SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

IEA SHC TASK 60 2018 - 2020

PVT systems

an introduction to the technology and Task 60 – Printed version

Jean-Christophe Hadorn OA

Austria National Day
Vienna June 5th 2019


TASK60
PVT SYSTEMS

What is IEA SHC ? iea-shc.org

- Australia
- Austria
- Belgium
- Canada
- China
- Denmark
- France
- Germany
- Italy
- Mexico
- Netherlands
- Norway
- Portugal
- Slovakia
- South Africa
- Spain
- Sweden
- Switzerland
- Turkey
- United Kingdom

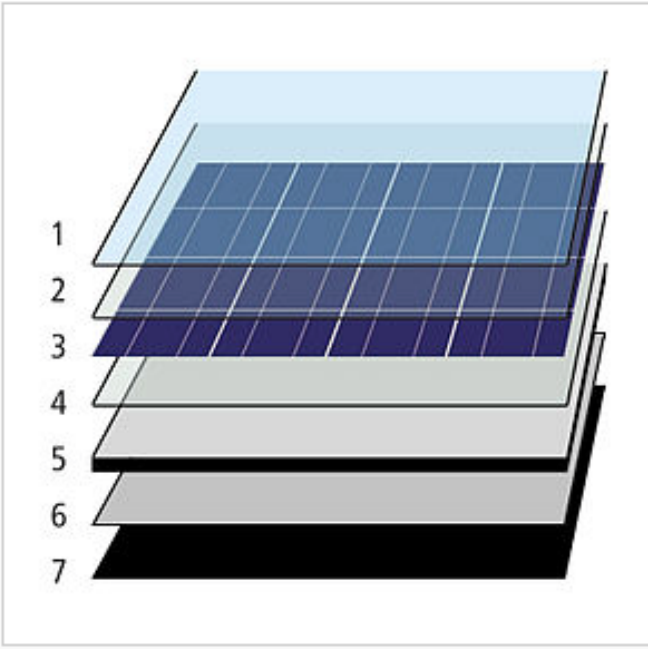
- Task 62 - Solar Energy in Industrial Water & Wastewater Management
- Task 61 - Integrated Solutions for Daylighting and Electric Lighting
- Task 60 - Application of PVT Collectors and New Solutions in HVAC Systems
- Task 59 - Deep Renovation of Historic Buildings Towards Lowest Possible Energy Demand and CO2 Emission (NZEB)
- Task 58 - Material and Component Development for Thermal Energy Storage
- Task 56 - Building Integrated Solar Envelope Systems for HVAC and Lighting
- Task 55 - Towards the Integration of Large SHC Systems into District Heating and Cooling (DHC) Network

PVT strength

Delivery of:

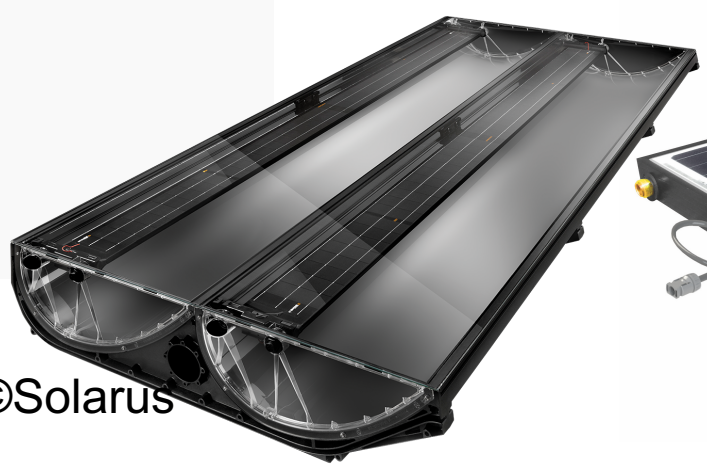
- **Heat up to 170 C !**
- **Cold**
- **Electricity for all kind of usage**

PVT collectors

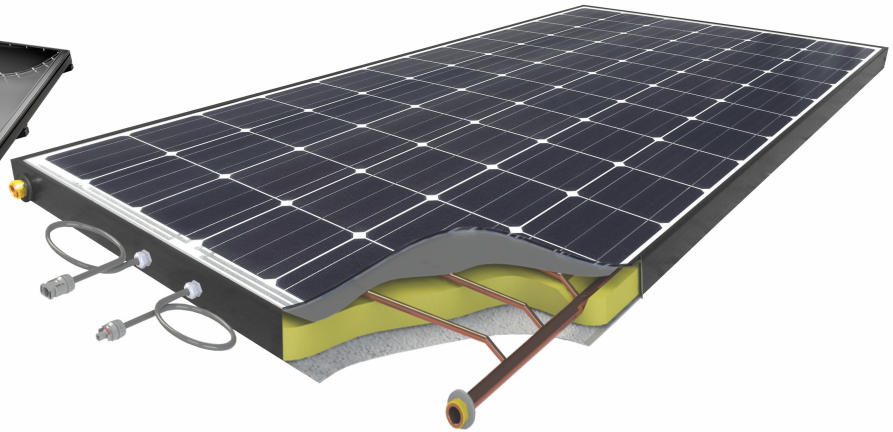


Schematic of a hybrid (PVT) solar collector:
1 - Anti-reflective glass
2 - EVA-encapsulant
3 - Solar PV cells
4 - EVA-encapsulant
5 - Backsheet (PVF)
6 - Heat exchanger (copper)
7 - Insulation (polyurethane)

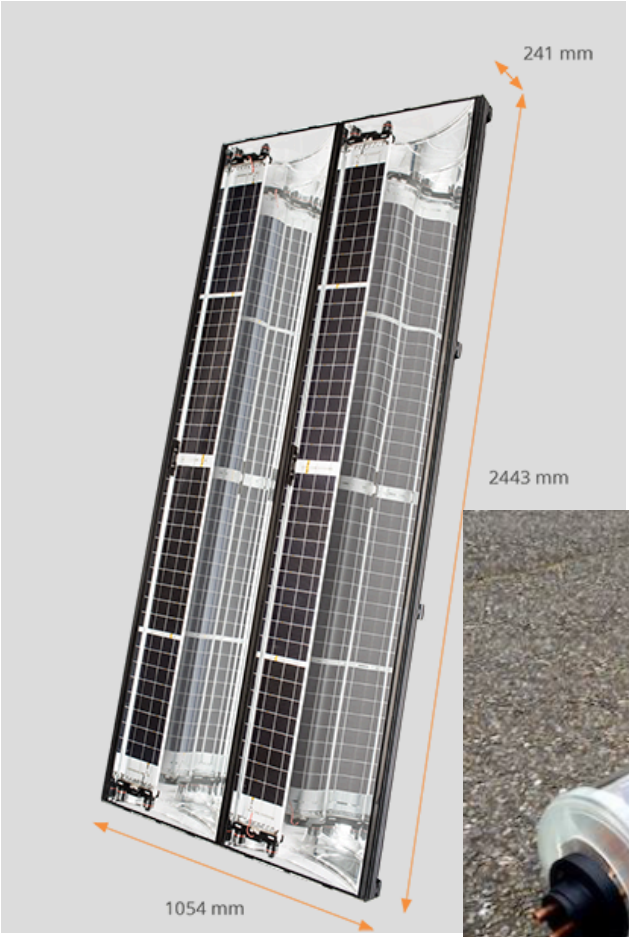
- PVT liquid heating collector
- PVT air heating collector
- PVT Liquid /and air heating collector
- WISC (formaly known as glazed / unglazed)
- PVT concentrating collectors (CPVT)



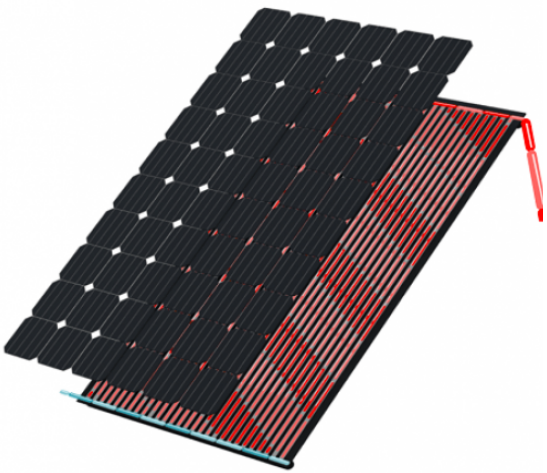
©Solarus



Example of types on the market



Courtesy of Dualsun , Solarus, Naked energy, Meyer Burger



www.dualsun.com, France

www.abora-solar.com, Spain

www.nakedenergy.co.uk, UK

www.endef.com, Spain

www.sunoyster.com, Germany

Some of the solar industries within Task 60

Segments of market

- **One family house 10 kW**
- **Swimming pools**
- **Multifamily house 100 kW or more - NZEB**
- **Green neighborhood**
- **Commercial – Industrial processes 100-200 kW … 1 MW**
- **District heating and cooling systems : 1 MW**
- **With seasonal storage**

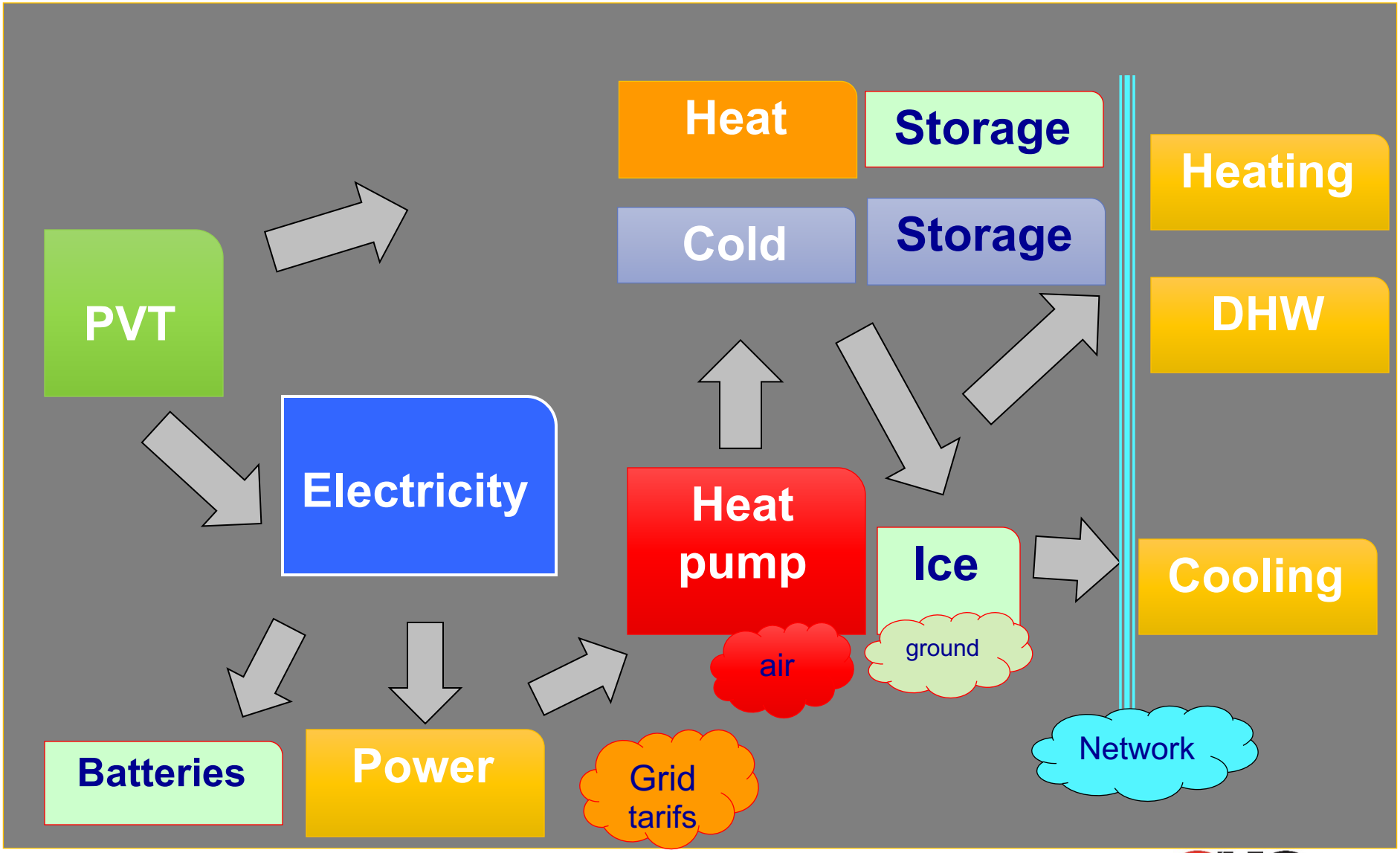
Vision:

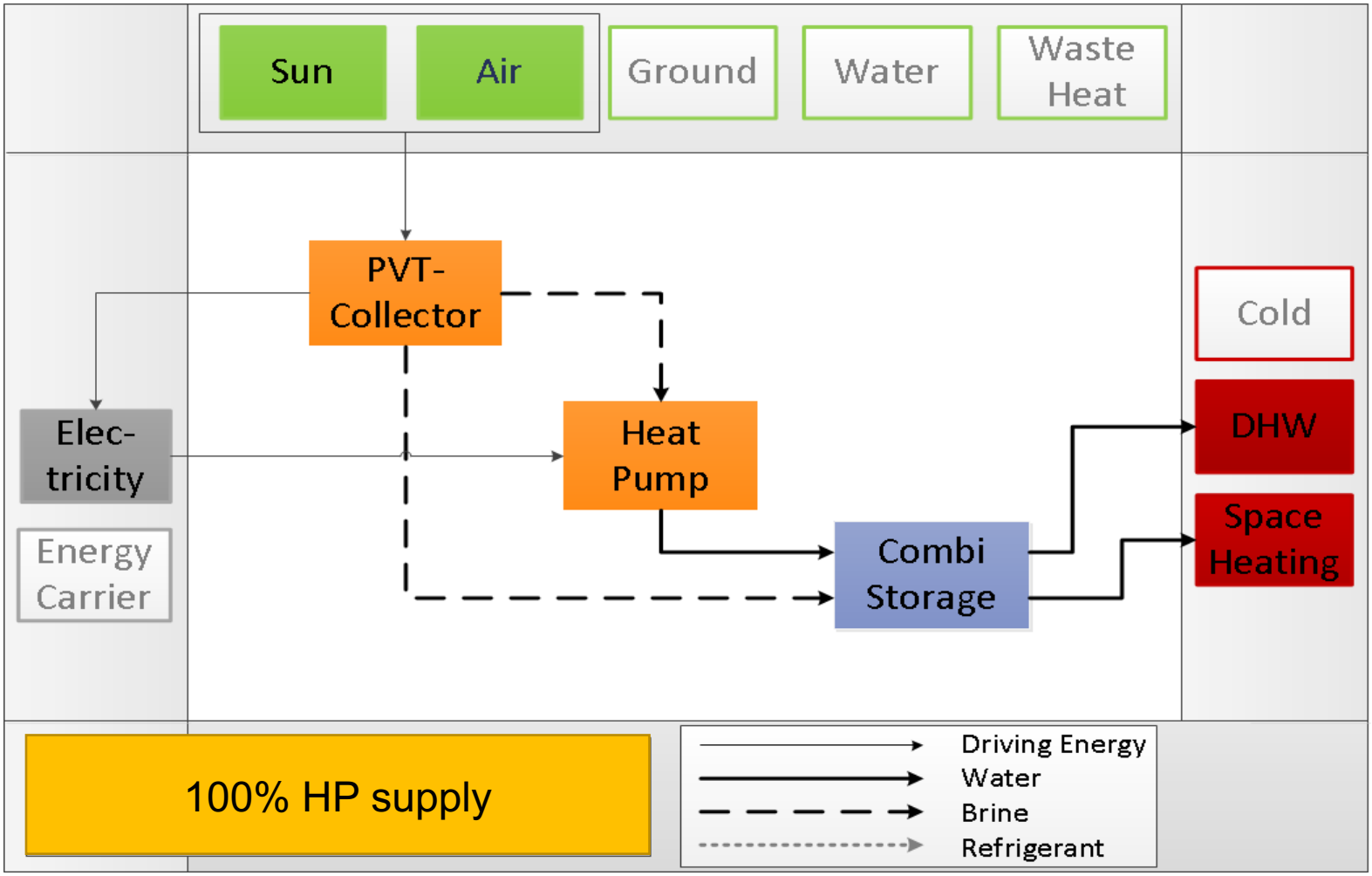
- Where PV is PVT can be !
- Where Heat pump or cooling machines are !
- Where electricity and heat or cold are needed !
- Where process heat is needed

Why PVT as Single Source for a Heat Pump?

1. Better use of the roof area
2. No noise
3. No ground work
4. Less moving or underground parts
5. 100% supply single system
6. Effect of Cooling PV modules ?
7. Clients with “Solar mood” will like it
8. Solar PV obligation in some countries

Much to optimize – much to innovate




Sun
Air
Ground
Water
Waste Heat
PVT-Collector
Elec-tricity
Energy Carrier
Heat Pump
Combi Storage
Cold
DHW
Space Heating
100% HP supply
Driving Energy
Water
Brine
Refrigerant

Task Organisation

Operating Agent
JC Hadorn, Switzerland

A
PVT systems in operation

T. Ramschak,
AEE, Austria

In situ monitoring

B
PVT Performance Characterization

K. Kramer, Fraunhofer ISE, Germany

Performance Characteristics

C
PVT Modeling

As. Sanz
Tecnalia, Spain

System Simulation

D Systems Design Examples
best practice of solutions from B and C with A constraints – KPIs – Basic recommended control strategies

Dissemination and market support

A. Haeberle, SPF, Switzerland

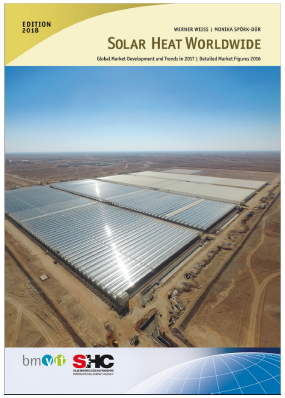
System Design examples

Participation from:

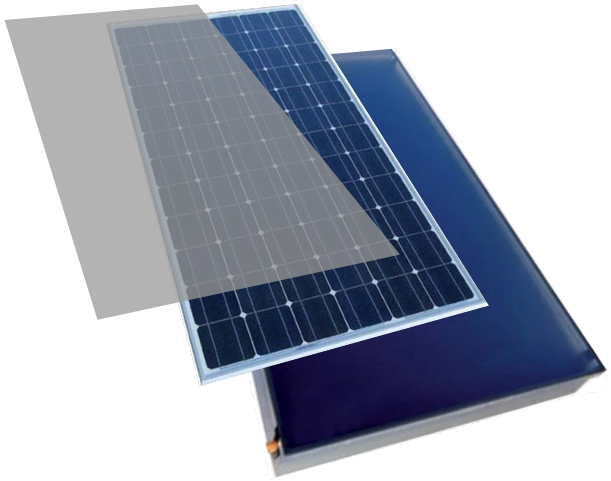
- **Australia** Sunovate
- **Austria** ASIC FH Wels, AEE Intec, *3F Solar*
- ***Canada*** *Trigo energies*
- **Denmark** DTU BYG, Ramboll
- **France** Univ Perpignan CESP, CEA INES, Dualsun, *Systobvi, GSE*
- **Germany** Fraunhofer ISE, Berlin HTW, ISFH, Univ Saarland, HTW Saar, Stutgart IGTE, ZAE Bayern, easy-tnt, Consolar , Sunoyster, PA-ID (2Power), Grammer
- **Italy** Politecno Milano , Uni Catania, Uni Bologna, Solink
- **RSA** Conver-TEK (CogenX solar)
- **Spain** Uni Zaragoza, Uni Lleida, Tecnalia, Endef, Abora
- **Sweden** *Darlana,* Univ. Gävle, BDR Thermea bv, Solarus AB
- **Switzerland** SPF, ZHAW, ETHZ LKE, Vela Solaris, ESSA, Hadorn, 3S solar ?
- **NL** SEAC-TNO, Eindhoven Univ, Solarus BV
- **UK** Naked energy, Solar Speedflex

Observers from: USA (Univ Charlotte EPIC, Tyll solar), Macedonia (Camel Solar), Czech (Tech. Univ. Prag), India (Solar Thermal Fed of India), Malaysia through Ireland EBC contact person , Israel Millenium, Greece Prime Laser technology, Korea (Kongju Univ)

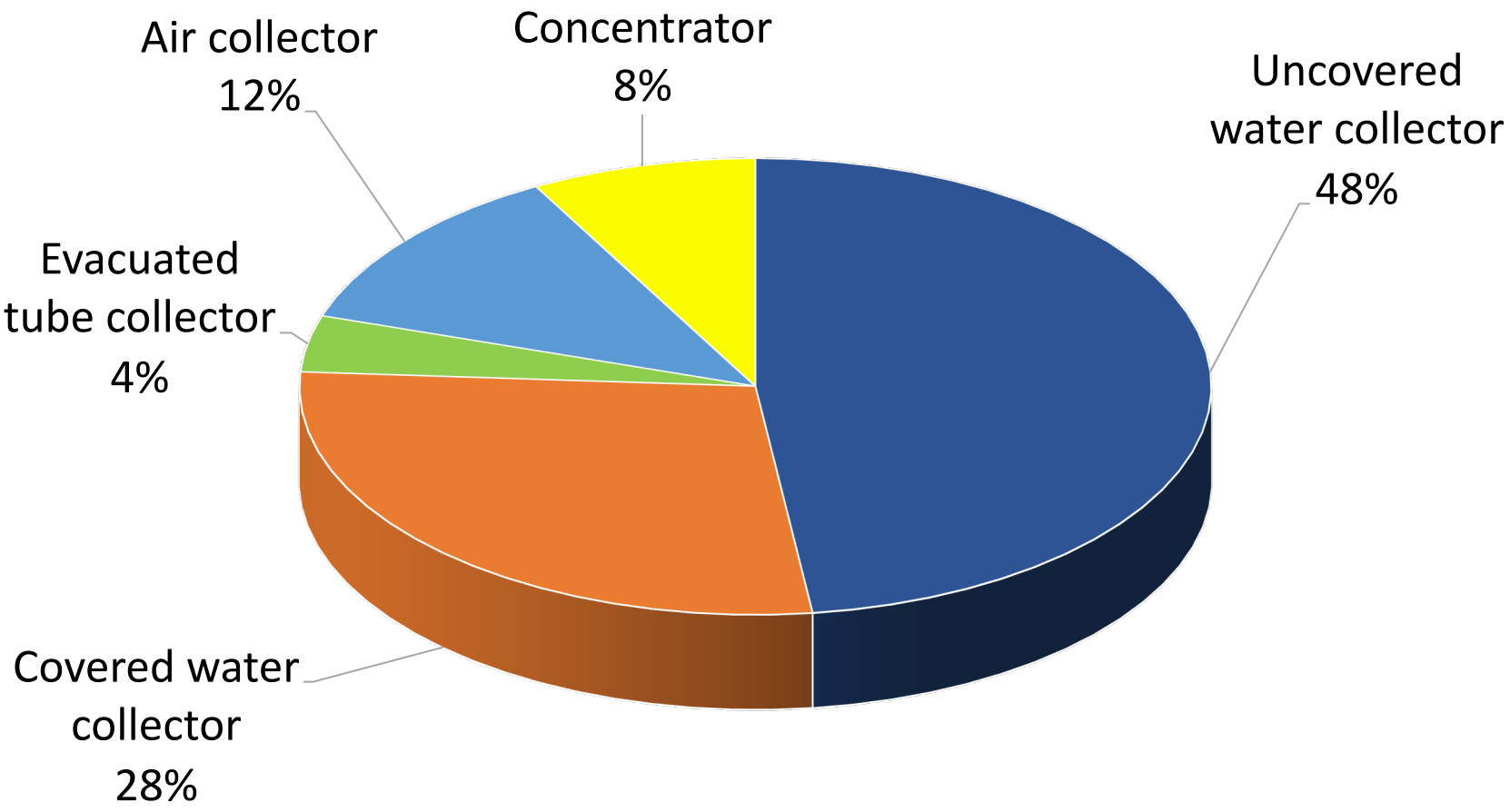
Working on



- Survey on PVT collectors in the world !
- Infosheet on 21 projects
- PVT equations (air, ice, condensation, rain, double face, temperature effects…)
- PVT certification (solar keymark + PV IEC 61215 + 61730) and where to test ?
- PV + T or T + PV re-certification
- PVT simulations
- KPIs
- Cost effectiveness
- Reliability, Quality insurances
- Dissemination
- PVT policy and support ?



Market overview – PVT-Producer
(Task 60 Sub A AEE Intec)



Distribution of PVT-manufacturer by collector type

PVT future ?

- Niche markets for 5 years then ramp up to ?

- Heating and/or cooling with heat pumps from villas to malls
- Pools

- Much dependant
  - on PV developments !
  - Heat pumps penetration