

# **ECONOMIC REPORT**

FOR THE CONSTRUCTION OF  
A PHOTOVOLTAIC SYSTEM OF 78 kWp  
NAMED  
Hybrid system for Delimart shopping center

SITE IN THE TOWN OF  
Port-au-Prince  
Route de Delmas, 32

-

## **CUSTOMER:**

Jason Martinez  
Port-au-Prince

-

**DATE**  
25/10/2017

**THE TECHNICAL**  
*Morel Francois*  
*Solar Haiti*

## Economic analysis

Analysis of the economic conditions for the installation of a system producing electricity through photovoltaic conversion named Hybrid system for Delimart shopping center to be installed in the town of Port-au-Prince for a nominal power of 78 kWp and energy delivered to the network the first year of 120.322 kWh.

### Cost analysis

The costs for the construction of the plant are listed below:

| Code           | Description                                       | M.U. | Q.ty    | Price €    | VAT % | Amount €     |
|----------------|---|------|---------|------------|-------|--------------|
|                | Photovoltaic modules                              |      |         |            |       |              |
| MFV2220        | Modulo CS6P-250P                                  | cad  | 312     | 200,00     | 10,00 | 68.640,00    |
|                | Inverter  |      |         |            |       |              |
| INV1529        | Inverter Sunny Boy SB 6000TL-21 con RPC           | cad  | 12      | 1.700,00   | 10,00 | 22.440,00    |
|                | Cables  |      |         |            |       |              |
| PIR20010766    | AFUMEX N07G9-K 1x6 MA M                           | LM   | 1465.76 | 198,00     | 10,00 | 319.242,00   |
| PIR20010763    | AFUMEX N07G9-K 1x6 NE M                           | LM   | 1465.76 | 198,00     | 10,00 | 319.242,00   |
| PIR20009902    | FG7OR 3G25 B G-SETTE-PIU ECO-LINE                 | LM   | 48.95   | 1.591,00   | 10,00 | 85.667,00    |
| PIR20009815    | FG7R 1X120 B G-SETTE-PIU ECO-LINE                 | LM   | 37.44   | 2.058,00   | 10,00 | 84.757,00    |
| PIR20009804    | FG7R 1X16 B G-SETTE-PIU ECO-LINE                  | LM   | 24.96   | 332,00     | 10,00 | 9.116,00     |
|                | Circuit-breakers                                  |      |         |            |       |              |
| SNRA9F79263    | iC60N 2P C 63A 6000A                              | PCE  | 12      | 64,00      | 10,00 | 8.448,00     |
| 31650          | Int.aut.Compact NS250N TMD 4x250 36 kA            | PCE  | 1       | 58.101,00  | 10,00 | 63.911,00    |
| 31690+29211    | Vigicompact NS250H TMD MH 4x250 70 kA             | PCE  | 1       | 115.971,00 | 10,00 | 127.568,00   |
|                | Surge protection devices                          |      |         |            |       |              |
| DEH952510      | SCARIC.SOVRA FOTOVOLTAICO DG M YPV SCI 1000       | PCE  | 24      | 23.575,00  | 10,00 | 62.238,00    |
| 15693          | Limitatore di sovratensione MC+MD                 | cad  | 1       | 316,00     | 10,00 | 3.476,00     |
|                | Transformers                                      |      |         |            |       |              |
| OCCMC60120CC05 | TRAS.MON.COM.OM.8500VA 230-400/110V               | PCE  | 12      | 62.491,00  | 10,00 | 824.881,00   |
|                | Storage system                                    |      |         |            |       |              |
|                | Storage system 3,6 kWh                            | cad  | 1       | 2.600,00   | 10,00 | 2.860,00     |
|                | Auxiliary generator                               |      |         |            |       |              |
|                | Diesel generator                                  | cad  | 1       | 35.000,00  | 10,00 | 38.500,00    |
|                | SOCOMEK EXCEL-CF 400/48 125A                      | cad  | 1       | 1.800,00   | 10,00 | 1.980,00     |
|                | Support structures                                |      |         |            |       |              |
|                | Support structures in galvanized steel            |      | 24      | 300,00     | 10,00 | 7.920,00     |
|                | Installation of support structures and PV modules |      | 24      | 180,00     | 10,00 | 4.752,00     |
|                | Electrical system and panels                      |      |         |            |       |              |
|                | Installation of electrical system and LV panels   |      | 1       | 12.600,00  | 10,00 | 13.860,00    |
|                | MV / LV cabinet                                   |      | 1       | 8.400,00   | 10,00 | 9.240,00     |
|                | Design and testing                                |      |         |            |       |              |
|                | Electrical system design                          |      | 1       | 5.000,00   | 10,00 | 5.500,00     |
|                | Testing and certification                         |      | 1       | 2.000,00   | 10,00 | 2.200,00     |
|                | Total   |      |         |            |       | 2.086.438,00 |

### Summary (VAT not included)

|  |                           |
|--|---------------------------|
| Total for the modules supply:                | € 62.400,00               |
| Total for the inverter supply:               | € 20.400,00               |
| Rest of the supply, installation and design: | € 1.230.888,00            |
| <b>Total cost of the plant:</b>              | <b>€ 185.138,22</b>       |
| <b>Specific cost:</b>                        | <b>€/kWp<br/>1.901,77</b> |

To the initial construction costs are added the cost of annual maintenance fees and extraordinary:

### Annual costs

| Description                     | % | Amount € |
|---------------------------------|---|----------|
| Photovoltaic system maintenance | 1 | 1.851,38 |
| Total                           |   | 1.851,38 |

### Extraordinary costs

| Description                           | Year | Amount €  |
|---------------------------------------|------|-----------|
| Inverters replacement and maintenance | 5    | 2.800,00  |
| Inverters replacement and maintenance | 10   | 3.200,00  |
| Inverters replacement and maintenance | 15   | 6.500,00  |
| Inverters replacement and maintenance | 20   | 2.800,00  |
| Total                                 |      | 15.300,00 |

### Auxiliary generator

|                                  |                   |
|----------------------------------|-------------------|
| Average annual produced energy:  | 72.188,16 kWh     |
| Average annual fuel consumption: | 24.578,5 l        |
| Maintenance cost:                | € 200,00/500 h    |
| Extraordinary maintenance costs: | € 2.000,00/2000 h |
| Fuel costs:                      | € 0,60            |
| Average annual maintenance cost: | € 5.136,46        |
| Average annual fuel costs:       | € 37.726,52       |

### Energy Income and prices

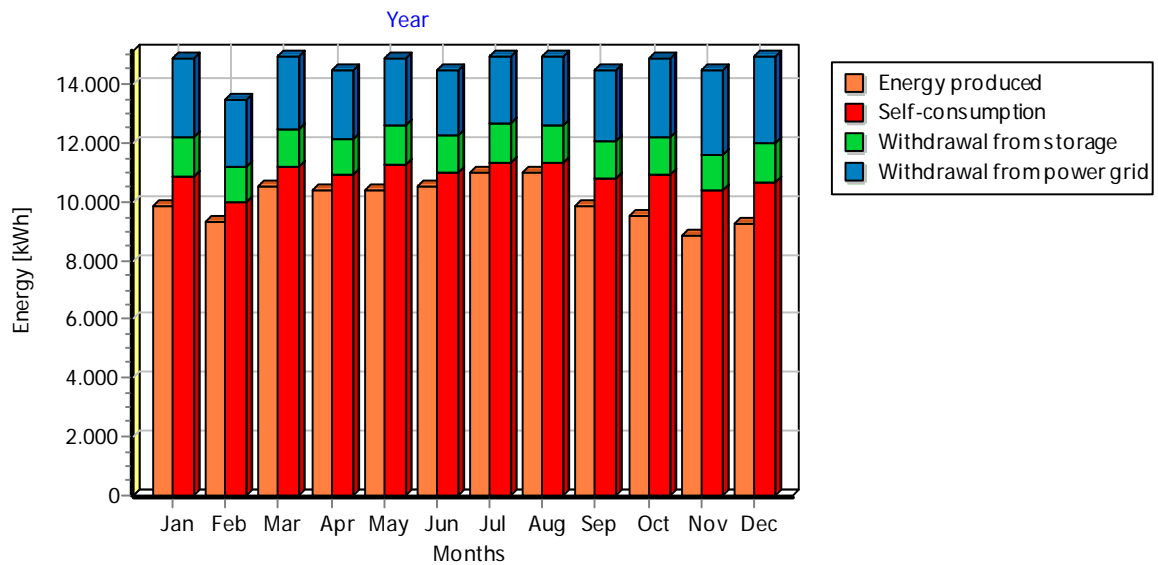
|                      |         |
|----------------------|---------|
| Rated power:         | 78 kWp  |
| Type of realization: | On roof |

## Unit power consumption

|  |               |
|--|---------------|
| Annual Unit power consumption:               | 175.774,4 kWh |
| Contemporary consumption of energy produced: | 145.968,7 kWh |
| Put in energy:                               | 45.248,9 kWh  |
| Withdrawn energy:                            | 29.805,7 kWh  |

### Load profile:

| Description                    | Consumption [kWh] | Power [W] |
|--------------------------------|-------------------|-----------|
| Video surveillance             | 7.008             | 800       |
| General services               | 17.350,4          | 3.200     |
| Indoor lighthing               | 43.376            | 8.000     |
| Outdoor lighthing              | 20.440            | 8.000     |
| Restaurants                    | 26.280            | 18.000    |
| Air conditioning               | 40.880            | 8.000     |
| Air conditioning - Restaurants | 20.440            | 14.000    |



## Financial return

The simulation of the economic performance of the system in the period of calculation is made considering the following parameters:

|  |       |
|--|-------|
| Annual plant degradation due to aging: | 0,8 % |
| Annual inflation rate:                 | 9 %   |
| Annual energy variation rate:          | 9 %   |
| Active interest rate:                  | 11 %  |
| Passive interest rate:                 | -     |

Return on investment made by the PV system:

|   |                       |
|---|-----------------------|
| Contemporary consumption of energy produced:  | 145.968,7 kWh         |
| End date Analysis:                            | 31/12/2037            |
| Incentive:                                    | € 0,00                |
| Consumption saving:                           | € 2.692.503,23        |
| Active interest:                              | € 2.437.325,21        |
| Other income:                                 | € 0,00                |
| Revenue from the sale of energy not consumed: | € 0,00                |
| Annual costs to deduct:                       | € 967.276,41          |
| <b>Total:</b>                                 | <b>€ 4.162.552,03</b> |
| Equity capital:                               | € 185.138,22          |
| <b>Cumulative cash flow:</b>                  | <b>€ 3.977.413,81</b> |
| Extraordinary costs:                          | € 15.300,00           |
| Repayment period (years):                     | 4                     |
| Amount after 20 years:                        | € 4.162.552,03        |
| Compound rate of return:                      | 16,84 %               |
| Discount rate:                                | 11 %                  |
| NPV:  | € 850.710,49          |
| IRR:  | 34,95 %               |

In the calculation of second and subsequent years are considered the coefficient of degradation of the system, the inflation rate and the rate of active return of the accumulated capital.

**Details of the calculations to December 31 2018:****Incentive:**

|                  |               |
|------------------|---------------|
| Energy produced: | 120.322 kWh * |
| Incentive rate:  | 0,000 € =     |
|                  | 0,00 €        |
|                  |               |
| Total:           | 0,00 €        |

**Saving consumptions:**

|                           |                |
|---------------------------|----------------|
| Energy consumption F1:    | 87.600 kWh *   |
| Self-consumption rate F1: | 0,492 €/kWh +  |
| Energy consumption F2:    | 58.368,7 kWh * |
| Self-consumption rate F2: | 0,1692 €/kWh = |
| Total:                    | 52.975,18 €    |

**Revenue from energy sale:**

|                                      |                |
|--------------------------------------|----------------|
| Energy produced:                     | 120.322 kWh –  |
| Energy consumed:                     | 73.810,1 kWh – |
| Energy dissipated by storage:        | 1.301,9 kWh =  |
| Energy injected into the power grid: | 45.210 kWh +   |
| Losses increasing:                   | 0% =           |
| Total energy paid:                   | 45.210 kWh     |
|                                      |                |
| Revenue from energy sale:            |                |
| E >= 1 kWh                           | 45.210 kWh *   |
|                                      | 0,00 € =       |
| Total energy return:                 | 0,00 € =       |
| Total:                               | 0,00 €         |

**Annual costs:**

|                                   |               |
|-----------------------------------|---------------|
| Annual costs:                     | 1.851,38 € +  |
| Annual costs auxiliary generator: | 15.140,55 € = |
| Total:                            | 16.991,93 €   |

**Economic analysis table for the period of observation:**

| Year  | 2018        | 2019        | 2020       | 2021       | 2022       |
|---|-------------|-------------|------------|------------|------------|
| <b>Energy produced [kWh]</b>                      | 120.322,0   | 119.359,5   | 118.724,6  | 117.434,2  | 116.471,9  |
| <b>Simult. consumption of prod. energy. [kWh]</b> | 145.968,7   | 145.802,6   | 145.902,4  | 145.528,3  | 145.375,2  |
| <b>Inputs [€]</b>                                 | 52.975,18   | 61.670,60   | 71.408,58  | 82.295,81  | 95.023,10  |
| <b>Savings from self-consump. [€]</b>             | 52.975,18   | 57.712,44   | 62.967,79  | 68.510,81  | 74.634,92  |
| <b>Energy sale [€]</b>                            | 0,00        | 0,00        | 0,00       | 0,00       | 0,00       |
| <b>Incentive [€]</b>                              | 0,00        | 0,00        | 0,00       | 0,00       | 0,00       |
| <b>Active interest [€]</b>                        | 0,00        | 3.958,16    | 8.440,79   | 13.785,00  | 20.388,18  |
| <b>Outputs [€]</b>                                | 16.991,93   | 20.919,43   | 22.824,86  | 22.266,90  | 29.893,42  |
| <b>Management cost aux. gen. [€]</b>              | 15.140,55   | 18.901,43   | 20.625,24  | 19.869,31  | 24.480,05  |
| <b>Annual costs [€]</b>                           | 1.851,38    | 2.018,00    | 2.199,62   | 2.397,59   | 2.613,37   |
| <b>Extraordinary costs [€]</b>                    | 0,00        | 0,00        | 0,00       | 0,00       | 2.800,00   |
| <b>Overdraft cash interest expense [€]</b>        | 0,00        | 0,00        | 0,00       | 0,00       | 0,00       |
| <b>Financing payment [€]</b>                      | 0,00        | 0,00        | 0,00       | 0,00       | 0,00       |
| <b>Interest contribution [€]</b>                  | 0,00        | 0,00        | 0,00       | 0,00       | 0,00       |
| <b>Equity contribution [€]</b>                    | 0,00        | 0,00        | 0,00       | 0,00       | 0,00       |
| <b>Cash flow [€]</b>                              | 35.983,25   | 40.751,17   | 48.583,72  | 60.028,91  | 65.129,68  |
| <b>Cumulative cash flow [€]</b>                   | -149.154,97 | -108.403,80 | -59.820,08 | 208,83     | 65.338,51  |
| <b>Own amount [€]</b>                             | 185.138,22  | 185.138,22  | 185.138,22 | 185.138,22 | 185.138,22 |
| <b>Future value [€]</b>                           | 35.983,25   | 76.734,42   | 125.318,14 | 185.347,05 | 250.476,73 |
| <b>Compound return rate [%]</b>                   | -80,564     | -35,621     | -12,198    | 0,028      | 6,232      |
| <b>NPV [€]</b>                                    | -152.720,88 | -119.646,31 | -84.122,32 | -44.579,41 | -5.928,12  |
| <b>IRR [%]</b>                                    | -80,57      | -42,38      | -16,53     | 0,04       | 9,84       |
|   |             |             |            |            |            |

| Year  | 2023       | 2024       | 2025       | 2026       | 2027       |
|---|------------|------------|------------|------------|------------|
| <b>Energy produced [kWh]</b>                      | 115.509,2  | 114.863,8  | 113.584,1  | 112.621,2  | 111.658,8  |
| <b>Simult. consumption of prod. energy. [kWh]</b> | 145.219,7  | 145.284,9  | 144.879,7  | 144.709,7  | 144.539,7  |
| <b>Inputs [€]</b>                                 | 108.864,05 | 124.976,70 | 142.980,57 | 163.872,83 | 187.086,08 |
| <b>Savings from self-consump. [€]</b>             | 81.311,61  | 88.697,67  | 96.498,32  | 105.120,25 | 114.514,55 |
| <b>Energy sale [€]</b>                            | 0,00       | 0,00       | 0,00       | 0,00       | 0,00       |
| <b>Incentive [€]</b>                              | 0,00       | 0,00       | 0,00       | 0,00       | 0,00       |
| <b>Active interest [€]</b>                        | 27.552,44  | 36.279,03  | 46.482,25  | 58.752,58  | 72.571,53  |
| <b>Outputs [€]</b>                                | 29.531,42  | 32.220,17  | 31.432,11  | 38.246,03  | 44.888,53  |
| <b>Management cost aux. gen. [€]</b>              | 26.682,84  | 29.115,22  | 28.047,71  | 34.557,04  | 37.667,53  |
| <b>Annual costs [€]</b>                           | 2.848,58   | 3.104,95   | 3.384,40   | 3.688,99   | 4.021,00   |
| <b>Extraordinary costs [€]</b>                    | 0,00       | 0,00       | 0,00       | 0,00       | 3.200,00   |
| <b>Overdraft cash interest expense [€]</b>        | 0,00       | 0,00       | 0,00       | 0,00       | 0,00       |
| <b>Financing payment [€]</b>                      | 0,00       | 0,00       | 0,00       | 0,00       | 0,00       |
| <b>Interest contribution [€]</b>                  | 0,00       | 0,00       | 0,00       | 0,00       | 0,00       |
| <b>Equity contribution [€]</b>                    | 0,00       | 0,00       | 0,00       | 0,00       | 0,00       |
| <b>Cash flow [€]</b>                              | 79.332,63  | 92.756,53  | 111.548,46 | 125.626,80 | 142.197,55 |
| <b>Cumulative cash flow [€]</b>                   | 144.671,14 | 237.427,67 | 348.976,13 | 474.602,93 | 616.800,48 |
| <b>Own amount [€]</b>                             | 185.138,22 | 185.138,22 | 185.138,22 | 185.138,22 | 185.138,22 |
| <b>Future value [€]</b>                           | 329.809,36 | 422.565,89 | 534.114,35 | 659.741,15 | 801.938,70 |
| <b>Compound return rate [%]</b>                   | 10,102     | 12,512     | 14,161     | 15,165     | 15,788     |
| <b>NPV [€]</b>                                    | 36.486,34  | 81.163,31  | 129.567,14 | 178.677,77 | 228.757,54 |
| <b>IRR [%]</b>                                    | 16,70      | 21,44      | 24,91      | 27,36      | 29,14      |
|   |            |            |            |            |            |



| Year  | 2028       | 2029         | 2030         | 2031         | 2032         |
|---|------------|--------------|--------------|--------------|--------------|
| <b>Energy produced [kWh]</b>                      | 111.002,8  | 109.733,6    | 108.771,1    | 107.808,5    | 107.141,6    |
| <b>Simult. consumption of prod. energy. [kWh]</b> | 144.602,2  | 144.198,2    | 144.000,8    | 143.795,7    | 143.820,4    |
| <b>Inputs [€]</b>                                 | 213.140,48 | 242.563,12   | 276.507,49   | 314.260,37   | 356.988,41   |
| <b>Savings from self-consump. [€]</b>             | 124.927,22 | 135.907,65   | 148.050,74   | 161.264,55   | 175.897,18   |
| <b>Energy sale [€]</b>                            | 0,00       | 0,00         | 0,00         | 0,00         | 0,00         |
| <b>Incentive [€]</b>                              | 0,00       | 0,00         | 0,00         | 0,00         | 0,00         |
| <b>Active interest [€]</b>                        | 88.213,26  | 106.655,47   | 128.456,75   | 152.995,82   | 181.091,23   |
| <b>Outputs [€]</b>                                | 45.484,02  | 44.369,60    | 53.425,09    | 58.847,54    | 64.022,50    |
| <b>Management cost aux. gen. [€]</b>              | 41.101,13  | 39.592,25    | 48.217,78    | 53.171,57    | 51.335,69    |
| <b>Annual costs [€]</b>                           | 4.382,89   | 4.777,35     | 5.207,31     | 5.675,97     | 6.186,81     |
| <b>Extraordinary costs [€]</b>                    | 0,00       | 0,00         | 0,00         | 0,00         | 6.500,00     |
| <b>Overdraft cash interest expense [€]</b>        | 0,00       | 0,00         | 0,00         | 0,00         | 0,00         |
| <b>Financing payment [€]</b>                      | 0,00       | 0,00         | 0,00         | 0,00         | 0,00         |
| <b>Interest contribution [€]</b>                  | 0,00       | 0,00         | 0,00         | 0,00         | 0,00         |
| <b>Equity contribution [€]</b>                    | 0,00       | 0,00         | 0,00         | 0,00         | 0,00         |
| <b>Cash flow [€]</b>                              | 167.656,46 | 198.193,52   | 223.082,40   | 255.412,83   | 292.965,91   |
| <b>Cumulative cash flow [€]</b>                   | 784.456,94 | 982.650,46   | 1.205.732,86 | 1.461.145,69 | 1.754.111,60 |
| <b>Own amount [€]</b>                             | 185.138,22 | 185.138,22   | 185.138,22   | 185.138,22   | 185.138,22   |
| <b>Future value [€]</b>                           | 969.595,16 | 1.167.788,68 | 1.390.871,08 | 1.646.283,91 | 1.939.249,82 |
| <b>Compound return rate [%]</b>                   | 16,244     | 16,588       | 16,780       | 16,892       | 16,952       |
| <b>NPV [€]</b>                                    | 281.952,14 | 338.603,93   | 396.050,83   | 455.305,29   | 516.536,44   |
| <b>IRR [%]</b>                                    | 30,52      | 31,60        | 32,43        | 33,07        | 33,58        |
|   |            |              |              |              |              |

| Year                                       | 2033                | 2034                | 2035                | 2036                | 2037                |
|--|---------------------|---------------------|---------------------|---------------------|---------------------|
| Energy produced [kWh]                      | 105.883,3           | 104.920,7           | 103.958,2           | 103.280,8           | 102.033,0           |
| Simult. consumption of prod. energy. [kWh] | 143.374,5           | 143.151,1           | 142.904,2           | 142.871,0           | 142.383,8           |
| <b>Inputs [€]</b>                          |                     |                     |                     |                     |                     |
| Savings from self-consump. [€]             | 191.341,87          | 208.411,64          | 226.986,30          | 247.539,59          | 269.232,95          |
| Energy sale [€]                            | 0,00                | 0,00                | 0,00                | 0,00                | 0,00                |
| Incentive [€]                              | 0,00                | 0,00                | 0,00                | 0,00                | 0,00                |
| Active interest [€]                        | 213.317,48          | 250.138,75          | 292.195,74          | 340.167,62          | 395.883,13          |
| <b>Outputs [€]</b>                         |                     |                     |                     |                     |                     |
| Management cost aux. gen. [€]              | 63.176,90           | 68.863,55           | 75.062,01           | 72.469,41           | 89.182,38           |
| Annual costs [€]                           | 6.743,62            | 7.350,55            | 8.012,09            | 8.733,18            | 9.519,17            |
| Extraordinary costs [€]                    | 0,00                | 0,00                | 0,00                | 0,00                | 2.800,00            |
| Overdraft cash interest expense [€]        | 0,00                | 0,00                | 0,00                | 0,00                | 0,00                |
| Financing payment [€]                      | 0,00                | 0,00                | 0,00                | 0,00                | 0,00                |
| Interest contribution [€]                  | 0,00                | 0,00                | 0,00                | 0,00                | 0,00                |
| Equity contribution [€]                    | 0,00                | 0,00                | 0,00                | 0,00                | 0,00                |
| <b>Cash flow [€]</b>                       | <b>334.738,83</b>   | <b>382.336,29</b>   | <b>436.107,94</b>   | <b>506.504,62</b>   | <b>563.614,53</b>   |
| <b>Cumulative cash flow [€]</b>            | <b>2.088.850,43</b> | <b>2.471.186,72</b> | <b>2.907.294,66</b> | <b>3.413.799,28</b> | <b>3.977.413,81</b> |
| <b>Own amount [€]</b>                      | <b>185.138,22</b>   | <b>185.138,22</b>   | <b>185.138,22</b>   | <b>185.138,22</b>   | <b>185.138,22</b>   |
| <b>Future value [€]</b>                    | <b>2.273.988,65</b> | <b>2.656.324,94</b> | <b>3.092.432,88</b> | <b>3.598.937,50</b> | <b>4.162.552,03</b> |
| <b>Compound return rate [%]</b>            | <b>16,972</b>       | <b>16,962</b>       | <b>16,932</b>       | <b>16,903</b>       | <b>16,840</b>       |
| <b>NPV [€]</b>                             | <b>579.565,15</b>   | <b>644.421,85</b>   | <b>711.068,82</b>   | <b>780.803,18</b>   | <b>850.710,49</b>   |
| <b>IRR [%]</b>                             | <b>33,98</b>        | <b>34,30</b>        | <b>34,56</b>        | <b>34,78</b>        | <b>34,95</b>        |

