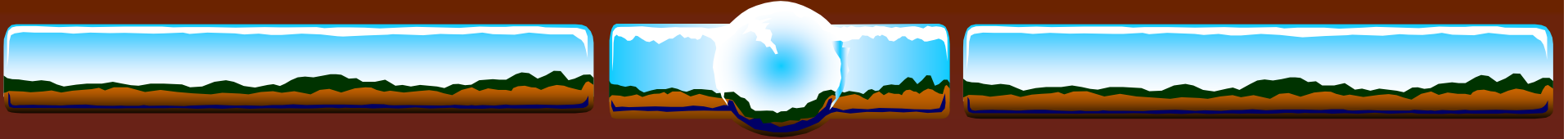


Reticulated LPG

An approach to systems design

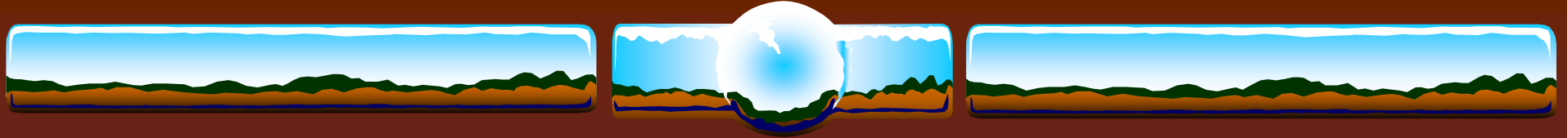
Presented By

M/s Optech Engineering Private Limited



Joy for Reticulation

- ❖ Fits to the modern concept of “ Gas on Tap”
- ❖ Space savings
- ❖ No cylinder follow ups required
- ❖ Centrally managed
- ❖ Safe



Design Criteria for the system

- ❖ Objective to ascertain following parameters
 - ❖ **Total Demand**
 - ❖ **Peak Demand**
 - ❖ **Pressure Requirement for each application**
- ❖ Variable needed to be studied to ascertain the parameters
 - ❖ Number of Households in 100s
 - ❖ Geometric spread of the Household
 - ❖ Application / Consumption Segments
 - ❖ Seasonal Fluctuations



Number of House Holds

❖ Typical consumption Figures

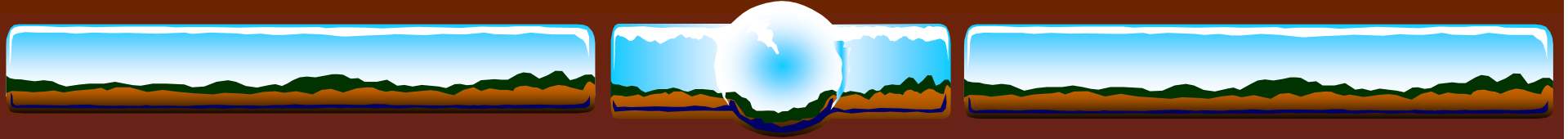
per day per HHs

(for cooking only)

- ❖ 1 BHK : 300 gms per day
- ❖ 2 BHK : 500 gms per day
- ❖ 3 BHK & above : 650 gms per day

➤ Total Consumption in Six Hr per day
(1morn + 2noon + 1evening + 2night)

➤ **Hence per Hr Consumption calculated accordingly**



Geometric spread of houses

- ❖ Land availability for any bulk installation
- ❖ Cost benefit for Secondary Piping cost Vs The New installation cost for wide spread sectors
- ❖ Routing of the piping inside the premises
- ❖ Pressure Drop in high risers

(Equal to the weight of the gas in the riser converted to the equivalent water column: Typically : 0.25 mbar per m)



Application

- ❖ Cooking avg. demand : 0.30-0.65 Kgs/HHs/Day
- ❖ Gyser Demand : 0.40-0.60 Kgs/HHs/Day
- ❖ Tailor-made calculations for
 - ❖ Swimming Pool
 - ❖ Space Heaters
 - ❖ Lawn Movers
 - ❖ DG Set applications



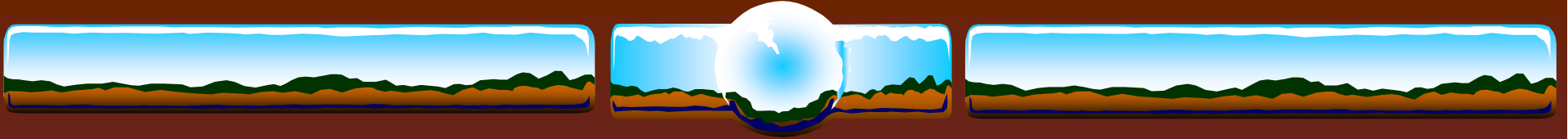
Seasonal Dependence

- ❖ Ratio of Winter Demand Vs Summer Demand (Source OCC)
 - ❖ Moderate Climates (e.g. Mumbai) : 1.1
 - ❖ Extreme Climates (e.g. Delhi) : 1.4
- ❖ Festival Demand
 - ❖ Considering this demand helps in finding the peak consumption per hour for the area as the peak consumption is the design criteria.



Process of Designing

- ❖ Calculate the Total Demand of LPG for the Housing Complex per month or year
 - ❖ Storage Capacity ascertainment
 - ❖ Inventory calculations
- ❖ Calculate the Peak Load and Min Load per Hr
 - ❖ Helps in calculation Vaporizer capacity in case of bulk installations OR
 - ❖ Helps in designing the cylinder bank capacity
 - ❖ Helps in designing the Pipe sizing calculations
 - ❖ Helps in designing the other line equipment capacities



Design Codes to Follow

- ❖ Bulk Storage Facility
 - ❖ SMPV (U) Rule 1981 for the installation
 - ❖ IS 2825/ PD 5500 for the tank design
 - ❖ IS 6044 Part II
 - ❖ ASME Sec VIII for WPS/PQR
 - ❖ IS 2148 for Zone II Classifications
- ❖ Packed Cylinders storage
 - ❖ Gas Cylinder Rules
 - ❖ IS 6044 Part 1
 - ❖ ASME Sec VIII for WPS/PQR



Standard Design Rules

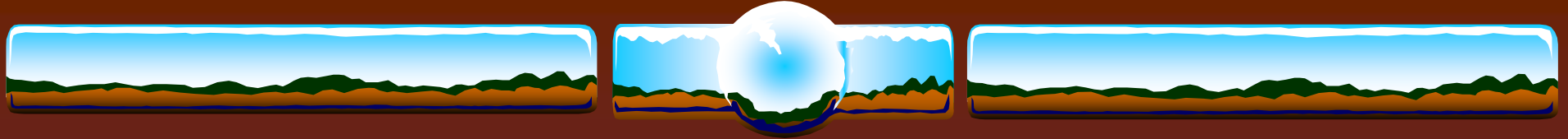
(specific to reticulated system)

- ❖ Vapor availability from each 15-17Kg LPG cylinder is 0.5 Kg/hr (avg.)
- ❖ Velocity in piping
 - ❖ Main headers : 3-4 m/sec
 - ❖ Branch Pipes : 5-6 m/sec
 - ❖ Risers : 3-4 m/sec
 - ❖ End Connections : upto 15 m/sec
- ❖ Inventory Norms
 - ❖ Bulk installations : 3 – 7 days
 - ❖ Packed installation : 100% stand by or case may be
- ❖ Pressure Regulators
 - ❖ Operating at middle of the regulation curve



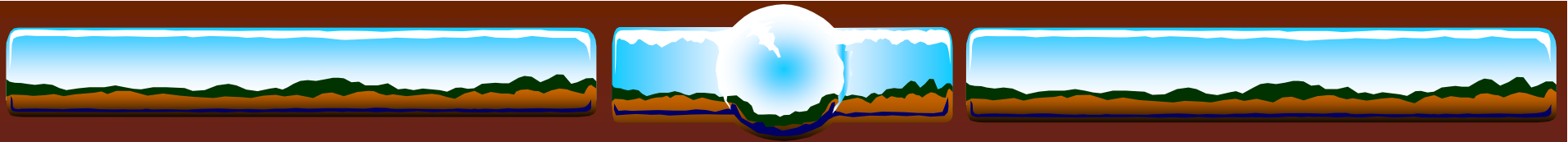
Components of A Reticulated system- Storage

- ❖ Bulk storage and associated systems for unloading, safety fittings, measurements, firefighting, control, Vaporizers
 - ❖ Aboveground
 - ❖ Mounded
 - ❖ Underground
- ❖ Packed cylinder
 - ❖ Cylinder Manifolds consisting of
 - ❖ Cylinder adapters
 - ❖ Flexible tubes SS Wire braided
 - ❖ NRV
 - ❖ Manifold pipe with isolating devices



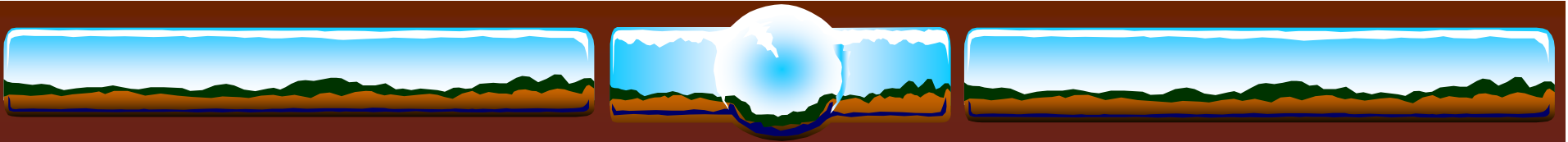
Components of A Reticulated system- Pressure Regulation

- ❖ Regulation of Pressure
 - ❖ Primary Regulator (Near the storage point)
 - ❖ Outlet pressure of 1.5-2 Kg/cm²
 - ❖ Second stage regulator (before risers)
 - ❖ Outlet Pressure of 0.7 Kg/cm²
 - ❖ Third stage regulator (before end consmptn)
 - ❖ Cooking/ Gyser : 300 mm WC
- ❖ Makes offered
 - ❖ Vanaz, Krom schoder, Fisher Rosemount



Components of A Reticulated system - Piping and Fittings

- ❖ Piping
 - ❖ Inside Yard/ Cylinder Manifold: ASA 106 Gr B, Sch 40
 - ❖ Outside yards : IS1239 Heavy class I.e ERW C class
- ❖ Ball valves
 - ❖ ASA 216 Gr B Body, with PTFE seat, Flanged to ANSI B 16.5 Class 150# (or NPT end for 25mm or less)
- ❖ Flanges and Fittings
 - ❖ ASA 105 Gr B. Forged WNRF
- ❖ Nut Bolts and Gaskets
 - ❖ ASA 193 Gr B and 2H
 - ❖ SS Spiral wound for bulk yard and CAF for the rest

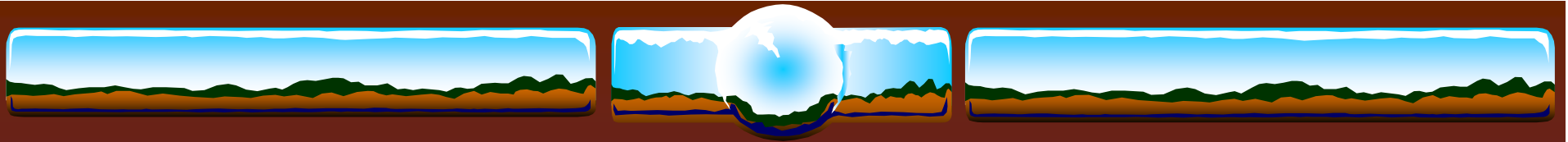


Components of A Reticulated system

–Flow Measuring devices

- ❖ Flow Measurement at the Bulk installation
 - ❖ Mass Flow measurement
 - ❖ Endress and Houser/ Fisher Rosemount
- ❖ Flow Measurement at the end consumer
 - ❖ Volumetric Flow measurement
 - ❖ Vanaz, IDEX, Actaris

Model mass reconciliation sample shown in slide no 18.



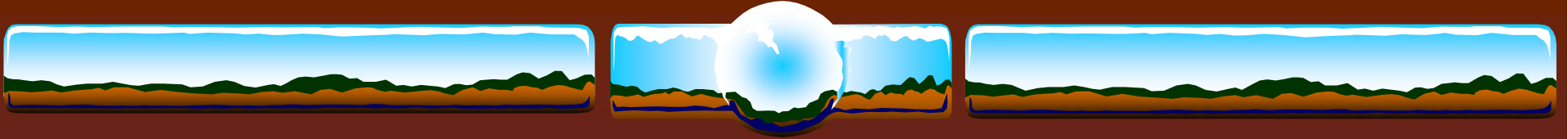
Components of A Reticulated system- Auto change over devices

❖ Objective

- ❖ To change over the cylinder bank in case of cylinder pressure has come down to 2.0-2.5 Kg/cm²
- ❖ To change over from Natural vapor to Vaporizer in case of bulk installation

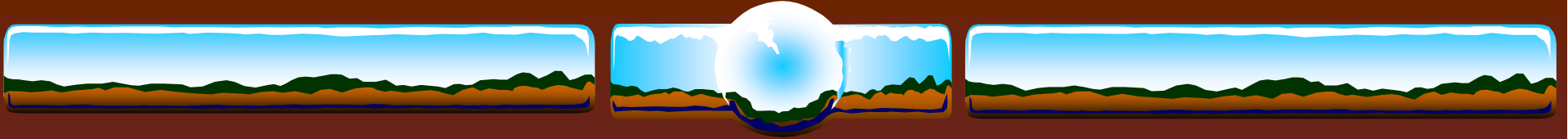
❖ Method

- ❖ Mechanical spring loaded valves OR
- ❖ ROVs controlled by the Pressure switches



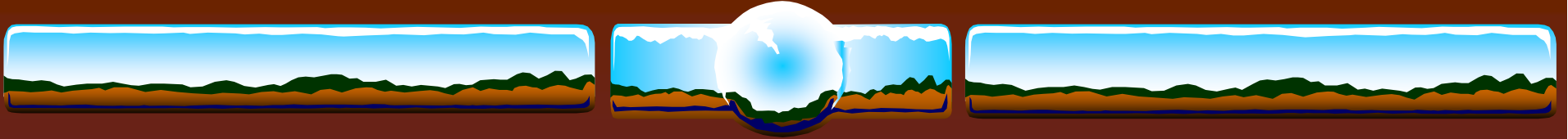
Components of A Reticulated system – Safety Devices

- ❖ Fire Fighting
 - ❖ Hydrant and sprinkler Systems
 - ❖ DCP Bottles
 - ❖ Sand buckets
 - ❖ CO2 Type extinguisher
- ❖ Detection
 - ❖ Leak
 - ❖ Fire
 - ❖ Alarms
- ❖ Emergency Control Devices and Logics



Cost Estimates of a Reticulated system

- ❖ Cylinder Manifold with mechanical auto changeover devices : Rs.3000/- per cylinder connection
- ❖ Piping : Rs.400-600 per inch-dia
- ❖ Riser along with the end connections and flow meters : Rs. 14000/- per house connection
- ❖ Bulk storage of 40m³ : Rs. 25-35 lac



Sample Mass balance

- ❖ Qty Unloaded : 2MT *actual reading*
- ❖ End consumption *actual reading*
 - ❖ A- 10 m³ in 10 houses (20% of volume)
 - ❖ B- 15 m³ in 20 houses (60% of volume)
 - ❖ C- 20 m³ in 5 houses (20% of volume)
 - ❖ Total 500 m³ actual reading
- ❖ Apportionment of the Mass on the basis of % volume to those house hold. Ie *billed reading*
 - ❖ A- 400 gms in 10 houses
 - ❖ B- 1200 gms in 20 houses
 - ❖ C- 400 gms in 5 houses