



# Solar Energy Seminar Techniques and applications



# Presentation

- Energy Smart OU
- Solar Resources
- Solar Thermal
- Solar PV
- Solar Environment
- The Future for Solar in Northern Latitudes
- Conclusion



## Energy Smart

- Private company incorporated in Estonia
- Established in May 2009
- First Solar RE company in Estonia
- Develop Solar Renewable Energy in Northern Latitudes



## Why Solar

- Solar energy is being overlooked as a viable renewable energy source in Estonia and the wider Baltic region
- 50 year historical solar irradiation data from (EMHI) clearly show that solar energy resources in the Baltic are equal to Eastern Germany and Poland
- The available solar energy resources provide significant growth opportunities over the next 10 years for companies involved in Solar RE.
  - EU 30% renewable energy by 2020
  - Interconnecting of the European electricity network.



## Energy Smart Management Team

- Michael Wegecsanyi Managing Director
  - Bsc, Dip Bus, Cert Solar PV design and installation
- Tonu Jogi Technical Director
  - Msc Eng
- Ronald Nermann Commercial Director
  - BA bus
- Viido Pilikarpus Marketing Director
  - BA



## Solar Resources

- EMHI have been measuring solar resources in Estonia for over 50 years.
- Calculating energy yields from available resources is best done with long term data
- Know efficiency of energy collecting equipment
- Good estimates of average energy yields can be made.

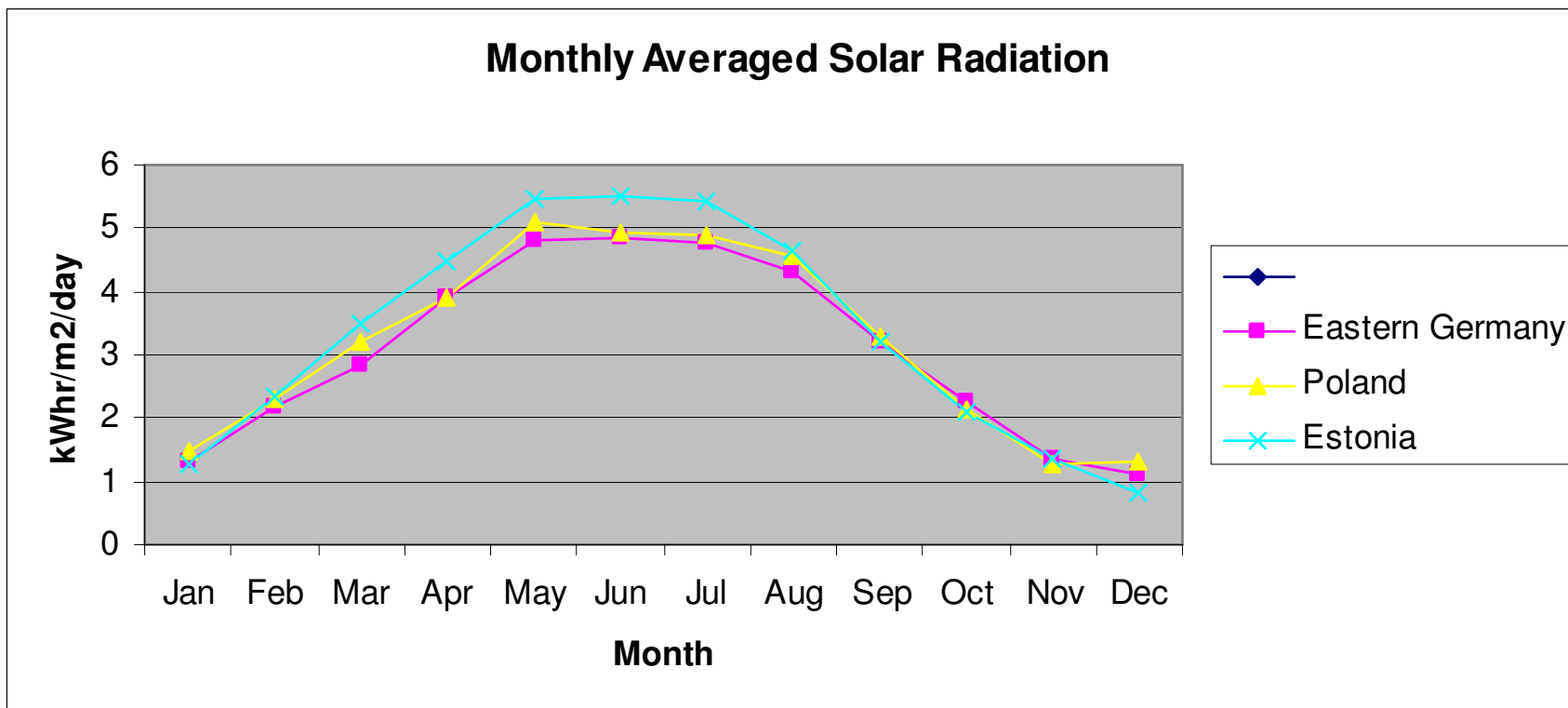


# Solar Resources

Monthly Averaged Radiation Incident On An Equator-Pointed Tilted Surface (kWh/m<sup>2</sup>/day)  
NASA Insolation data

Country	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
Eastern Germany	1.32	2.18	2.83	3.9	4.8	4.85	4.76	4.32	3.19	2.24	1.37	1.13	<b>3.08</b>
Poland	1.49	2.31	3.22	3.9	5.11	4.92	4.9	4.55	3.27	2.15	1.28	1.33	<b>3.21</b>
Estonia	1.27	2.35	3.5	4.47	5.45	5.5	5.41	4.66	3.21	2.09	1.36	0.82	<b>3.35</b>

# Solar Resources







## Solar Resources

- Cold climate improves efficiency of Solar PV
- Flat, un shaded, cheap land
- Interconnection of Northern grid with central Europe



## Why No Solar Industry?

- Tallinn Technical University advocates solar development
- EMHI wealth of solar resources data
- Lack of technical expertise
- Accepted myth that there is no sun in Estonia
- No active government support to develop the industry



# Energy Smart

- Solar Park Construction
- Solar Hot Water system supply and installation



## Solar Thermal Strategy

- Identify the most suitable Solar Thermal technology for Northern conditions.
- Test the system for at least 1 season to learn capability in real conditions
- Identify and build a working relationship with a quality supplier of solar thermal equipment.
- Establish reliable supply network and test purchase and logistic processes.



## Solar Thermal

- Identify and train an installation team
- Test and develop installation process with at least 3 technically differing installations, small domestic, large domestic and large commercial system - completed
- Purchase stock to service the market for the 2011 installation season (March to September)
- Appoint a sales agent to drive sales
- Initiate marketing strategy

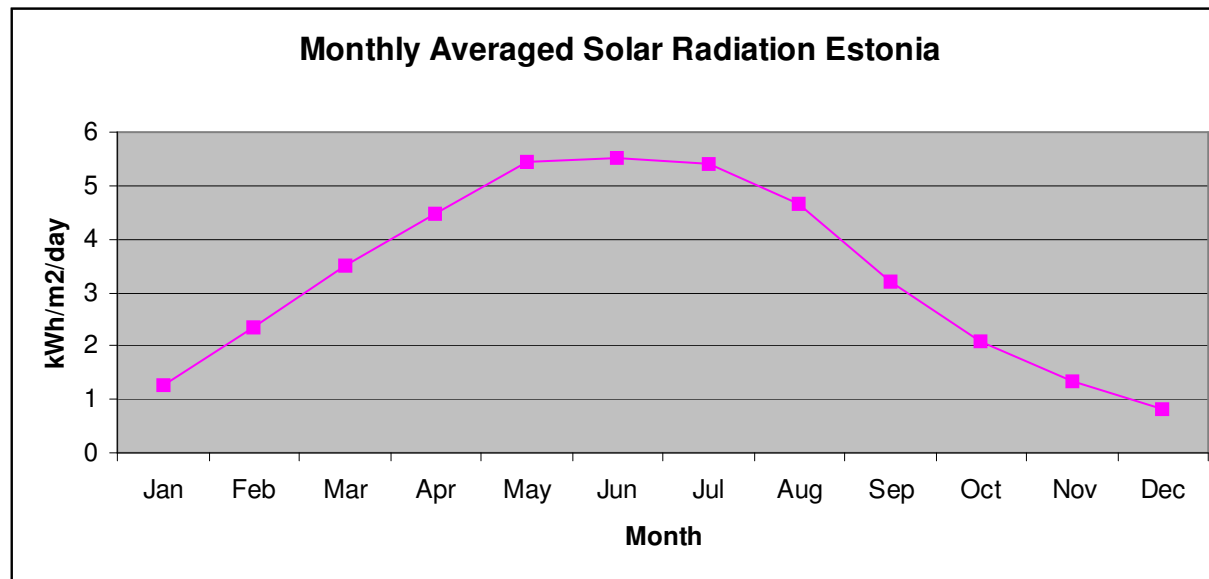


## Solar Thermal Equipment

- Vacuum Tube closed loop systems
- Still operate under freezing conditions
- Higher efficiency
- Lower heat losses from the system
- Integrates well with existing water heating systems



# Solar Thermal





## Solar Thermal

- Solar Thermal should be seen as a booster to an existing system
- April to September solar will provide most hot water needs
- October to March solar will provide pre heated water into existing water heating system

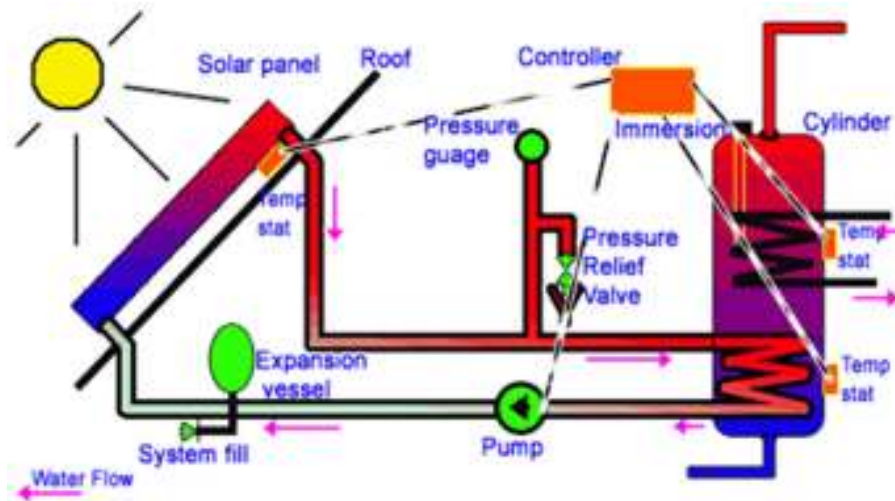




## Solar Thermal

- In Estonia solar thermal will provide 40 – 60% average domestic hot water requirements
- Easily integrated into existing systems preserving existing investment.
- Payback less than 6 years
- Payback much less with funding support

# Solar Thermal Equipment





# Solar Thermal Test System

- 18 tube collector system integrated with an electric boiler



# Solar Thermal Test System



# Solar Thermal Test System

- Reduced Electricity cost by 40%
- When the sun shone it produced hot water
  - February 2011
  - Outside temp  $-25^{\circ}$
  - Collector temp  $+45^{\circ}$
  - Water temp  $+30^{\circ}$
  - Need to clean the snow



## Solar Thermal Equipment Supply

- Good working relationship with French owned solar company manufacturing systems in China
- Developing relationships with two German controller and related equipment suppliers
- Tested logistics with Estonian shipping and storage companies



## Solar Thermal Installation

- Trained and certified installers
- Test Installed
  - 1.44m<sup>2</sup> collector x 150 Lt Domestic system integrated with electric boiler
  - 2.88m<sup>2</sup> collector x 300 Lt system integrated with a gas fire boiler supplying 4 apartments
  - 8.66m<sup>2</sup> collector x 600 Lt system integrated with heat exchanger system supplying technical school with internet data display



## Solar Thermal

- Works in this region when integrated with existing system
- Becoming accepted
- Short payback times especially when support funding is available





## Solar Thermal

- Energy Smart working on
  - Hospital renovation in Southern Estonia 60 - 100 m<sup>2</sup> Collector area.
  - Three systems for school in Southern Estonia total 60 m<sup>2</sup> collector area.
  - Hot water supply for Tallinn bus company
  - Tallinn hotel renovation



# Energy Smart Solar Thermal

- Supply complete domestic systems
- Supply components – collectors, controllers
- Design and supply large commercial systems



# Solar Thermal

- Future is good for Solar Thermal



# Solar PV

- Solar PV electricity generation



## Solar PV

- The biggest barrier to development of Solar PV is the mentality that there are not enough solar resources in this part of the world
- Estonia has better solar resources than Eastern Germany and Poland where solar investment is strong.
- Why is there no Solar PV Industry in Estonia?
- No support from Estonian government
  - Very low and conditional feed in tariff
  - Fixated on large wind projects, Biomass and Nuclear



## Solar PV

- The mentality here is that this technology must be proven before its accepted.
- Calculated yields are not enough
- Investors want to see hard data



# Pilot 100kW Photovoltaic solar park in Somerpalu Vald



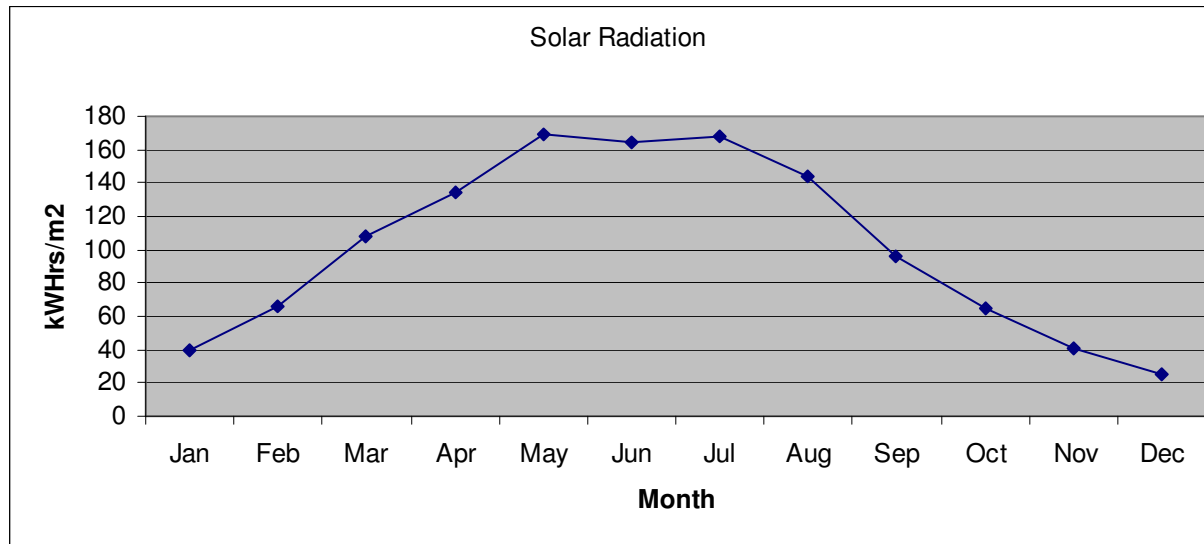
## Solar PV

- Energy Smart is building a 100 kWp pilot solar park in Southern Estonia.
- The pilot park will correlate the calculated potential of solar energy electricity production with real production data.
- The park is partly funded by the KIK environmental fund
- Is supported by Tallinn Technical University and Estonian Meteorological and Hydrological Institute.



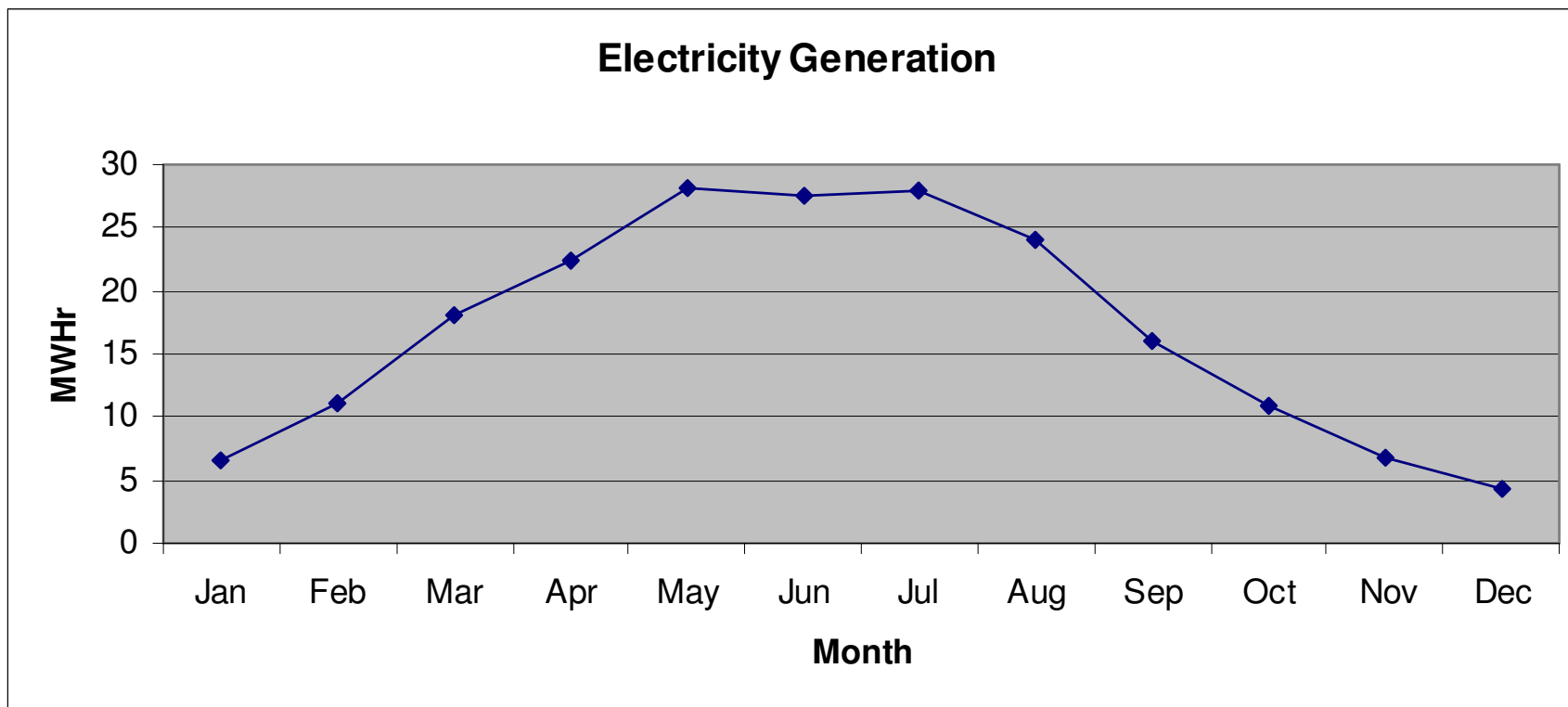


# Solar Resources



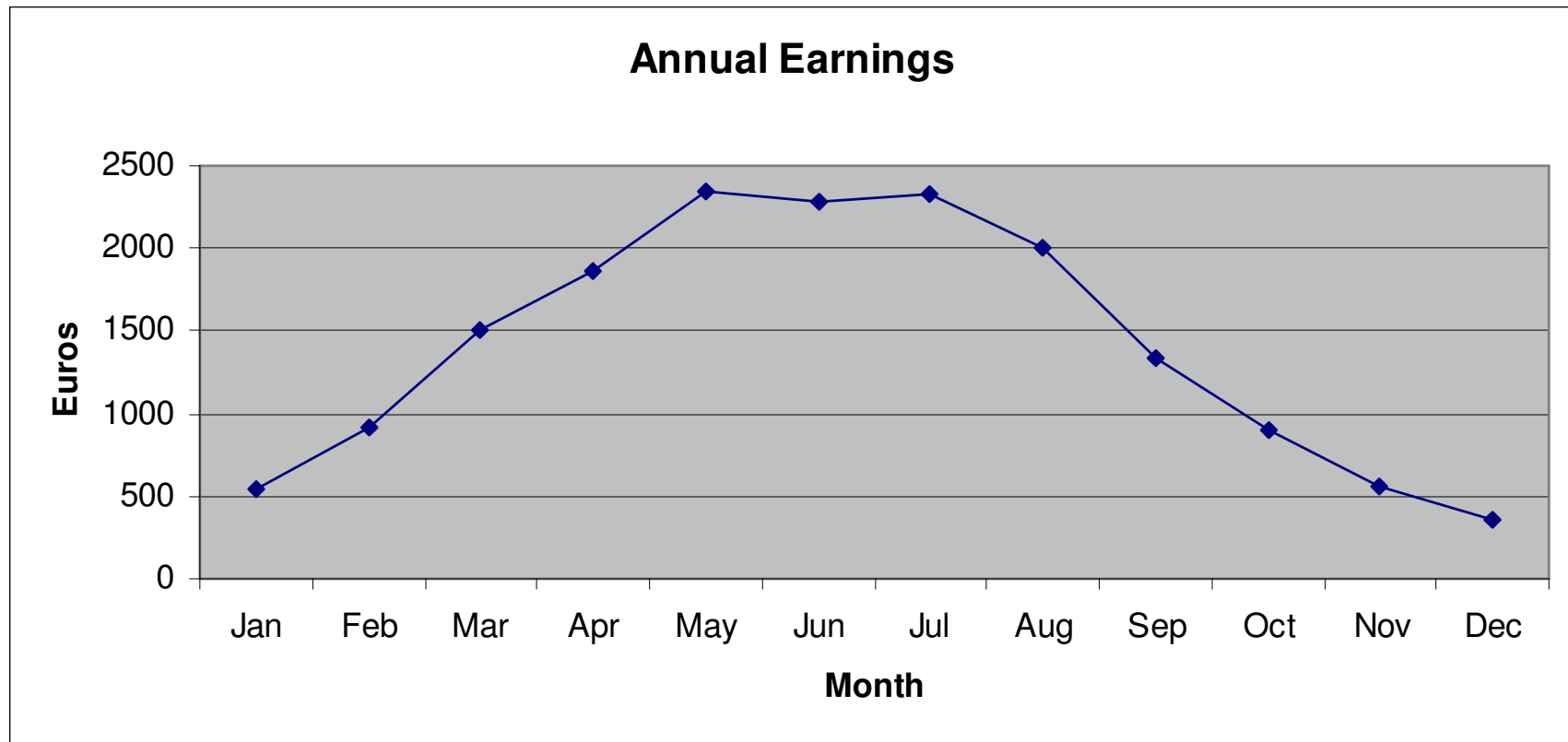


# Solar Resources





# Solar Resources





# Solar Farm Components

- Solar Modules
- Tracker system
- Central Inverters
- Cabling
- Control Room
- Lightning protection
- Security
- Earth Works

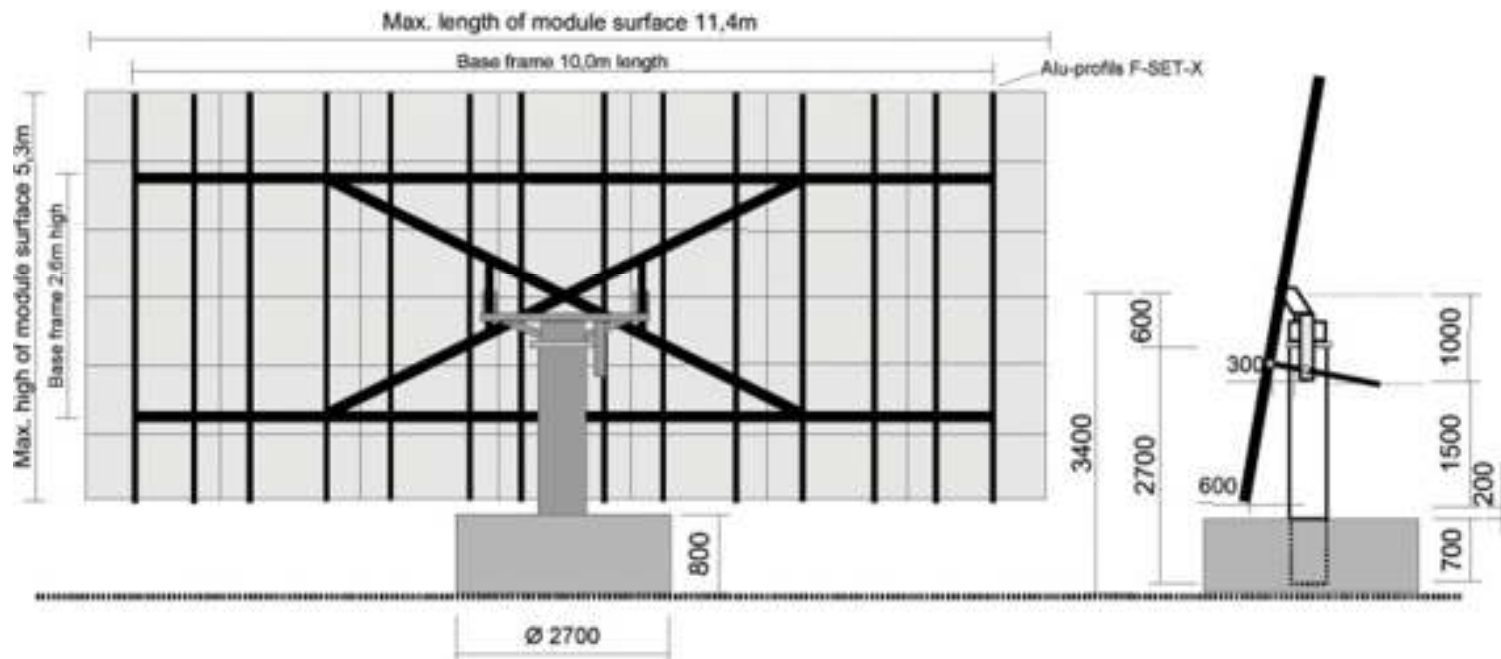


# Solar Modules

- Modules
  - High efficiency polycrystalline 230Wp solar modules



# Trackers





# Trackers



ENERGY SMART OÜ Õismäe tee 46A 13512 Tallinn  
reg. code:11662253  
[www.energysmart.ee](http://www.energysmart.ee)



- 125 Wp three phase  
400V central inverter

Three-phase Soleil models are available ranging from 10 to 500kWp for Grid-connected or stand-alone applications.

#### Efficiency

The three-phase Soleil range offers the highest efficiency levels in the industry thanks to the innovative technologies utilized in design and manufacturing.

Inverter power modules uses IGBT components and PWM principle with microprocessor control reaching a level in excess of 96% including LF transformer.

These values have been "certified" by an independent authorised body to guarantee the most important parameters to be considered when planning a PV installation.

The combined use of an MPPT system places Soleil inverter at the top of energy conversion systems.

# Inverter







BOS

- The balance of system will be sourced in Estonia where possible



# Construction

- Construction by local Estonian builder

# Park Layout





## Finance

- 48% finance from KIK environmental development fund
- Balance private investment
  - Energy Smart offering equity investment
    - Solar Park
    - Energy Smart Business



# Current Environment for Solar PV

- Estonia
  - Low feed in tariff - 83 Euros per MWhr
  - No meaningful government support for solar
  - General skepticism about viability of solar



# Future Environment Estonia

- Main market will be farming community
- With FIT of 200 Euros MWhr
  - 100 kWp park will earn 40000 Euros per year
  - Working life 30 years
  - Payback under 10 years
  - Potential export earner for Estonian farmers
  - Minimal inputs, no transport costs, minimal operating costs
- Capital support and/or moderate fees in Tariff



## Current Environment

- Latvia
  - FIT 427 Euros MWhr
  - Selected projects only
  - No development to date
- Lithuania
  - FIT 470 Euros MWhr
  - Selected project only
  - No development to date



## Conclusion

- Solar energy is a viable energy source in northern latitudes
- Requires correct technology
- Finance structures to fund developments
- Reasonable feed in tariffs that will support long term development of solar resources
- Change in physiology and mentality towards solar energy





## Questions

- Tonu Jogi
  - Estonian, Russian
- Ronald Nermann
  - Estonian, English, Finish, Russian
- Viido Polikarpus
  - Estonian, American



- Thank you