | 754 | 724 | 679 | 560 | 513 | 671 |
| 9:37 | 579 | 658 | 744.93 | 757 | 746 | 780 | 827 | 797 | 768 | 724 | 608 | 557 | 712 |
| 9:52 | 613 | 698 | 783.06 | 793 | 778 | 814 | 859 | 836 | 808 | 764 | 652 | 596 | 750 |
| 10:07 | 643 | 734 | 817.47 | 826 | 807 | 845 | 887 | 871 | 844 | 800 | 692 | 632 | 783 |
| 10:22 | 670 | 766 | 847.23 | 855 | 833 | 872 | 912 | 903 | 876 | 832 | 728 | 663 | 813 |
| 10:37 | 693 | 794 | 873.27 | 879 | 855 | 895 | 932 | 930 | 903 | 860 | 759 | 691 | 839 |
| 10:52 | 713 | 817 | 895.59 | 900 | 873 | 915 | 949 | 952 | 926 | 883 | 785 | 714 | 860 |
| 11:07 | 728 | 836 | 912.33 | 917 | 888 | 931 | 961 | 970 | 945 | 902 | 806 | 732 | 877 |
| 11:22 | 740 | 850 | 925.35 | 929 | 899 | 942 | 969 | 984 | 959 | 916 | 822 | 746 | 890 |
| 11:37 | 748 | 859 | 930 | 938 | 906 | 950 | 973 | 993 | 968 | 925 | 832 | 756 | 898 |
| 11:52 | 752 | 864 | 939.3 | 942 | 910 | 954 | 973 | 998 | 973 | 930 | 838 | 760 | 903 |
| 12:07 | 752 | 864 | 939.3 | 942 | 910 | 954 | 969 | 998 | 973 | 930 | 838 | 760 | 902 |
| 12:22 | 748 | 859 | 930 | 938 | 906 | 950 | 961 | 993 | 968 | 925 | 832 | 756 | 897 |
| 12:37 | 740 | 850 | 925.35 | 929 | 899 | 942 | 949 | 984 | 959 | 916 | 822 | 746 | 888 |
| 12:52 | 728 | 836 | 912.33 | 917 | 888 | 931 | 932 | 970 | 945 | 902 | 806 | 732 | 875 |
| 13:07 | 713 | 817 | 895.59 | 900 | 873 | 915 | 912 | 952 | 926 | 883 | 785 | 714 | 857 |
| 13:22 | 693 | 794 | 873.27 | 879 | 855 | 895 | 887 | 930 | 903 | 860 | 759 | 691 | 835 |
| 13:37 | 670 | 766 | 847.23 | 855 | 833 | 872 | 859 | 903 | 876 | 832 | 728 | 663 | 809 |
| 13:52 | 643 | 734 | 817.47 | 826 | 807 | 845 | 827 | 871 | 844 | 800 | 692 | 632 | 778 |
| 14:07 | 613 | 698 | 783.06 | 793 | 778 | 814 | 791 | 836 | 808 | 764 | 652 | 596 | 744 |
| 14:22 | 579 | 658 | 744.93 | 757 | 746 | 780 | 752 | 797 | 768 | 724 | 608 | 557 | 706 |
| 14:37 | 541 | 614 | 703.08 | 717 | 710 | 743 | 710 | 754 | 724 | 679 | 560 | 513 | 664 |
| 14:52 | 500 | 566 | 657.51 | 674 | 672 | 703 | 664 | 708 | 676 | 631 | 508 | 467 | 619 |
| 15:07 | 456 | 515 | 609.15 | 628 | 630 | 659 | 616 | 658 | 626 | 580 | 454 | 417 | 571 |
| 15:22 | 409 | 462 | 557.07 | 579 | 586 | 613 | 566 | 606 | 572 | 525 | 398 | 365 | 520 |
| 15:37 | 360 | 406 | 502.2 | 528 | 540 | 565 | 514 | 551 | 516 | 468 | 339 | 311 | 467 |
| 15:52 | 308 | 349 | 445.47 | 475 | 491 | 514 | 460 | 495 | 458 | 409 | 280 | 256 | 412 |
| 16:07 | 254 | 290 | 386.88 | 420 | 441 | 462 | 405 | 437 | 398 | 348 | 222 | 200 | 355 |
| 16:22 | 199 | 232 | 327.36 | 364 | 390 | 409 | 350 | 379 | 338 | 287 | 165 | 145 | 299 |
| 16:37 | 144 | 175 | 267.84 | 308 | 338 | 356 | 295 | 320 | 278 | 226 | 111 | 88 | 242 |
| 16:52 | 83 | 120 | 209.25 | 253 | 286 | 302 | 241 | 263 | 220 | 166 | 60 | 44 | 187 |
| 17:07 | 24 | 67 | 152.52 | 199 | 235 | 250 | 190 | 208 | 164 | 110 | 25 | 0 | 135 |
| 17:22 | 0 | 22 | 101.37 | 148 | 186 | 199 | 141 | 156 | 113 | 57 | 0 | 0 | 94 |
| 17:37 | 0 | 0 | 52.08 | 103 | 140 | 151 | 98 | 109 | 68 | 22 | 0 | 0 | 62 |
| 17:52 | 0 | 0 | 19.53 | 63 | 99 | 107 | 62 | 69 | 32 | 0 | 0 | 0 | 38 |
| 18:07 | 0 | 0 | 0 | 33 | 63 | 70 | 45 | 35 | 0 | 0 | 0 | 0 | 21 |
| 18:22 | 0 | 0 | 0 | 0 | 44 | 53 | 27 | 20 | 0 | 0 | 0 | 0 | 12 |
| 18:37 | 0 | 0 | 0 | 0 | 22 | 34 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| 18:52 | 0 | 0 | 0 | 0 | 0 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Total | 5.1 | 5.8 | 6.8 | 7.1 | 7.2 | 7.5 | 7.6 | 7.5 | 7.1 | 6.5 | 5.3 | 4.8 | 6.5 |

3rd process PV configuration:

**Fifth step**:

P(pv) = (IN1\*IN2)/ (6.5\*368\*0.7\*0.7)

this is the suggested power to be used

1ycalculate number of modules in a string and the number of strings:

Nm=19 or 16

**Data base of the no. of modules in a single string based on the max power of the module**

Nt= P)pv)/IN6,3

Ns=Nt/Nm

Nm,max = 21

Nm,min= 540/(IN5,2\*0.9)

pmax= P(motor) \*1.7

Pmin= P(motor)\*1.2

**Sixth step:**

Match the recommended Motor cable from this chart:



Report Data:

1. Header

* Customer's Logo
* Customer's Address
* Contact Information
* date

1. Project Summary

* Location
* Pump name
* Average output daily (m3/day)
* Recommended cable
* Drive (option)
* Motor rating (HP)
* PVgen
* Output through the year (table)
* Average yearly output daily (table)

1. The months that the customer choose to appears( average output monthly)
2. P-Q curve of the pump
3. Datasheet